MEXICO

OIL & GAS REVIEW

2013

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The Mexican oil and gas industry entered a new era in 2013. Under the leadership of a new President and a new CEO of Pemex, the industry will be building on the exploration and production success of 2012 and is preparing itself for the new opportunities that are expected to be opened up by the energy reform later this year.

At this time of change, Mexico Oil & Gas Review provides a comprehensive overview of the latest developments, business strategies, technological breakthroughs, and operational challenges in the Mexican oil and gas industry. By connecting key stakeholders across the public and private sectors, Mexico Oil & Gas Review 2013 is dedicated to accelerating the exchange of essential industry information that drives the industry's development and allows you to capitalize on emerging business opportunities.

Published annually, Mexico Oil & Gas Review features the perspectives of the leading Mexican and international players in the industry, and offers an in-depth analysis of the crucial industry trends. Moreover, we match Mexico's main operational and technological challenges with international best practices and proven technologies that have the potential to boost Mexico's upstream and downstream performance.

The topics covered in this year's edition of Mexico Oil & Gas Review are those that have mattered the most in the Mexican oil and gas industry over the last twelve months, and we also provide you with an in-depth understanding of the most relevant issues that are expected to influence and transform the industry in the coming year.

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SEDAL

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Under the leadership of a new President and a new CEO of Pemex, the Mexican oil and gas industry entered a new era in 2013. Understanding the state of the industry in this year will be essential to anticipate the strategies that will be employed over the months and years to come.

Pemex has been facing the same challenges for close to a decade, since its giant field Cantarell began its decline and the company started diversifying its portfolio of projects in order to boost both reserves and production. Pemex's production peaked at 3.45 million b/d in December of 2003; the NOC hopes that by the end of Enrique Peña Nieto's six-year presidential term, it will have brought production back to the 3 million b/d mark, from the 2012 production rate of 2.55 million b/d, while keeping its 1P reserve replacement rate above 100%.

Congress is expected to pass a new energy reform before the end of the year, and Pemex is also expected to undergo an internal restructuring in the next few months. These changes in the oil and gas landscape have the potential to be massively important to the future development of the industry, but it is only by understanding why the need exists for these changes to be made that their importance and success can be properly judged.

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THE YEAR IN REVIEW

2012 was arguably a good year for Pemex, in which it was able to consolidate the more positive achievements of 2011 - without losing much ground from the position it had reached by the end of the previous year - and adding to its successes in several areas. According to the company's preliminary results for 2012, Pemex's crude oil production actually dropped 0.2% in nominal terms, but the company has explained this by stating that in its move to diversify production, a year of stable production is a positive result. The company also made its first deepwater oil discoveries, a long-awaited achievement in the process towards deepwater oil production. Pemex also managed to make a net profit after tax for the first time in many years. This net income of US$400 million, although relatively small in comparison to its income before tax and duties of US$63 billion, looks rather impressive compared to 2011's US$5.7 billion net loss after tax.

RESTRUCTURING

The Pemex board of directors is in the process of discussing an internal restructuring of the company, to move away from its current layout and embrace a new method of organization. Pemex is currently organized into four internal subdivisions, each with its own board, led by a corporate division that some in Pemex describe as acting as a 'holding company', also with its own board. Many have criticised this structure as being too bureaucratic, saying that it contributes to slow decision-making, and a lack of communication between the subdivisions. The new structure has not yet been announced, but is expected to re-integrate these four subdivisions into one entity. Carlos Murrieta, COO of Pemex, explains that the NOC wants "equal management within all business units. We want successful interaction between all business units, including PMI [Pemex's fifth subdivision that works in international markets]. We hope that this will enable the subdivisions to achieve their objectives more easily," he explains.

EXPLORATION AND PRODUCTION

Preliminary results from 2012 show production remaining relatively stable year-on-year, dropping only slightly from 2011's figure of 2.553 million b/d to 2.548 million b/d; 26% of Mexico's production came from onshore fields and 74% from offshore fields. The stabilization of Cantarell, once Pemex's biggest producing field, is proving increasingly successful. Following a 10% drop from 449,000 b/d in 2011 to 404,000 b/d in 2012, Cantarell's annualized production decline slowed to 2.4% between Q1 2012 and Q1 2013. At the same time, production at Mexico's main field Ku-Maloob-Zaap increased from 842,000 b/d in 2011 to 855,000 b/d in 2012.

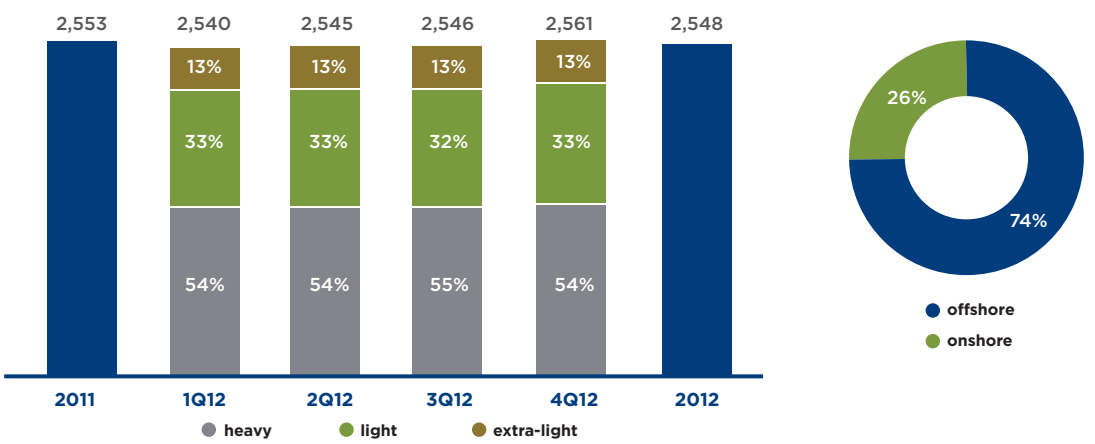
One of the lynchpins in Pemex's exploration and production strategy, and one of the main factors in increasing production, has been sourcing the appropriate drilling equipment in order to drill the wells needed. Pemex increased the amount of drilling rigs in the country from a yearly average of 128 in 2011 to 136 in 2012, and this is reflected in the average number of wells drilled in 2012, which increased from 1,005 wells in 2011 (32 exploration wells and 973 development wells) to 1,296 wells in 2012 (36 exploration wells and 1,260 development oil wells).

Murrieta explains that Pemex's biggest priority regarding its portfolio is to maintain its 100% 1P reserve rate, which the company achieved last year and hopes to retain this year. Pemex currently has enough 3P reserves to maintain around 30 years of production at current levels, according to Murrieta.

DEEPWATER

Perhaps Pemex's greatest achievement of 2012 has been finding oil in deepwater, at its Trion and Supremus wells. Pemex now has a deepwater exploration success rate of 55%, which is much higher than the international average

MEXICO'S 2012 CRUDE OIL PRODUCTION



Source: Pemex

"This has been an exciting year during which we have started start reaping the benefits from all the hard work of the past years"

Carlos Morales Gil, Director General of Pemex E&P

of 33%. Trion added at least 350 million barrels to Pemex's 3P reserves; Supremus added around 125 million barrels. "It was between seven and 10 years ago that Pemex decided to make a huge investment in exploration, since deepwater is a very important part of the diversification strategy," says Murrieta. "We have to recognize that our first deepwater oil discoveries are very significant, and the next step is to obtain more information so that we can put together a development program that is reasonable and reliable, from an economic, environmental, and safety perspective." On December 6, 2012, Pemex started drilling the Maximino-1 well, which is the most promising exploratory well to be drilled in Perdido according to Pemex E&P's management.

Pemex will have to balance deepwater development and production with its less expensive, low risk projects that can be put into production faster, in order to manage risk (make sure that its investments are not overly weighted towards high risk, high capex projects), and reach short term production targets.

SHALE GAS

Having identified 200 exploratory opportunities in shale formations, Pemex intends to drill 20 wells in Burro-Picachos, 30 wells in Sabinas, 25 wells in Burgos-Mesozoic, and 100 wells in other regions by 2015. Nevertheless, exploration of Mexico's shale gas potential advanced slowly in 2012 as only six wells were drilled, which resulted in the discovery of both a commercial producer of shale gas and shale oil, as well as two non-commercial producers of dry gas. It is expected that Pemex will not progress rapidly with the development of shale resources until the energy reform has been passed in the country, and will in the meantime only drill a few exploration wells each year.

CONTRACTING

2012 was the second year since Pemex had introduced integrated service contracts for private operators. The first contracts were awarded in 2011, and the winners, Schlumberger and Petrofac, spent much of 2012 on the development of their awarded fields which were Magallanes, Santuario and Carrizo. Pemex also awarded a second round of integrated service contracts in 2012 in its Northern region: six areas were offered for tender, and of these five blocks were awarded, which brought some new private operators to the country. While Schlumberger and Petrofac won the only offshore block in the second round through their joint venture Petro-SPM Integrated Services, Pertrofac also won the onshore Pánuco field while new operators Cheiron Holdings and a consortium consisting of Monclova Pirineos Gas and Grupo Alfa also picked up contracts. The fact that the second round of contracts also featured two offshore blocks, of which one was not awarded, marked an important progression from the first round, which only featured onshore blocks. The third round of contracts was announced in December 2012, this time at Chicontepec, and contracts are scheduled to be awarded in July 2013. The areas on offer have 3.2 billion boe of 3P reserves, an enormous ramp-up in the size of the areas on offer in previous rounds.

REFINING

Pemex's refining throughput remained fairly stable between 2011 and 2012, increasing from 1.17 million b/d in 2011 to 1.20 million b/d in 2012. Murrieta explains the difficulty of comparing Mexico's refining capacity to that of other countries: "Refining is a downstream industry that is all about margins. So when Pemex talks of an improvement, it is usually in terms of a comparison between US Gulf coast and Mexican refining systems. Our target is to be in the first or second quartile of performance in the US Gulf refining system. Some of our targets to achieving this include producing less fuel oil and more gasoline at our refineries, and also removing the subsidies that affect the profitability of Mexico's refineries." Murrieta explains that improvements in Pemex's refining efficiency will have huge impacts on the bottom line of Pemex Refining, due to the sheer volume of crude that is processed each day.

SAFETY AND ENVIRONMENT

With the explosion at the Pemex tower in Mexico City dominating headlines in February 2013, safety at the NOC has come to the forefront of national discussion. In 2012, Pemex furthered its goal of moving to a preventative maintenance cycle in order to improve safety at its facilities, and has developed its use of SSPA (safety, security and environmental protection) regulations with its employees in an attempt to improve its safety performance.

FINANCE

Financial figures presented in March by Pemex's Board of Directors stand out as veritable achievements. Total sales registered a record high of US$129 billion, up 6% over 2011. In addition, the company's EBITDA indicator also recorded a new high of US$88 billion; another 6% increase in comparison with 2011. Moreover, Pemex's total investment also reached a record high of US$24 billion. On the other hand, the price of the Mexican crude oil basket only increased modestly, from US$101.09 in 2011 to US$101.86; this was just enough to offset the 0.2% reduction in Pemex's crude oil production.

TAKING THE REINS FOR A NEW ERA AT PEMEX

EMILIO LOZOYA AUSTIN
CEO of Pemex

Q: In what ways can increased budgetary and administrative autonomy enable Pemex to optimize its profitability and success in creating economic value?

A: One way to measure the value of an oil company is through its sales, and the benefits that these sales generate. Pemex, compared with other oil companies, makes a high profit before taxes and operates at relatively low production costs. For this reason, Pemex should have management autonomy and be subjected to a fiscal regime that allows it to invest more in order to produce more, and thus pay more taxes. While other oil companies pay around 35% of their revenue in taxes, Pemex pays over 70%. Management and budgetary autonomy would allow Pemex to operate with far greater efficiency by reducing bureaucracy, and to respond to changing market circumstances with more agility. Pemex should be seen as an engine of economic growth, through which Mexico can attract investment and technological development while strengthening the domestic supply chain.

Q: What are the main pillars of Pemex's strategy to increase oil production to between 2.7 and 3 million b/d by 2017, and what is your approach to help Pemex to reach that goal?

A: Unlike in recent history, Pemex now has a broader portfolio of exploration and production activities. We are currently working on 20 new projects, both offshore and onshore, to increase production. However, it is imperative for Pemex to have partners with whom we can share risks, because Mexico's energy future lies in deepwater exploration and production, where projects require larger investments. Oil companies around the world, including state-owned oil companies, diversify risks without losing the ownership of the hydrocarbons. Mexico has 30 years of oil production guaranteed at the current production rate, but if you want to exploit unconventional resources it is necessary to drill thousands of wells, and partners are required to do that, not only from a budget and technological perspective but also to meet the organizational and logistical requirements of such an undertaking. Also, by working with partners Pemex will be stimulating the development of the oil services industry by bringing new players into Mexico.

Q: The energy reform envisions the participation of the private sector in non-essential activities of Pemex. Which activities of Pemex do you consider to be essential?

A: The aim of the reform is to exploit Mexico's hydrocarbon wealth in a way that enables Pemex to stop being a source of foreign currency and start becoming a company that produces more hydrocarbons in a cheaper and cleaner way, while creating high quality jobs and generating more tax revenue. All of Pemex's activities are important because they are part of a production chain that starts with exploration and finishes with the delivery of the end product to the client. However, the priority for Pemex at this moment is exploration and production of hydrocarbons in order to advance the entire production chain of the company.

Q: What would be the impact of spinning off non-essential activities on Pemex's performance in core activities?

A: Pemex is the seventh largest oil company in the world and has large hydrocarbon reserves. However, Mexico is forced to import gasoline and gas. The fact that Pemex represents around a third of Mexico's federal revenue limits its ability to maneuver and exploit other business areas or invest in modern technology. As I said before, the entire production chain is important. We need to increase oil and gas production, we need to make substantial investments in refining to refined product imports, especially gasoline and diesel, and we need to increase gas production and build more transportation infrastructure to increase the competitiveness of the manufacturing industry, and seize opportunities in petrochemicals. As emphasized in the Pact for Mexico, we will be looking for the participation of new players in the oil and gas industry, both individualy and in partnership with Pemex, in many of these areas. Pemex is seeking to attract resources from other players to accelerate the development and exploitation of Mexico's hydrocarbon resources.

Q: What do you consider to be the main opportunities for enhancing operating performance through organizational restructuring?

A: First of all, our intention is to emphasize the corporate ethics and social responsibility of our company. Therefore,

| PEMEX CEO'S TRACK RECORD

Emilio Lozoya Austin was born on December 9th, 1974 in Mexico City. He is the son of Emilio Lozoya Thalmann, Energy Minister under President Carlos Salinas de Gortari and former Director of ISSSTE. Lozoya Austin comes from an extensive political lineage, which started with his grandfather, Jesús Lozoya Solís, a military doctor who served as Senator and Governor for Chihuahua from 1952-1955 and 1955-56, respectively.

Lozoya Austin started his career as Analyst of International Reserves and Currency at Banco de México, and subsequently served as Founder and Director of social interest housing company TerraDesign, and as member of the Board of Directors of the construction company OHL. In 2003, he started collaborating with the Inter-American Corporation of Investments, before becoming the Latin American Director for the World Economic Forum. He is the founder of the investment fund JF Holding, with headquarters in Luxemburg, which grew from €50 million to €1.2 billion euros in just 13 months.

During Enrique Peña Nieto's presidential campaign, Lozoya Austin was the Coordinator of International Linkage, and he served as Vice-Coordinator of International Affairs in the transition team. The President appointed him as CEO of Pemex on November 30th, 2012.

Pemex should be transparent and operate based on a permanent system of accountability. Mexico has the most restrictive regulatory framework in the world, and we have to make this framework more competitive because the oil and gas industry is global. A company that does not see sufficient return on its investments in Mexico will go to another country. There are more favorable conditions available around the world, and this is a critical point that must be addressed. A new organizational structure should improve decision-making and increase operational efficiency, which in return will require the advancement of corporate governance best practices. This is an area we are studying and we expect to see the results soon.

Q: What will be the respective roles of Pemex and external partners in introducing advanced technology and developing expertise to address the unique challenges faced in Mexico?

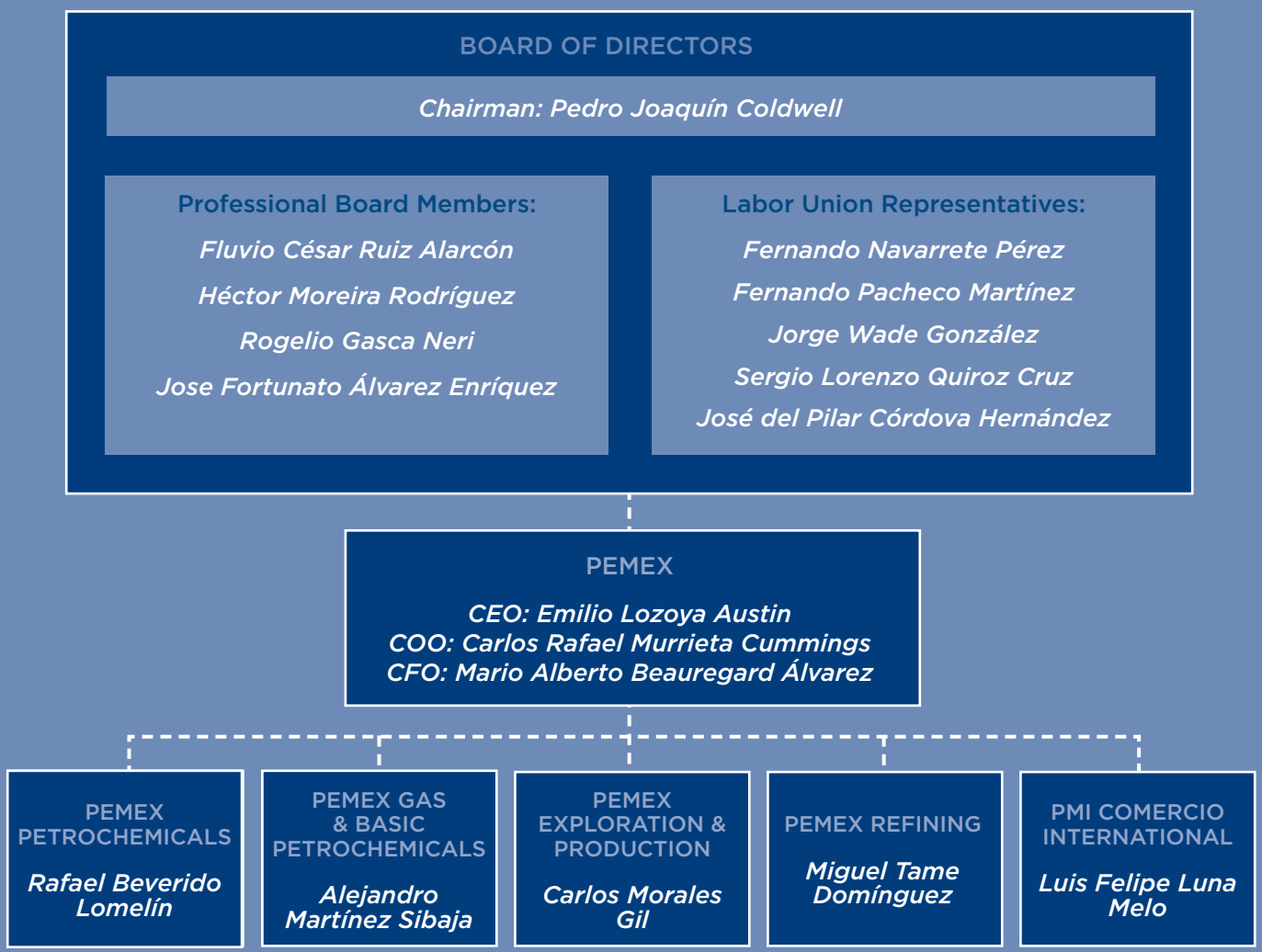
A: Technology is one of the most important variables that determine the success of a company. Today, Pemex is working with the best and most innovative technologies on the market; however, we still have a lot to do. One of the main instruments in allowing Pemex to meet its strategic goals is to promote technological development and human capital development. To achieve this goal, Pemex has agreements with various universities and institutes. Additionally, we have been signing technological cooperation agreements with various international companies. Recently, we renewed our agreement with Statoil, which allows us to advance the acquisition of technology and establish new ways of working in accordance with international best practices. Furthermore, Pemex has signed cooperation agreements with eight international oil companies, such as Exxon, Shell, Chevron, Statoil and Petrobras, with regard to research, technological development, scientific cooperation, and training in the areas of exploration, drilling, and the production of hydrocarbons. These agreements with operators enable our people to participate in technology research projects and geological analysis programs, and learn about research and the application of new technologies, and to conduct analyses of geological conditions or new ways of completing wells. We have also been looking for ways to develop our staff through postgraduate programs in Mexico and abroad. This has allowed us to strengthen our project execution capacity in exploration and production projects.

Q: What is your perspective on the success of the first two rounds of Integrated Services Contracts (ISC), and what are your expectations for the upcoming third round in Chicontepec and a future round in deepwater?

A: In early March, we held an informative workshop about the third round of integrated service contracts, during which it became evident that there was great interest among the companies participating in the Chicontepec bidding round, despite the fields' complexity and the degree of specialization required for their successful exploitation. Based on our experience from the last two rounds of ISCs we are looking for honest and open dialogue with organizations that are interested in bidding in the third round. The fields in Chicontepec will be awarded in July 2013. We still have not established the correct scheme for deepwater, but it will be completely in line with the current regulatory framework.

The integrated service contracts have allowed us to invest resources in fields that were previously inactive. In addition to the nine integrated service contracts that were tendered in the first two rounds, we have signed over 200 framework agreements, in line with the new legal framework, for the procurement of equipment and services in areas such as drilling, pipeline and platform construction.

PEMEX ORGANIZATIONAL STRUCTURE



WHO RUNS PEMEX AFTER THE ELECTIONS?

A few hours before taking office, President Enrique Peña Nieto announced the names of the Energy Minister and Pemex's CEO, both key positions in his cabinet. Pedro Joaquín Coldwell, appointed Energy Minister, and Emilio Lozoya Austin, Pemex's CEO, were unexpected choices for both positions, since neither had previous experience in the energy sector. Nonetheless, both men were very close to Peña Nieto during the presidential campaign; Joaquín Coldwell was the PRI's National President for less than a year, maneuvering the party to electoral triumph and a return to power after 12 years. Lozoya Austin met the President through Luis Videgaray Caso, current Finance Minister, and worked together with both men to secure foreign investment during Peña Nieto's governorship of the State of Mexico. Later on, Lozoya was the Coordinator of International Linkage and Vice-Coordinator of International Affairs during the transition period.

The relationship between the Energy Minister, Finance Minister, and Pemex's CEO is evident, and shows Peña Nieto's strategy to coordinate the three entities, form a common front, and prepare for upcoming challenges. Pemex is governed and regulated by two bodies, the Energy Ministry and the National Hydrocarbons Commission (CNH), and is also directly dependent on the Federal Budget and the policies of the Finance Ministry. One of the key issues that the administration needs to address in the near future is making a clear definition of roles between the Energy Ministry as policymaker, CNH as regulator and enforcer of such policies, and Pemex as operator. Even though these roles were established by the 2008 Energy Reform, the boundaries between each entity are not clearly defined, particularly because the CNH lacks the practical authority to supervise the exploitation and extraction of hydrocarbons.

After the 2012 election, the only major change was the appointment of a new CEO, with none of the directors in charge of the main subdivisions of the NOC changing roles. The board of directors also remained largely unchanged.

IMPROVING CORPORATE GOVERNANCE AT PEMEX

Twenty-one years ago, a new Pemex Law was approved, which included the first step towards the modernization of the NOC: the law determined the creation of a corporate governance structure and divided Pemex into four subsidiaries: Pemex Exploration and Production, Pemex Refining, Pemex Gas and Basic Petrochemicals, and Pemex Petrochemicals. On January 16, 2013, during an unscheduled Pemex Board Meeting, a proposal from the Professional Board Members triggered discussions on overturning this model, when Fluvio César Ruiz Alarcón, Professional Board Member of Pemex, recommended an internal restructuring that would see the four subsidiaries merged into one to increase efficiency. "We believe that the current subsidiary model has already yielded the expected results and that a change is needed for the company to continue growing," explains Ruiz Alarcón.

He believes that the strategic decision to divide Pemex into divisions has lost its validity since it no longer offers an optimal platform to streamline execution across the value chain. "The system is inefficient because it generates division in the decision-making process and creates power structures that cause conflicts of interest," Ruiz Alarcón claims. "It has also reduced the possibility of improving the information sharing process and the transfer of human, technological, and material resources between the company's different areas. In retrospect, it might seem that the creation of the four subsidiaries hindered the formation of a collective identity, both in terms of operations and in building a single corporate philosophy and identity."

When this issue of organizational restructuring was last brought before the Board of Directors, in August 2010, it was rejected since only Rogelio Gasca Neri and Ruiz Alarcón voted in favor. "The motives for change were already there, because success for one subsidiary does not necessarily mean success for the whole company," Ruiz Alarcón explains. "However, the political timing was not perfect: we were two years away from the end of the presidential term and the company needed to yield results, so the Board voted against change."

The proposed restructuring, to which Pemex CEO Emilio Lozoya will have to respond this year, is expected to benefit the company in some specific ways. "First of all, we expect the decision-making process to become more agile by eliminating bureaucracy and the concentration of power, thus facilitating the flow of information." Ruiz Alarcón adds: "Processes relating to issues such as safety, security, and the environment should be homogenous across all operations, and the restructuring will eliminate any duplication of functions; not by firing people, but by converting their capabilities to perform different activities."

The reintegration of the four subsidiaries into one strong, unified Pemex also brings a symbolic solidity back to the company. "Reafirming a collective identity will be vital for Pemex's future, harmonizing the company's goals and working towards them with a unified strategy that does not differ from region to region or from subsidiary to subsidiary," Ruiz Alarcón remarks.The creation of a more solid identity might be the first building block towards letting Pemex work as a business-oriented company. The restructuring would also allow for the elimination of so-called 'internal sales', and the possible conflicts of interest within the company. In the current organizational structure the transfer of one subsidiary's final product to another has to be accounted for as an individual transaction, even if the product remains within the company. Having unilateral objectives for each subsidiary also causes inefficiencies. "For example, it is not always in Pemex E&P's best interests to exploit natural gas, since it primarily uses it for reinjection; but Pemex Petrochemicals needs that gas to operate. As a result, the conflict of interest between the objectives of each division directly affects the overall performance of Pemex," explains Ruiz Alarcón.

The current concern for Ruiz Alarcón is again the timing at which this first step is taken. "The restructuring is overdue," he states, "but there are several groups inside the government that would prefer to delay it until the energy reform is officially proposed."

According to Héctor Moreira, Professional Board Member of Pemex, the first efforts to modernize the NOC should focused on the most conflicting issues. "Which model best fits Mexico? Should we create a new business model to better fit the unique requirements of the national industry?" he asks. "These questions need to be properly addressed in the first three quarters of this year. Debate should not be prolonged past September, since the different stance of each political party would then combine with the urgency of reaching an agreement to present the federal budget."

"The current subsidiary model has already yielded the expected results and a change is needed for the company to continue growing"

PEÑA NIETO'S FIRST 100 DAYS

Moving Mexico towards progress is President Peña Nieto's main goal during his presidential term. His efforts during the first 100 days of his term were focused on the ideals that he aligned himself with on his first day of mandate. By firmly stating the commitments of his government, President Peña Nieto publicly set milestones, so that the population would be able to evaluate the success of his presidential term in five main areas: peace, social inclusion, quality education, sustainability and energy prosperity, and global responsibility.

"Let us all be part of a new Mexico, which is not afraid of transformation and is prepared to transcend and leave a mark. Transforming the country means moving all that needs to be moved: people, mentalities, and institutions"

President Enrique Peña Nieto

In the first three months and ten days of his administration President Peña Nieto has achieved important progress in several of these areas. He started out by signing a political agreement with the country's main parties, rallying them in favor of structural reforms and development goals. President Peña Nieto later managed one of the most important political feats in Mexico's recent political history: the arrest of the politically powerful Elba Esther Gordillo, leader for the National Education Workers' Union (SNTE), and with it, apprehending the main opponent to a quality-based education reform that would grant teaching positions based on merits and not inheritance. The education reform was passed under the tacit warning that corruption and opposition to the greater good would not be tolerated under the new PRI mandate.

Arguably the most significant success within Peña Nieto's first 100 days is the political consensus he has managed to achieve, across the political parties that form Mexico's Congress. "The new administration surprised everyone by negotiating the Pact for Mexico with all the political actors involved in government," states Jesús Reyes Heroles, former CEO of Pemex. "The pact broke the paradigm of the last ten years, where there was not enough representation or governability to introduce significant reforms. The political agreement to join forces, diagnose the state of the country, and combine efforts in order to benefit Mexico was unprecedented, and the President was one of the key forces behind the achievement. The main legislative battles that the present administration is fighting have the approval of all political forces. President Peña Nieto has relied on political ability and wit to create legislative agreements that facilitate dialogue and consensus around the different political ideas that abound in Congress. This cooperation will be crucial in achieving a lasting and comprehensive energy reform. "The second most important achievement of this administration, is the pace at which it has moved to implement this agreement and materialize its agenda," Reyes Heroles comments. "They have used political savvy to move swiftly and effectively to streamline the changes that are needed." As David Penchyna, President of the Senate Energy Commission, believes, the President has been brave to pick subjects that were originally vetoed by the PRI and succeeded in changing the mentality within his own party with the country's interests in mind. Under this disposition, the party has already modified its own bylaws to allow further openness in Pemex and in the energy sector.

President Peña Nieto's first 100 days created a platform for reaching consensus and overcoming political differences in Congress, which will pave the way for a comprehensive energy reform to be passed, followed by a proper fiscal reform.

CREATING COMMON GROUND FOR THE ENERGY DEBATE AND FUTURE POLICY DECISIONS

"There is huge political diversity in Congress: the governing party, the PRI, does not own the majority of the seats in either of the Chambers," states Senator David Penchyna, President of the Senate Energy Commission. "However, there is clarity within the presidency and some ideological agreement among the legislative branch, both in the Senate and the Chamber of Deputies. Proposals by the PAN and the PRD are on the table and the dialogue is ongoing: there may be many topics on which we do not see eye to eye with other parties, but we now have common ground from which to start working, and the openness to debate. These energy reform proposals are good news for the energy sector, and are based on the idea that the past reform was insufficient due to political challenges to the legislation; we have high expectations that we will achieve progress through a new comprehensive reform."

CNH PERSPECTIVE ON INDUSTRY DEVELOPMENT

JUAN CARLOS ZEPEDA MOLINA
President of the CNH

Q: What are the main challenges that the Mexican oil and gas industry is facing, and what are the roles of PEMEX and the private sector in addressing these challenges?

A: The definition of the strategy for hydrocarbons exploration and production must start by recognizing the strengths and weaknesses of Pemex, and the opportunities and threats that exist in the industry nowadays.

No company in the world aspires to be leader in the operation of all types of oil and gas fields. Companies specialize in deepwater, have competitive advantages in unconventional resources, or focus on non-associated gas. It is not feasible to oblige Pemex to keep exploiting its shallow water oil reserves successfully while also requiring the company to efficiently exploit deepwater and unconventional resources such as shale gas, shale oil and Chicontepec's oil. Pemex must build on its strengths and allow participation of third parties in some other areas. Forcing Pemex to excel on all fronts means losing competitiveness in those areas where it has the greatest potential, and it jeopardizes the company's ability to reach its goals.

Pemex is the world's number one producer of oil in shallow water. In the 1970s, it was a pioneer in drilling shallow water wells and it remains the most active company in this area today. Historically, 61% of oil production in Mexico has been extracted from shallow water fields, which represents 24.021 billion bbl of 39.695 billion bbl produced until January 1, 2012. Shallow water production is concentrated in the South-East Region, which has produced 99% of the marine production (23.709 billion bbl). In numbers, 59% of 2P reserves and 51% of 3P reserves are concentrated in the South-East Region. In light of this, Petróleos Mexicanos has clear strengths in areas with high commercial potential. Therefore, this is the area in which Pemex has to focus its financial and human resources.

Regarding Mexico's deepwater, ultra-deepwater and unconventional resources – tight oil, shale gas and shale oil – I believe they must be developed via third party companies whose strengths lie precisely in these types of fields. Chicontepec is without doubt the project where Pemex weaknesses have been revealed; to date this project has not been able to meet the high expectations that we had for it. For every US$100 invested in deepwater exploration 14 barrels of oil reserves have been discovered, while in shallow water for the same investment 147 barrels of oil reserves have been discovered. For shale gas and shale oil, the scenario does not look any better. Despite Pemex's regular exploration activities in the northern part of the country, these unconventional resources require technology, techniques and expertise that Pemex has not yet fully acquired. Mexico has sufficient oil and gas resources to increase hydrocarbon production; nevertheless, Pemex must invest its resources in its strongest areas – such as shallow water – and leave projects such as unconventional resources to specialized third parties.

The National Hydrocarbons Commission (CNH) was created as part of Mexico's 2008 Energy Reform, and was installed on May 20, 2009 via the Presidential appointment of the five commissioners that form its governing body. Today, the CNH is headed by President Commissioner Juan Carlos Zepeda Molina, and four commissioners: Edgar René Rangel German, Guillermo Cruz Domínguez Vargas, Alma América Porres Luna, and Néstor Martínez Romero. Their mandate is to regulate and supervise the exploration and exploitation of Mexico's hydrocarbons by ensuring that projects of Pemex and its subsidiary companies are performed in accordance with the following objectives: (1) optimizing the recovery factor and maximizing long-term production of hydrocarbons, (2) ensuring a reserves replacement rate that guarantees Mexico's energy security, (3) using appropriate technology for exploration and extraction of hydrocarbons, (4) ensuring environmental protection and sustainability during hydrocarbon exploration and exploitation, (5) conducting activities in line with Mexico's industrial safety standards, and (6) minimizing flaring and venting of gas and hydrocarbons.

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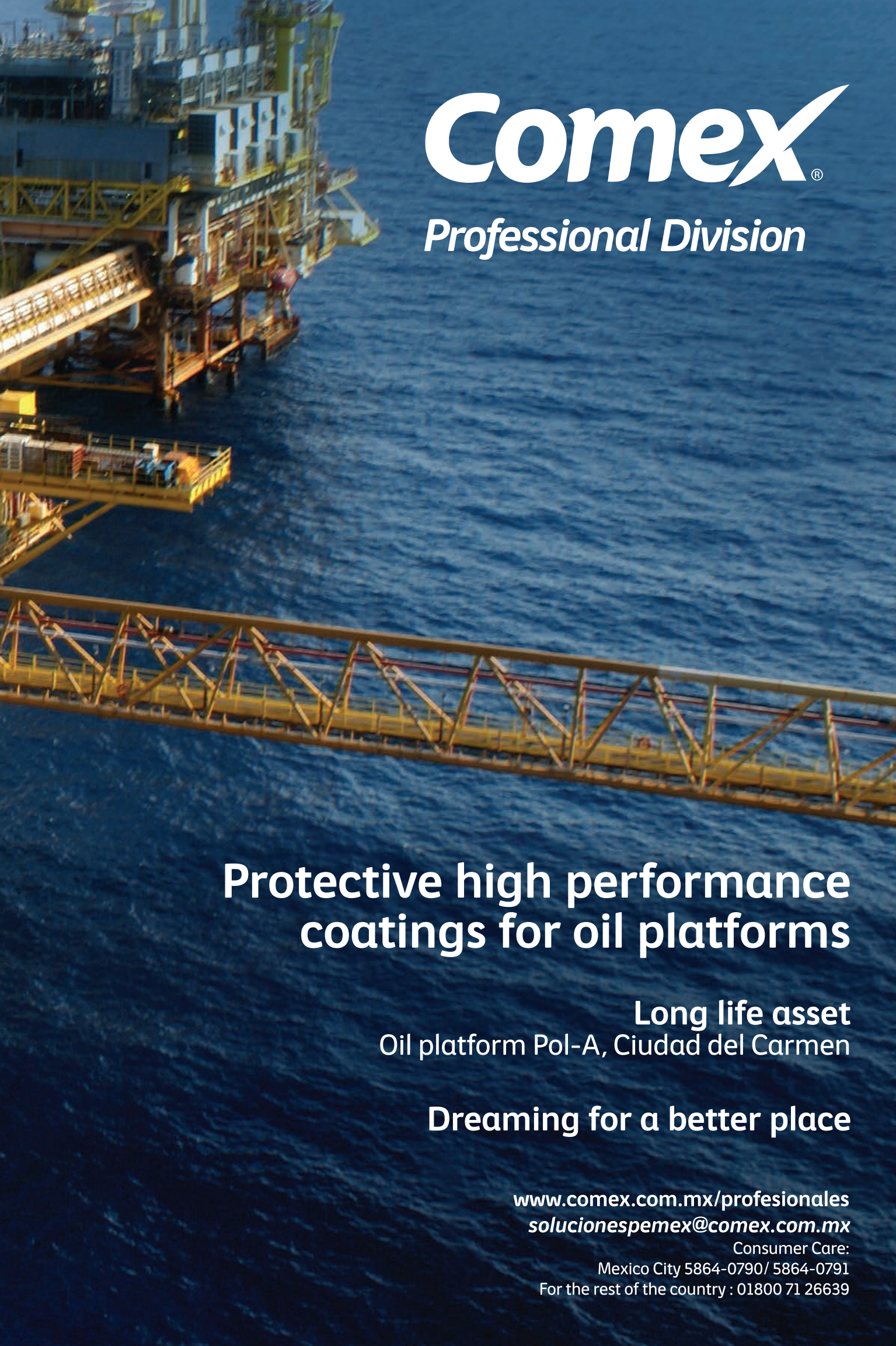
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MEXICO'S CHANGING TECHNOLOGY CHALLENGES

VINICIO SURO PÉREZ
Director General of the Mexican Petroleum Institute (IMP)

Q: How would you assess the alignment between the technological needs of Pemex and the research focus of the IMP?

A: We are in the process of establishing a better alignment between the IMP's research priorities and the technical services the institute offers, and the current and future needs of Pemex. One of the crucial priorities is to decide on the measure by which the IMP's performance is measured. It should not be the same measure used for private sector companies, because they have different goals and expectations. Once such a measure has been established, it will be easier for us to set goals and priorities.

Q: How can the IMP measure the value it creates when it does not commercialize its technological developments?

A: I do not believe that commercialization is a necessary condition for measuring value. What we need are indicators to measure performance, and in this way we will be able to assess the value that we have generated for Pemex. For example, technology we developed to incrementally increase production at mature fields generates value for Pemex, and shows our worth. This should be how we define our value as an institution.

Q: Such technologies are also developed by various international companies. Why should Pemex acquire its technology from the IMP and not from the private sector?

A: I would say the answer is very simple: the market is extensive, and the IMP offers services in the same way as other companies. Therefore, the IMP's technological offer has to be better than the rest. Our goal should be to compete with these companies to offer better technology. Sometimes we will succeed and sometimes we will not. We are ready to face that, but the important thing is to remove the distinction between private and public companies, compete in the open market, and to do that the IMP requires an efficient business model.

Q: In which areas can you generate most value, and where are you planning to concentrate the IMP's human and financial resources to be competitive in the open market?

A: We need to identify the specific areas and business lines in which we need to work. For instance, in research we are working extremely hard to identify and update technologies in order to produce shale gas more effectively in Mexico. The second challenge is how to adapt current technologies in order to produce from deepwater wells. Another avenue of research focuses on how to increase the recovery factor at existing fields in Mexico. In terms of refining, we have a long history of producing catalysts in order to enhance the production of gasoline and diesel. So we have different avenues in which we are competing, and we are competing well.

Q: What have been the IMP's main achievements in deepwater technology research, and how can these be put to practical use?

A: For the last few years, the IMP has focused on studying current technologies in order to exploit deepwater reservoirs. Besides this, we are exploring different materials in order to perform better in deepwater conditions. At such depths, the water temperature is close to freezing, and new materials can help Pemex to both explore and produce better in these conditions.

Q: How will you support Pemex to make technological choices during the development of deepwater projects?

A: The first area is technology management - which technologies to use and why - and the second is the engineering process necessary to come up with a detailed analysis of all the facilities that are necessary to produce in deepwater.

Q: How do you interact with Pemex to ensure that the work of one aligns with and complements the work of the other?

A: In terms of research, we have a committee in which Pemex participates so we can discuss and approve projects jointly. We also have a technical group that is in charge of setting project goals and monitoring progress towards achieving these goals.

Q: What is the extent of the IMP's involvement in Chicontepec?

A: In Chicontepec we are in the process of formalizing the conceptual design of a research center focused exclusively on the region. The problems we want to address are very similar to those of shale gas. We are working on drilling and fracking methods and, of course, we are using 3D seismic technology to analyze the elasticity of the rock and calculate the level of fracking needed to improve productivity and reduce capital costs while maximizing oil production. Since the saturation pressure of the fields is very close to the reservoir pressure, and mobility of gas is higher than mobility of oil, the production of oil will be halted. The idea is to develop a secondary recovery method or enhanced recovery method to address this.

Q: How well aligned is your budget to the goals and ambitions of the IMP? How can budget allocation be optimized to achieve your goals and address the challenges the Mexican oil and gas industry is facing?

A: The legal reforms in Mexico in 2006 and 2008 allocated enormous amounts of money to research and development. What we need today is to form new research groups to address the current problems and to complement Mexico's current scientific capacity. It is not a question of money; it is the focus on the management of that money; the focus on selecting the correct problems to solve, and the management of allocating money and people to the right problems.

Q: How will you convince Pemex that the IMP is capable of taking on the technological challenges Pemex will face in the future?

I would say it is organization; we need to change the organization. We also need to change the relationship with Pemex, which has to be based on the generation of value for Pemex and knowledge for the IMP. The rest relates to the internal organization of the different research groups that will address the important challenges ahead of us. The IMP is a Mexican institution that has been around for over 47 years and has the ambition to transform Pemex and the country. Mexico will only be successful in the development of its oil and gas sector if we address current problems: we need to improve the recovery factor of our fields, develop our deepwater reserves efficiently, increase production in Chicontepec, optimize value creation, create new technologies, and begin producing shale gas and oil. We have a lot of work to do, but we have the will to do it. The challenge will be to keep up the pace of development.

THE STRATEGIC TECHNOLOGY PLAN

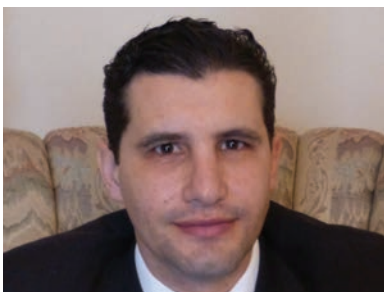
In 2010, Pemex and the IMP drafted the Strategic Technology Plan (PET) 2010-2024 to identify the technological needs of Pemex and align these with the research and development priorities of the IMP. Its four different sections are dedicated to: the technological challenges and strategies that emerge from the business plan, associated problems and technological challenges, technological requirements to address the identified problems, and an impact assessment.

TECHNOLOGICAL NEEDS OF THE PEMEX'S SUBSIDIARIES

Divisions	Acquisition	Assimilation	Technological Development	Technological Services	Total Requirements
Exploration	0%	36%	61%	3%	59
Production	14%	29%	51%	6%	215
Refining	23%	34%	31%	11%	35
Gas and Basic Petrochemicals	7%	0%	28%	65%	114
Petrochemicals	26%	4%	27%	43%	143

Once the Board of Directors approved the Strategic Technology Plan on June 3, 2011, the company devised a strategy for its conscientious execution. This strategy outlined the need to focus on the main challenges, identify technological alternatives to address them, map a critical path for execution, and create a platform for technology projects. The Strategic Technology Plan has a strong focus on the technological needs, and a direct impact on the performance of Pemex E&P: the incorporation of technologies to optimize production and increase recovery rates in mature fields, and the development of technologies for the exploitation of unconventional resources. Initially, the strategy was focused on the development of technology roadmaps for four exploration projects – Gulf of Mexico B, Perdido, Campeche Oriente, and Comalcalco – as well as in the exploitation projects – KMZ, Chicontepec, Crudo Ligero Marino, and Delta del Grijalva. The Strategic Technology Plan will continue to assist Pemex E&P in incorporating new technologies based on its roadmaps in order to face the toughest technology challenges, and leverage the methodology applied in other priority projects.

STREAMLINING PEMEX'S PROCUREMENT PROCESS



ARTURO HENRÍQUEZ AUTREY
President and CEO of Integrated Trade Systems

Q: What are the main challenges that suppliers and service providers face when contracting with Pemex?

A: The public bidding process is very laborious and complex, and requires a tremendous amount of procedures that are not necessarily aligned with global best practices in this area. As a result of the high level of bureaucracy and red-tape involved, the bidding process becomes inefficient.

Q: What is the role of Integrated Trade Systems (ITS) in streamlining the procurement process?

A: ITS was established to create value for Pemex by ensuring that the company is able to procure products and services at the best market rates and conditions, such as short delivery time and improved legal and technical compliance. We have formulated macro contracts, called framework agreements, that enable the NOC to perform direct purchases that are in compliance with the law. These framework agreements allow the process to become faster, more efficient, and more transparent, while facilitating faster communication between Pemex and its suppliers.

Q: What are the main requirements that suppliers and service providers have to meet before they can enter into a framework agreement?

A: Pemex needs to have a direct procurement requirement for us to start overseeing negotiations with any company that could satisfy this need. Once the need is confirmed, the user within the Pemex subsidiary asks ITS to negotiate a framework agreement with the company that would meet this need. We certify their reliability and financial strength, which is a prerequisite for them to be able to establish a long-term relationship with Pemex. ITS negotiates with the company, without discriminating on its national or international background as long as it complies with our requirements, and establishes the range of products and services that it can directly sell to Pemex subsidiaries under the framework agreement. We audit prices through outsourced auditors and make sure that we get the best price according to the size of the company and the deal struck, with the possibility to cancel the contract if we find inconsistencies or better prices in the market. If, during our continuous auditing, we find out that the supplier has not given us the best market price, we can apply a retroactive clause, charging that price difference in the next installment of the contract. A penalty value is also established in case the company is inefficient on delivery or fails to observe the legal conditions stipulated in the contract.

Q: How can ITS accelerate the introduction of new technologies to Mexico?

A: Suppliers need to convince Pemex that it needs their technologies. It is not our responsibility to promote suppliers or technologies, since we are not the experts in this domain; we are the experts in the procurement of those technologies, processes, services, and equipment. On the other hand, ITS strives to ensure that a sound percentage of Mexican content is included in the products and services that Pemex procures. Even though the domestic industry is very competitive, Pemex sometimes needs international technologies to overcome new challenges in areas where the national industry lacks the necessary capabilities, technology and experience. It all comes down to what is best for Pemex, but we are very mindful of local content and the idea of strategic alliances between national and international players.

Q: What opportunities do you see for improving the procurement process under the present legal framework?

A: The procurement process is currently fragmented, since each division has its own procurement activities. This creates several inefficiencies, since the procurement committees of the four subsidiaries use different procedures and standards, even when they have the same guidelines. The solution to further streamline the process is to centralize procurement activities and standardize the procedure. Once centralized, we will better understand the bigger picture and negotiate more intelligently under the Pemex umbrella. It will be very different to negotiate under that guise, giving companies a certain procurement commitment as opposed to every subdivision buying products separately from the same supplier. The centralized vision would allow us a stronger negotiating stance and better compliance regulations and guidelines, with a decentralized distribution scheme. We are currently looking at this hybrid centralized model with Pemex, since most of the large oil and gas companies have a variation on this type of model.

DEVELOPMENT OF PEMEX'S CONTRACTING STRATEGY

In terms of contracting, one of the biggest changes in recent years has been the introduction of integrated service contracts. Luis Sergio Guaso Montoya, Subdirector of Business Development at Pemex, explains the reasoning behind their introduction from the Pemex perspective: "One of the main levers for supporting the future development of Pemex is to attract additional capabilities in order to develop new fields, or fields where Pemex does not have enough internal development capability. The bidding rounds that have already started, and those that are planned for the future, will provide the private sector with access to opportunities in Mexico, and also address the different needs and priorities of Pemex."

Mature fields that have been left as a low priority for Pemex in the past are starting to be contracted out under the integrated services contracting model, for private operators to step in and boost production. Two contracting rounds have taken place so far for fields of this type, with the first round in Pemex's Southern Region and the second one in the Northern Region. Analyzing the success of these contracting rounds so far, Guaso Montoya says that: "At the end of the day, we can say that the balance of results was eventually positive for the first two rounds: seven contracts were awarded out of nine, which is good by international standards. We are in the process of analysing and evaluating these contracting rounds, and implementing changes for future rounds."

"The bidding rounds that have already started, and those that are planned for the future, will provide the private sector with access to opportunities in Mexico, and also address the different needs and priorities of Pemex"

Luis Sergio Guaso Montoya, Subdirector of Business Development at Pemex

The third round of contracts will focus on Chicontepec, a challenge for both Pemex and private operators: the fields are unconventional in nature, and getting production to required levels has so far proven difficult for the NOC. Guaso Montoya explains the changes that have been made to the structure of the contracts in order to make this third round more appealing for bidders. "Comparing the different characteristics of Chicontepec with the mature fields that have previously been awarded, the model and the terms of the contracts should be adjusted, according to the characteristics of Chicontepec," he says. "I believe that awarding the contracts at Chicontepec based only on the lowest fee-per-barrel is not the optimal criteria. On the contrary, it should be just one element, because the risk, uncertainty and cost is difficult to manage with only a single variable. That is why we need to involve other conditions in order to evaluate what might be the best offer for Pemex.

"One element is investment commitment," continues Guaso Montoya. "In these different areas at Chicontepec, current production is almost zero - in practical terms there is no production. In the previous two rounds of contracts, there was some production in all areas, and this represented good leverage for contractors to carry out their different development programmes. At Chicontepec, this is not the case. Another way to evaluate bids, aside from investment commitment, should be social and community responsibility and local content."

Recently, the role of contracting regimes in the development of local content has been discussed a lot in Mexico. Guaso Montoya explains that for Pemex there is only one definition of local content: the economic value created in the country by a particular company or project. "There are different dimensions to this concept," he explains. "One is the legal dimension. Mexico is part of a number of different international treaties, which limits our ability, as a public sector entity, to impose local content restrictions up to a maximum figure of 40%. Only in the case of integrated contracts do we have the ability to set this minimum local content requirement." The other element, according to Guaso Montoya, is the duration of the contracts offered. By offering longer contracts to international service providers and contractors, Pemex can incentivize businesses to establish themselves within the country. "If a contract lasts for 30 or 40 years, then it will be more cost efficient for the company to establish long-term links to the domestic industry," he explains.

Issuing longer term contracts is also a strategy that Pemex is using to boost the number of rigs in the country: for the last two years, Pemex has been unable to reach its drilling targets because it did not have the sufficient number of rigs contracted to complete the work. By moving from contracts that only lasted a few months to contracts that stretch to five or six years, and with the possibility of tendering for 10 year contracts also on the table, Guaso Montoya hopes that Pemex will be able to reach its drilling targets more easily.

DEVELOPMENT OF ISCS IN 2012

"I believe the second round of contracts can be considered a success for Pemex, despite the fact that there were fewer participants in the second round than in the first"

David Enríquez, Partner at Goodrich, Riquelme y Asociados

Many of the companies that participated in the first round of integrated service contracts (ISCs) also competed in the second round of contracting. Additionally, there were some new players in the second round that did not bid in the first, something that David Enríquez, Partner at Goodrich, Riquelme y Asociados, sees as a positive sign for Pemex. "It is always interesting to see new players in the marketplace, and this should be considered an achievement for Pemex." He goes on to say that the lack of interest from the IOCs in the second round was natural. "The brownfield contracts on offer did not have the profile to match the investment priorities of such large companies. It should not be considered a failure on the part of Pemex that these companies were not interested in the available fields."

"When it comes to ISCs, I have always said that we have to measure commercial success according to the reference price of the contracts, the final fee per barrel, and the number and level of participants in each round," says Enríquez. "In these terms, I believe the second round of contracts can be considered a success for Pemex, despite the fact that there were fewer participants in the second round than in the first; this could instead be seen as a message from the industry regarding the areas that were offered in the second round."

Rather than focus on the fact that the contracts were not ideally suited to the IOCs, Enríquez points out that other companies such as Petrofac have taken advantage of the field profiles: "Petrofac have made it very clear to everyone that they have come to Mexico to capitalize on the mature fields on offer, and now, after two rounds of contracting, they have asserted themselves as the leading private operator for this type of field."

The second round of contracts was an excellent example of the importance of choosing fields with the right profile for potential operators, and setting the right reference price: at the initial awarding stage the tender for the two offshore areas on offer, Arenque and Atún, was voided by Pemex. At Arenque this happened due to the fact that no company made an offer under the maximum fee per barrel price set by Pemex. At Atún, it was due to the fact that no company had made a bid for the field. Enríquez's perspective is that Pemex misjudged the reference price it set for the areas, and the reason for this is difficult to explain. "There has been a lot of criticism of Pemex for the reference price it set for the two offshore areas. Pemex has been working in shallow waters for so long that it should have a fair appreciation of the cost of working on such projects; the reference price was so far below a fair price for the contracts that it almost seems like Pemex wanted to send a message to the market about its perspective on the integrated service contracts. At the very least, it is fair to say that there was some serious misalignment of goals within Pemex."

However, Enríquez is careful to point out that from the Pemex perspective the contracts have to be considered successful. "In the second contracting round Pemex is able to set the reference price for its fields based on the maximum it wishes to pay for the service being provided. If no company manages to make a bid under that price, then fields are not awarded. Through this system Pemex never puts itself into a situation where it makes a loss on the fields, and for the contractors success must also be measured in this way: companies would not make bids that would not be profitable for them in the long run. Therefore, every awarded tender can be seen as a success for both parties."

The third round of integrated service contracts are scheduled to be awarded in July: this time, the blocks on offer are in Chicontepec, one of Pemex's more challenging geological areas. "Chicontepec is going to be an interesting round, because of the companies that have a working knowledge of Chicontepec and its challenges," says Enríquez, referring to the private sector oilfield service companies that have been working at the asset for a number of years through field labs, experimental zones where companies were charged with testing different extraction technologies and techniques. "In this round, I believe that rather than seeing new players winning blocks on their own, we will see experienced players teaming up with newcomers. Without the actual experience of working at the field, it will be hard to outbid the companies that have an understanding of the region."

IMPORTANCE OF THE ISCS FOR PEMEX'S PRODUCTION STRATEGY

The integrated service contracts, or ISCs, implemented in Mexico following the 2008 Energy Reform, have both supporters and detractors in the national oil and gas industry. Arguments over whether they are the best way to outsource services have gone back and forth. As Carlos Rafael Murrieta Cummings, Chief Operating Officer of Pemex, describes before the ISCs were introduced life in the Mexican oil and gas industry was complicated. Pemex believed itself to be extremely powerful, as its mandate was to carry out all upstream and downstream activities within the Mexican oil and gas industry, with a limited budget. Over time, it became clear that Pemex's objectives throughout the value chain were not being reached: production started to decline, and questions about the availability of resources for Mexico's future started to be raised. "When I first stepped in as COO in 2009, the headlines of news articles were: 'Pemex is running out of crude!'" Murrieta Cummings recalls.

"For 20 years, Pemex believed it did not need any help in advancing projects from early exploration stages to production"

Carlos Rafael Murrieta Cummings, Chief Operating Officer of Pemex

At that time, the company was adapting to the 2008 Energy Reform and the Pemex Law was at its early implementation stage. "For 20 years, Pemex believed it did not need any help in advancing projects from early exploration stages to production," he says. As a result, Pemex is experiencing the pressures of not having focused on its long-term goals as well as it should have done, being burdened with so many tasks and such a small budget to complete them. "The strategy of investing in the present rather than in the future does not pay off in the long run, so whatever task you leave unfinished now will have consequences in around 10 years," he adds.

However, the Pemex Law and the 2008 Energy Reform allowed Pemex to contract private companies to produce oil in designated fields at the lowest cost on fee per barrel basis. The ISCs serve as a platform from which to obtain more production from existing fields, by enabling Pemex to choose which fields it should develop, and which field should be awarded to private sector operators. This decision is based on the technological capabilities required, Pemex's execution capacity, and a field's priority level in Pemex's budget allocation process. By inviting private operators, Pemex effectively attracts new technology and obtains additional production without having to invest itself from Pemex, allowing the company to concentrate its budget and efforts in the business areas where it can create the most value.

After awarding eight of the nine blocks tendered within the first two ISC rounds, Pemex is enjoying a slight increase in production in mature fields – total average production expected from the blocks licensed in the first and second rounds should add up to 34,000 b/d this year, and increase up to 73,000 b/d during 2014, according to Gustavo Hernández García, Subdirector of Planning and Evaluation at Pemex E&P. This is due to the focused technologies and international best practices that private companies bring to projects. The expertise from those companies is also expected to result in the transfer of technology and knowledge that will benefit Pemex and the Mexican oil and gas industry more widely.

"Pemex can still do everything – in spite of the debate over whether it would excel at or have the adequate technology for each activity," Murrieta Cummings claims. "The problem has more to do with the restrictions that forced us to perform all of those activities at the same time. Pemex does not have the budget, time, or human resources to execute all that is needed to optimize production of Mexico's hydrocarbon reserves."

THE FUTURE OF ISCS: CHICONTEPEC AND DEEPWATER

Six blocks in Chicontepec are to be awarded to the highest qualified bidder in the third round of ISCs on July 11th 2013: Pitepec, Soledad, Amatitlán, Miquetla, Humapa, and Miahuapan. Located in the Tampico-Misantla basin, these six blocks have 3P reserves close to 3.2 billion boe and prospective resources of up to an additional 0.9 billion boe.

A future fourth round of ISC blocks is expected to be tendered sometime in 2014. "Deepwater represents a high-risk, high-profitability area for Pemex," explains Carlos Morales Gil, Director of Pemex Exploration and Production. "Those are the kinds of projects that Pemex wants to concentrate on. Whether integrated service contracts are the best way to approach this segment is a question that the energy reform should address."

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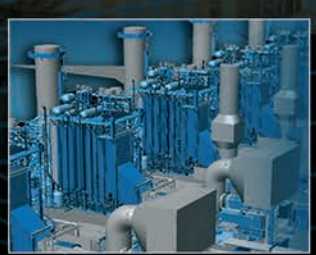

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THE PROS AND CONS OF MEXICO'S CONTRACTING MODEL

By José Pablo Rinkenbach. Multiple debates have lead to diverse opinions on how to successfully capitalize on the experiences of Brazil and Norway's energy sectors. However, in order to achieve a comprehensive reform that is beneficial to Mexico, there needs to be an in-depth analysis of the economics related to oil exploration and production projects, as well as a general understanding of existing international legal frameworks.

The pros and cons of each contracting model depend greatly on the development challenges of a country's reservoirs. Concessions and joint ventures tend to be used more frequently when a substantial exploration program is required That creates a need for the diversification of the high geological and developmental risks. On the other hand, countries such as Mexico tend to use service contracts for oil production, given the presence of reservoirs with low geological and development risks, combined with a strong knowledge base gained through a long history of operation. These contracts stem from the premise that the private service provider will assume a low level of risk and uncertainty and, therefore, needs to be compensated only with a service fee. It is also relevant to mention that, on an international level, there is no precedent of using service contracts for the development of deepwater or shale gas.

The wide variety of priorities and development challenges that the global oil industry have led to the creation for a range of contracting models, of which the most widely used is the concession model. At present, 60 countries use concession systems, 20 use joint ventures, 41 work under the production sharing agreement (PSA) model, four use service models, and 16 work with hybrid models. Anglo-Saxon countries tend to work with concession models, African and Asian countries usually prefer PSA frameworks, and models used in Middle Eastern countries tend to vary significantly.

Brazil uses a hybrid model, by a concession framework is in place and a PSA model is about to be implemented for the country's pre-salt deepwater reservoirs. It is important to note that the structure of the Brazilian model is extremely open but maintains a public-private modus operandi. In fact, Petrobras could be classified as a national champion with access to private investment, since it combines federal and private resources, operates as a private company, and is listed on the Stock Exchange; nevertheless, the State keeps control of the majority of the voting stock.

What model is Mexico considering implementing through its Energy Reform? The answer is simplified when we look at the 54th commitment in the 'Pact for Mexico', which states: "The nation will keep the ownership and control of hydrocarbons and of Pemex as a public company through the state. In all cases, the nation will receive the totality of hydrocarbon production." The first statement of this pledge eliminates the possibility of using concession and joint venture models, and the second statement also prohibits the use of PSA models.

José Pablo Rinkenbach, Director of Ainda Consultores

While this might imply that the energy reform will focus on looking for more sophisticated service contracts, it also leaves open the possibility of using a hybrid model, such as the one that Venezuela developed two decades ago: a risk-based exploration model, also referred to as a shared profit model. Along the spectrum of different types of development models, these risk-based exploration contracts are located in between PSA models and service contracts. They establish the necessary incentives for efficient exploration and production of oil resources by private companies, and allow for the maximization of oil income for the country.

The most feasible outcome of the energy reform will therefore be the creation of new service contracts, applied to oil production in mature fields, onshore, shallow water conventional reservoirs, and risk-based exploration models for unconventional reservoirs, such as shale gas and deepwater fields. But the success in the implementation of this new business model and of efficient management for the industry requires the energy reform to clearly define the division of responsibility between the Energy Ministry, CNH, and Pemex.

MODELS FOR PRIVATE PARTICIPATION IN E&P

Concession agreements: private operator has ownership of both reserves and production.

Joint venture: state and private operators are co-owners of reserves and production.

Production Sharing Agreement: state is owner of the reserves but production benefits are shared with the private operator.

Service contracts: state is owner of both reserves and production, while the private operator receives compensation for services provided.

PEMEX'S POSITION IN AN INTERNATIONAL CONTEXT

RENÉ ORTIZ
Secretary-General of OPEC from 1979-1981

Q: How does an organization like OPEC allow non-members such as Mexico to participate in influencing global energy markets?

A: After the tumultuous years of 1979 and the early 1980s, of oil production shortages and several other threats, oil diplomacy was inaugurated at OPEC. Some of the OPEC gatherings were open to non-OPEC members like Mexico, Russia, Egypt, and Oman, among many others. Frequent dialogues took place between OPEC members, non-OPEC countries, consumer energy watchdogs, and international media, with the objective of establishing a just forum to discuss issues of common interest, and to avoid another energy crisis. Today, this idea is commonplace, and international organizations like OPEC, IEA, OLADE, IEF, and dozens of other institutions hold hundreds of forums year after year.

Q: With a renewed focus on North American energy security, and continued domestic industrial growth, how do you foresee the future of Mexico's oil and gas sector?

A: The oil and gas industry is a capital-intensive industry. Ever since the first oil crisis, back in 1973-1974, the objective of oil importing countries has been to separate economic growth from energy consumption growth. However, there is no development without energy. The great political challenge faced by the Mexican government is to recognize that the pace of economic development relies upon assured flows of oil, gas, and coal, among other resources. The more of those resources that can be produced locally, the better it is to keep development costs lower.

Q: What are the biggest trends in the global oil and gas industry that have the potential to influence the development of the Mexican market?

A: Even the growth of countries like China, India, and Indonesia will not change the fact that oil and gas is the cheapest energy source available in the international marketplace, and cost of alternative energy sources will inevitably be compared to oil prices. The more high-tech applications that are developed for unconventional oil and gas operations, the better for countries like Mexico, which has huge unconventional oil and gas reserves.

Q: How does Pemex benchmark against other NOCs and IOCs in a global context?

A: Unfortunately, Pemex is considered a local oil company. Pemex's international exposure is not considered to be enough to evaluate its international stature. There are several NOCs that enjoy world-class reputations, which are taking advantage of an open marketplace to directly compete with the supermajors. Probably the only difference between a NOC and an IOC is the degree of investment in research and development.

Several other NOCs are much more mature in the international oil business than Pemex. Some of them have more than 40 years of international experience, and Pemex has barely even begun. Pemex will have the advantage of analyzing the historical international activities of other NOCs, and will be able to learn from their mistakes.

Q: With expectations for an internal reorganization of Pemex and a Mexican energy reform on the horizon, what do you believe would be the ideal structure?

A: The ongoing trend of NOC restructuring over the last 40 years clearly provides good and successful examples worldwide. ENI of Italy is one of the success stories of effective transformation. The original AGIP of 1927 was a 100% state-owned oil and gas company. ENI set the terms for restructuring. The government retained the so-called 'golden shares' to manage government interests, up to a range between 30-40%. Statoil of Norway followed a similar pattern. However, the management of the impact of resource wealth on public policy lead to the establishment of several special trust funds, called heritage funds. In the province of Alberta, Canada, similar trust funds have been in place since 1976. In other European countries, similar restructures took place, giving birth to Total of France, Repsol of Spain, OMV of Austria and so on. In Latin America, NOCs like Petrobras in Brazil and Ecopetrol of Colombia have established oil companies along the European model, with a varying amount of 'golden shares' to be managed by the government. The ideal NOC structure for Mexico is the Mexican way, following certain basic successful principles for the restructuring of other NOCs from around the world.

TIME FOR PEMEX TO OUTPERFORM ITS GLOBAL PEERS

"Less experienced companies have overtaken Pemex in the global ranking of national oil companies, due to thorough, relentless preparation, well-organized operations, and their countries' positive economic situations," says Guillermo Pineda, Energy Specialist at PricewaterhouseCoopers (PwC) Mexico. "Norway is a clear example: Statoil successfully took advantage of the country's favorable economic circumstances and the company made a conscious effort to improve its operation in the early 1990s. Brazil did the same, evolving from a country that depended on ethanol to having a strong national oil company. Colombia has also exceeded Mexico's efforts, with drastic improvement in both its oil industry and its economy. Even oil companies in Europe and Japan that do not possess large hydrocarbon reserves have improved their efficiency to enviable levels." Oil companies that appeared to be behind Pemex have shown resilience in their efforts to improve their national oil industries, and are now topping the performance of Pemex, according to PwC's latest report.

The paper presented by PwC also includes the results of an analysis made by Rice University on how oil companies around the world transfer part of the benefits obtained from petroleum production to local communities, showing that countries that have neglected to follow this course have failed to remain successful. "Venezuela had a very efficient oil company in PDVSA, with a large amount of booked reserves that promised a bright energy future for the country," Pineda explains. "However, when Hugo Chávez became president, he replaced the qualified executives of PDVSA with new government officials, who destroyed all the value previously generated for the community and spent all the money generated on filling the country's coffers."

IOCs have also adapted to the dynamic challenges of the industry over time, from seeing each other as competitors to forming alliances between themselves to share the risks and benefits of projects. This is a lesson that runs contrary to the Mexican Constitution mandate that allows only Pemex to perform oil-related activities. "Mexico has to understand that it is not detrimental to the interests of the industry's development to partner with other companies to achieve better results; even companies that could undertake projects on their own prefer to share the implicit risks," Pineda asserts. "Pemex should not work on its own, but rather shake hands with other experienced companies and share knowledge and technology to successfully realize the full potential of the Mexican Gulf of Mexico. When we see how countries in Africa have evolved in their hunt for oil through alliances, we realize the limitations in our regulatory framework."

Guillermo Pineda, Energy Specialist at PwC Mexico

Both positive and negative outcomes from business cases around the world are analyzed in the PwC investigation, with the objective of creating discussion that improves the way Pemex operates and, eventually, stimulating the country's economic development. "The moral of the story is that, no matter what the circumstances bestow, we can always work towards the industry's betterment," Pineda says. "After seeing the modernization processes these oil companies have undertaken and knowing the conditions of the oil industry in Mexico, it is easy to conclude that there is still a lot of work to be done to further improve Pemex." Pineda is convinced that the lag that Pemex shows compared with other national oil companies is a direct consequence of not having planned adequately for the future. "We used to rely heavily on Cantarell, to the point that its decline caused a 30% decline in Mexico's national production," he explains. "The lack of preparation for the Cantarell situation exemplifies how Pemex officials reasoned in the past: the problems we have today are a direct consequence of inadequate spending on exploration and production. We did not make the proper investments at the correct moment, when we were still overproducing oil and costs were not as high. Now, we are paying the price."

"We have failed to optimize the exploitation of natural gas in the country's northern region, choosing to import instead of investing in the infrastructure needed to develop our own resources," Pineda says. "Gas exploitation is another area where Pemex should look for alliances. The first step is to verify the prospective shale resources of the northeastern regions of the country, and then define the correct strategy to extract them," Pineda states. "If the incentives are not aligned with Pemex's short-term priorities and capabilities, then Mexico should open the sector to private initiative, with private companies taking the risk and obtaining part of the benefits, under the unmovable axiom that hydrocarbons are still property of the country."

Pineda believes that these lessons should carry important weight in the way the new reform is presented. "A reform needs to take a look at the entire sector, not just oil, gas, or power generation," Pineda concludes. "With a comprehensive reform, Pemex stands a better chance of closing the gap and becoming once again a top oil company in the world."

FINANCIAL HIGHLIGHTS OF 2012

Pemex plays a pivotal role in the Mexican economic, political and social realm, and is an essential contributor to Mexico's federal budget; it is estimated that around 34.5% of the federal government's income in 2013 will be provided by the NOC. This staggering figure makes Pemex the main source of public financing in the country. Therefore, it is of the utmost importance to optimize the sustainable financial performance of the company.

Key financial figures presented in March by Pemex's Board of Directors seem to support the notion that things are looking up for Mexico's national oil company as well as the federal budget. Pemex reported record-breaking numbers for 2012. Total sales registered an all-time high of US$126.6 billion (MX$1.647 trillion) and the company's EBITDA recorded a new high of US$88billion (MX$1.145trillion), both figures represent a 5.7% increase over 2011. Moreover, Pemex's total investment also reached a record high of US$23.98 billion (MX$312 billion).

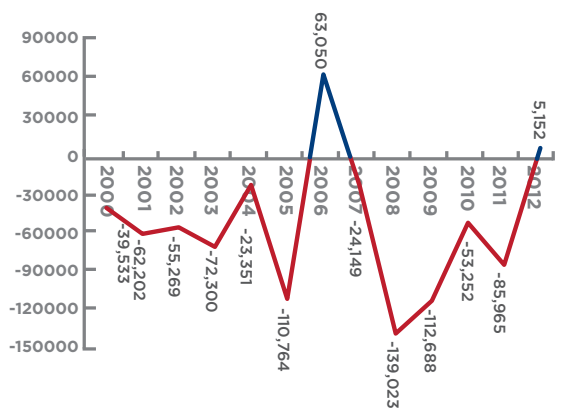
The most remarkable result was the income generated by the NOC; which reported a gross income of US$63 billion (MX$820 billion), an operating income of US$69.79 billion (MX$908 billion) and a net income of US$400 million (MX$5 billion). This meant that Pemex announced a net profit for the first time since 2006, and only for the second time since the turn of the century, in spite of the fact that taxes and duties paid by the company also reached a new record high of US$69.4 billion (MX$903 billion), beating the previous record set in 2011 by 3.3%. The taxes paid by Pemex in 2012 represent 54.8% of its total revenue and 99% of the operating income reported by the company last year.

The US$400 million (MX$5 billion) net income, which contrasts sharply with the net loss of US$6.14 billion (MX$80 billion) that Pemex suffered in 2011 – is primarily due to the appreciation of the peso. The company's record breaking sales revenue was greatly fuelled by an exchange gain of MX$45 billion (US$3.45 billion) that resulted from a 7% appreciation of the Mexican currency against the US dollar throughout 2012. On the other hand, the price of the Mexican crude oil basket only increased modestly, from US$101.09 in 2011 to US$101.86. This minimal increase of 0.8% was just enough to offset the 0.2% reduction in Pemex's crude oil production, and did not contribute substantially to the rise in the NOC's income. As mentioned by Pemex's Chief Financial Officer, Mario Beauregard, "During fiscal year 2012, Pemex recorded a net income of MX$5 billion, an increase in domestic sales revenues, an increase in other revenues, and a positive variation in the comprehensive financial result due to the exchange rate."

Pemex still has not managed to reverse its downward production trend; 2012 was the eighth year in a row in which Pemex has reported a production decrease, albeit a small one. However, since it reached its maximum production level at the end of 2003, the NOC's oil output has dropped 24%. However, the company's production downfall has practically stabilized since 2010. The 0.2% decrease in 2012, down from 0.7% in 2011, indicates that the company might be able to register a production increase for the first time in nine years at the end of 2013.

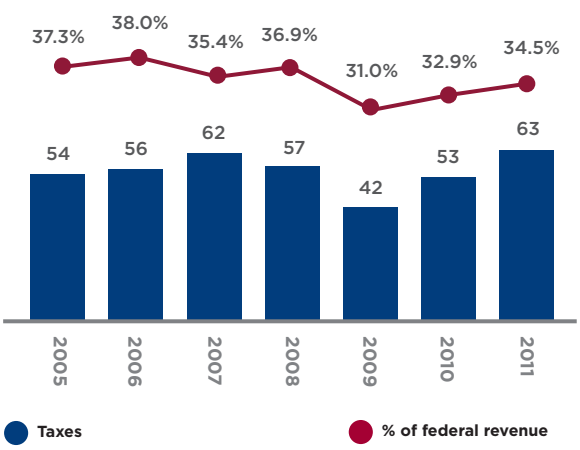
Even though Pemex's debt has increased, the NOC's debt to revenue from sales ratio has decreased over the past three years, meaning that its ability to pay off its incurred debt has increased. The company's performance in the capital markets seems to reflect the optimism surrounding the company's future. On November 29, 2012, Pemex issued MX$25 billion (US$1.92 billion) in stock notes in three tranches, the biggest issue made by a corporation in the local market. More recently, on January 30, 2013, US$2.1 billion in 3.5% notes due in 2023 were also issued, of which 50% were allocated in the Asian market. This issuance is the one with the lowest yield ever for Pemex.

PEMEX'S NET INCOME (MX$ MILLION)



Source: Pemex

TAXES AND DUTIES (US$ BILLION)



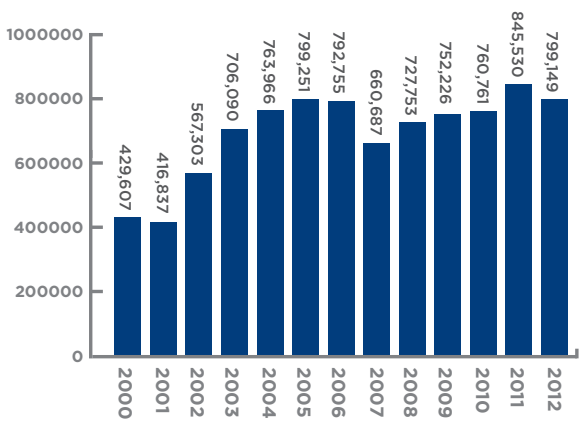
FINANCIAL HIGHLIGHTS	2011 (billion MX$)	2012 (billion MX$)	VARIATION		2011 (billion US$)	2012 (billion US$)
Total revenue from sales and services	1,558.4	1,646.9	5.7%	↑	111.4	126.6
Gross Income	786.2	819.8	4.3%	↑	56.2	63.0
Operating Income	888.7	908.0	2.2	↑	63.5	69.8
Income before Taxes and Duties	794.8	907.9	14.2%	↑	56.8	69.8
Taxes and Duties	874.4	902.9	3.3%	↑	62.5	69.4
Net Income (loss)	(79.6)	5.0	106.3	↓	(5.7)	0.4
EBITDA	1,084.6	1,145.3	5.7%	↑	77.5	88.0

Source: Pemex

Pemex's financial results for 2012, especially the income before duties and taxes generated, indicate that the company has a stable financial basis. However, its results will continue to depend heavily on the development of the crude oil price and the taxes and duties imposed by the federal government. During the first quarter of 2013, Pemex recorded total sales of US$32 billion, a 3.7% decrease over the first quarter of 2012 due to a lower oil price and a slight production decrease of 0.4% year-on-year. The corresponding drop in income before taxes and duties by 23.4% resulted in the government's take for this quarter decreasing by 9.1%.

Nevertheless, given that Pemex's annual budget, approved by the Chamber of Deputies, has gradually increased from US$13.8 billion in 2006 to US$25.3 billion this year. Of this budget, no less than 79% or US$19.9 will be dedicated to upstream activities that are the foundation of Pemex's financial health. Provided that this investment is spent effectively, and building on the investment budget increases in recent years, improved operational performance in upstream activities should allow Pemex to deliver strong financial results again in 2013.

PEMEX'S DEBT INCREASE (MX$ MILLION)



Source: Pemex

PEMEX'S HIGH TAX BURDEN

Pemex does not control its financial situation; the federal government both sets its tax rate and decides how the company allocates its budget. Pemex's taxes are calculated as a percentage of its sales revenues for the year. An example of the extent of taxation that Pemex faces is Article 7 of the 2013 Federal Income Law, which obliges Pemex to make daily payments of MX$634 million (US$49 million), including official holidays. Since 1989, Pemex's tax burden has exceeded 60% of its total revenue. In comparison, Petrobras pays an average of 35%, almost half as much as Pemex. However, in Mexico the high tax level has long been an essential source of funds for the federal budget. Last year, Pemex achieved record sales of US$126.6 billion, up from US$111.4 billion in 2011. The company also paid a record US$60.4 billion to the federal government in taxes and duties, leaving it with a net profit of just under US$400 million, and contributing 35.4% of the federal budget. The federal government budgetary dependence on Pemex is caused by a structural problem of the Mexican economy. In 2011, Mexico collected 19.7% of GDP in taxes, while the average among members of the Organization for Economic Cooperation and Development (OECD) taxes represent on average 33.8% of GDP. If oil taxes, duties, and royalties were to be discounted, Mexico's tax collection would only reach 13.9% of GDP, which is comparable to countries like Congo and Ghana. Experts agree that the energy reform on its own will not be the solution to Pemex's fiscal burden, but that a fiscal reform has to be carried out in parallel to alleviate Pemex fiscal strangulation: "These two reforms have to come together in order to be successful. The Pemex's tax regime has to be revised and the fiscal burden lightened to provide budgetary and managerial autonomy to Pemex," explains Fluvio César Ruíz Alarcón, Professional Board Member of Pemex.

EXCHANGE RATE RISK

A significant amount of Pemex's revenues is derived from exports of crude oil and petroleum products, which are priced and payable in US dollars. Pemex's revenues from domestic sales of gasoline and diesel after the Special Production and Services Tax (IEPS), petrochemicals and natural gas and its by products are related to international US dollar-denominated prices, except for domestic sales of LPG, which are priced in pesos. At the same time, the hydrocarbon duties, most capital expenditures and investments and the cost of petroleum products and natural gas that Pemex imports for resale in Mexico or use iat its facilities are denominated in US dollars. By contrast, most of its operating expenses and a significant amount of capital expenditures and investments are payable in pesos and are not linked to the US dollar. As a result of this cash flow structure, the depreciation of the peso against the US dollar increases our income in peso terms. The appreciation of the peso relative to the US dollar has the opposite effect. Pemex perceives this risk as manageable, without the need for hedging instruments, because most of its investments and debt issuances are carried out in or converted into US dollars and therefore, the impact of the fluctuation in the exchange rate between the US dollar and the peso on Pemex's revenues is offset in whole or in part by its impact on its obligations.

CROSS-CURRENCY SWAPS

Most of Pemex's debt is denominated in US dollars or pesos. Although the company attempts to issue debt in these two currencies, this is not always achievable. As a consequence of the cash flow structure, fluctuations in non-US dollar currencies other than pesos may increase its funding costs or expose the company to foreign exchange risk. For non-US dollar or peso issuances, since 1991, Pemex has made the strategic decision to swap this debt into US dollars, except for debt denominated in UDIs (UDIs, or unidades

HIGHLIGHTS OF PEMEX BUSINESS PLAN 2013-2017

Pemex's board of directors approved the current Business Plan almost six months before the President Peña Nieto's government took office. The document is a continuation of past development strategy, with objectives such as maintaining and increasing current levels of hydrocarbon production, keeping the proven reserve replacement rate over 100%, and increasing operating efficiency, among many other targets set by the NOC.

INCREASING RESERVES

One of Pemex's main goals is to increase the proven, probable and possible hydrocarbon reserves through new discoveries, delineation and reclassification, particularly by accelerating the evaluation of potential deepwater reserves in the Gulf of Mexico, without neglecting onshore and shallow waters. Pemex estimates that Mexico's prospective resources stand at 54.7 billion bbl, of which 52% are located onshore and in shallow water, concentrated in the Southeastern Basins, Tampico-Misantla, and Veracruz. The business plan emphasizes the importance of increasing exploration and development activities in these areas using Pemex's existing capabilities and technologies. The total of these prospective resources is 90% oil and gas condensate, and 10% non-associated gas. For 2013, Pemex plans to acquire AVO analysis and seismic inversion, as well as available seismic PSDM seismic processing. Furthermore, for the 2013-2017 period, 14,083km^2 of 3D seismic will be acquired and 274 exploratory wells will be drilled. Deepwater comprises 48% of Mexico's prospective resources. In order to transform these prospective resources into proven reserves, significant investment and technological resources are required. Pemex will focus on carrying out the necessary activities in order to have a better understanding of the location and characteristics of potential reserves, and then be able to develop the required capabilities and infrastructure for the exploration and exploitation of such areas. This strategy is being applied on new exploratory projects such as Han, Holok, Perdido, and Tlancanan, known as Gulf of Mexico B, and Gulf of Mexico C. Pemex is looking to acquire 25,581 km^2 of 3D seismic, seismic processing including areas of complicated geology and/or affected by salt tectonics, and is planning to drill 32 exploratory wells during this five year period. As for natural gas, the main producing basins for non-associated gas are Burgos and Veracruz. Of the 3P reserves added in the past nine years, 17% come from these gas basins. According to the analysis done by Pemex Exploration and Exploitation, the country's potential shale gas resources have been estimated at between 150 and 459 tcf, which would represent 2.5 to 7 times the volume of Mexico's conventional gas 3P reserves. The Business Plan considers the need to evaluate the potential of

de inversion, are nonmonetary units that are adjusted for inflation every day by the Mexican Central Bank. Any obligation or debt denominated in UDIs can immediately and automatically be converted into pesos guaranteeing equal purchasing power), which is swapped into pesos. As a result of this strategy, Pemex holds a debt portfolio with negligible sensitivity to currencies other than pesos and US dollars.

Most of Pemex's cross-currency swaps are straightforward, with no unusual terms, except for two swaps entered into in 2002 and 2004 to hedge exposure to Japanese yen and euros, with termination dates in 2023 and 2016, respectively. These swaps are referred to as "extinguishing swaps" and were obtained in order to be able to hedge long-term obligations. The main characteristic of extinguishing swaps is that the DFI terminates upon the occurrence of any of the credit default events specified in the DFI contract confirmation, without any payment obligation by either party. Pemex recorded a total net foreign exchange gain of MX$44,846 million in 2012, as compared to a total net foreign exchange loss of MX$60,143 million in 2011. Its foreign exchange gain in 2012 and the loss in 2011 were due to the effect of the significant appreciation of the peso on the value in pesos of Pemex's US dollar-denominated debt. A significant portion of Pemex's debt, 80.5% at December 31, 2012, is denominated in foreign currencies. The appreciation of the peso in 2012 therefore resulted in an increase in our net foreign exchange gain. The value of the peso in dollar terms appreciated by 7.5% in 2012, from MX$13.9904 = 1 US dollar on December 31, 2011 to MX$13.0101 = 1 US dollar on December 31, 2012. By the middle of May 2013, the exchange rate has reached MX$13.3564 =1 US dollar, and is expected to dip below MX$12 = 1 US dollar before returning to MX$12.30 = US dollar later in the year. This implies that further foreign exchange gains can be expected for 2013.

Source: Annual Report of Pemex filed with the UStates Securities and Exchange Commission.

non-conventional reservoirs of shale oil and shale gas, which in mid-term are expected to contribute to maintaining and/or increasing hydrocarbon production. In order to achieve this growth, Pemex plans to perform multiple shale plays studies during 2013 and 2014; acquire 10,350 km^2 of 3D seismic in 2015, and by 2017 complete the perforation of 274 exploratory wells.

INCREASING PRODUCTION

Increasing hydrocarbon production has been one of Pemex main concerns, and is an essential component of the business plan, if the company is to revert the downward production trend after production peaked in 2004. 80% of the producing fields are currently mature and at an advanced exploitation stage. As a result, the NOC is focused on optimizing production through the implementation of best practices and new technologies, such as secondary and enhanced oil recovery techniques, in order to increase the oil recovery factor by between 3-8%. Furthermore, Pemex is aiming to increase efficiency levels above the international standards of oil production costs. During 2011, its oil production cost was US$6.12/boe, which made it one of the lowest among the world's major oil companies. However, production costs rose after 2010 due to expenses related to the shift from relatively cheap production at fields such as Cantarell, to fields with higher production costs, as well as the 1.9% decrease in total oil production.

BOOSTING OIL REFINING AND PETROCHEMICALS

One of the Business Plan's main goals is for Pemex to raise its operational performance above the industry average in refining and petrochemical activities. The first step towards achieving this goal is to narrow the technology gap that the NOC faces in its aging infrastructure. Pemex aims to improve the efficiency and operating performance of the National Refining System (NFS) in the short term by identifying the gaps that do not require a large amount of investment. The NOC is aware that fuel demand in the country will increase by 4.6% between 20011-2017, which translates in 246 thousand b/d. Furthermore, fuel imports represented 51% of the national demand during 2011. The business plan acknowledges that in the coming years domestic oil refining should be favored over fuel importation to guarantee supply. The reconfiguration of the Salamanca Refinery, which should be operating by 2017, and the construction of the Tula Refinery, as well as the construction of new petrochemical capacity that uses the residuals produced by the NFS are all crucial advancements, as is the construction of infrastructure for producing gasoline and diesel with ultra-low sulfur content.

The Pemex Business Plan recognizes the need to boost domestic petrochemical production in response to Mexico's need a stable raw material supply for the manufacturing and agricultural industries in the coming years. The strategy focuses on three chains: methane, ethane, and aromatics; and four products: ammonia, ethylene oxide, styrene, and xylene.

2

Mexico has tried, at several points in its recent history, to reform its energy sector, the most recent of which was in 2008, under the last administration. Although this reform brought several key changes to Mexico's energy landscape, such as the introduction of the CNH – Mexico's upstream oil and gas regulator – and the creation of incentive-based, integrated service contracts – which for the first time allowed private operators into Mexico under certain restrictions – many felt that it did not bring the sweeping changes needed to help Pemex reach its goals.

Now, under a new administration, a new energy reform is expected to be passed before the end of the year. This chapter looks at the intentions of the new government regarding the reform of the energy sector, the work that has already been done to build the consensus required to achieve meaningful reform, and what key figures in the energy sector believe the reform must included to help the Mexican oil and gas industry reach its targets.

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THE ENERGY MINDSET OF MEXICO'S NEW PRESIDENT

"I am not in favor of privatization, but I am in favor of opening the sector to private investment, while guaranteeing the state's sole ownership of its resources."

Enrique Peña Nieto, President of Mexico

President Enrique Peña Nieto has been very clear about the fact that an energy reform is coming, and that it is needed in order for the country to develop, and face its most difficult challenges, such as poverty reduction. Peña Nieto's emphasis is on a reform that will modernize Pemex, transforming it into a productive company focused on value creation, and making the NOC "a stronger lever for national development." The energy reform was a key proposal in Peña Nieto's electoral campaign, and has become one of the president's signature issues since he took office, as well as being one of the structural reforms agreed upon in the Pact for Mexico. The aim is clear: to increase private investment in the oil sector, which the president hopes will kick-start economic growth in the country.

During the campaign leading up to the 2012 elections Peña Nieto expressed his desire to promote reforms that allow private investment in Pemex, especially in exploration, production and refining. "I am not in favor of privatization, but I am in favor of opening the sector to private investment, while guaranteeing the state's sole ownership of its resources. Mexico has a great opportunity, as Colombia and Brazil had, among other countries that have made the necessary reforms to modernize their oil and gas industries," he said during the Mexican Construction Industry Congress in April 2012. During the run-up to the election, Peña Nieto's proposals focused on making Pemex a modern and competitive company that meets and exceeds international industry standards, chiefly by increasing the use of state-of-the-art technology.

On July 2, 2012 – just a day after the presidential elections in Mexico and before he was declared elected president – Peña Nieto published an op-ed piece in the New York Times in which he mentioned that after the improvement of economic conditions for millions of struggling Mexicans, his priority was to end the polarization that has paralyzed Mexico's politics, and make urgently needed reforms in the energy sector, and in other areas, impossible. The pivotal moment of change in his party's attitude towards energy reform came at the beginning of March, when the PRI broke with long-standing tradition and agreed to modify its formal position on the energy sector, in order to provide backing for Peña Nieto's plan to increase private investment in Pemex.

MEXICO'S ELECTORAL MAP

Despite the federalist character of the Mexican Republic, until 1991 all of Mexico's State Governors were members of the PRI. Since then, the country's political map has started to change, but the PRI still retains control over 20 of Mexico's 32 States, while the Governors from the PAN and PRD preside over respectively six and four states. The map on the right shows which parties currently hold the office of Governor in each State.

Source: Secretaría de Gobernación

"The PRI has begun a new era. It has transformed itself in order to be able to transform Mexico," said Peña Nieto, who closed the party's two-day national convention in front of more than 4,000 delegates. By changing its formal position, the PRI is paving the way for Peña Nieto to present the upcoming energy reform.

During the 75th anniversary of oil expropriation in Mexico, Peña Nieto reiterated that Pemex is not for sale and will not be privatized. The event was the platform from which to present the six major changes that would modernize the NOC under the PRI's energy reform. The first is to establish a new organizational structure that makes Pemex more efficient and transparent; the second is to encourage corporate ethics and social responsibility; the third is to promote green growth; the fourth is to empower local industries; the fifth is to orient investment towards higher value-added activities; and the sixth is to strengthen investment and technological development capability. The President also took the opportunity to warn that the energy sector is facing new challenges that must be confronted, because if current production and consumption trends continue, by 2020 Mexico will develop an energy deficit. "This scenario is very serious because it will limit economic growth and the chance to improve the quality of life of many Mexican families," Peña Nieto added.

The National Energy Strategy 2013-2027 also reveals the urgency in Peña Nieto's agenda to push through energy reform, despite the strategy being developed under the existing legal framework. It emphasizes that the transformation of the sector is essential if it is to achieve the administration's core objectives, which are GDP growth and social inclusion. "If the structural reforms are passed, the country might be able to reach GDP growth of more than 6% per year and become one of the world's 10 most important economies," the President said during a trip to China in April, where he witnessed Pemex's agreement with Sinopec to provide 30,000 b/d of crude oil. Even though the political landscape seems to be shifting in favor of the energy reform, Peña Nieto still faces heavy opposition, particularly from the more radical left led by Andrés Manuel López Obrador, who has threatened to call for protest against what he sees as privatization of the country's oil resources.

ROAD TO THE PRESIDENCY

After graduating with a BA in Law from the Universidad Panamericana, and an MA in Business Administration from the Instituto Tecnológico de Estudios Superiores de Monterrey, Peña Nieto soon joined the public service. He formally started his political career in 1993, when he was appointed as the Personal Secretary of Arturo Montiel Rojas, who served as Economic Development Minister for the State of Mexico. In 1999, when Montiel Rojas became State Governor, Peña Nieto went from occupying secretarial positions to a higher level of government, and was appointed as the Undersecretary of the Interior. In 2003, Peña Nieto won his first elected position as Deputy, representing his hometown of Atlacomulco in the Congress of the State of Mexico. In September 2005, after a successful election campaign, he became Governor of the State of Mexico, a position held until September 2011. The cornerstone of his governorship was the 608 promises made during the election campaign and signed in front of a notary, to demonstrate his effectiveness as a leader capable of delivering results. In November 2011, as a stepping stone for the upcoming election campaign, he released his book, 'Mexico, The Great Hope', in which he argued the importance of expanding the economy to create formal jobs. He also pointed out the need to open Pemex to private investment in order to increase the NOC's productivity. After an intense election campaign, Enrique Peña Nieto won the elections on July 1st 2012, with 38.21% of the votes, followed by Andrés Manuel López Obrador of the PRD with 31.59%. Peña Nieto was sworn in as the 57th President of Mexico on December 1st 2012, marking the return of the PRI to power after 12 years in opposition.

PACT FOR MEXICO: A POLITICAL ROADMAP FOR REFORM

In March 2012, while he was still a presidential candidate, Enrique Peña Nieto signed an agreement with Mexico's largest business chamber, the Consejo Coordinador Empresarial (CCE). This document, entitled Agenda for Mexico, engaged the presidential candidate in the promotion of a series of structural reforms geared towards the country's economic development, namely regarding education, labor, tax collection and government spending, energy, justice and democracy.

As elected President, Peña Nieto supported former President Felipe Calderón's labor reform initiative. His party's votes in Congress were essential to ensure the approval of over 80% of the modifications proposed by the Executive. As a result, Mexico's Labor Law now allows more flexible schemes for the recruitment of workers, and it includes and protects the notion of decent work proposed by the International Labor Organization, thus increasing access to the labor market and fostering productivity while also strengthening workers' rights. The CCE congratulated both the outgoing and incoming administrations and urged Peña Nieto to continue supporting the major legal modifications proposed in the Agenda for Mexico.

Peña Nieto has shown from the beginning of his term that his government is decided on the approval of the multiple structural reforms put forward by the CCE. On the day of his inauguration, December 1st 2012, he signed a covenant with the country's main parties: the PRI, his own party and Mexico's biggest legislative group that also controls most of the state governments; the PAN, the right-leaning party which governed for the past two presidential terms; and the PRD, the leftist party whose presidential candidate disputed the election's results. The PRI's electoral ally and Mexico's fourth biggest political force, the PVEM, added its signature a few weeks later. The agreement, called the Pact for Mexico, aims to rally support for upcoming reform. In order to ensure pluralism and broad approval for future reforms, the main objectives of the initiatives and their content will be negotiated among the four main parties by the means of a governing council.

The fact that the country's biggest parties signed the Pact for Mexico is a reflection of their leaders' commitment to the reforms, but it might not translate into widespread support for the initiatives issuing from the agreement. This is especially true in the case of the PRD: a considerable number of the party's members, including its Secretary General, opposed National Party Leader Jesús Zambrano Grijalva in his decision to sign the pact. In fact, the party is planning a survey to accurately measure its members' support for the pact. If the results of this survey turn out to be negative, they could sway the party away from the commitments signed by Zambrano Grijalva.

The Pact for Mexico has already yielded its first results. Before the end of Peña Nieto's first month in power, Congress had already approved a constitutional reform to restructure the country's educational system, in spite of voting divisions within the PRD's parliamentary group. By the end of January 2013, 19 State Congresses had also approved the initiative, thus enabling the President to sign and enact the first constitutional reform of his administration. Less than two months later, on March 11, 2013, the governing council of the Pact for Mexico presented another initiative for constitutional reform, this time focused on telecommunications. It took the Chamber of Deputies only 10 days to discuss the proposed reform, agree on modifications and approve it. This time, all of the signatories of the Pact for Mexico wholly supported the initiative. Nevertheless, the reform's discussion in the Senate proved to be more complex. Six commissions within the legislative chamber, ranging from Radio and Television to Justice, participated in the discussion and modification process. These commissions had to turn in their draft bill to the Senate in early April so it could be voted on before April 30, during the last Regular Session Period in Congress. The support of the PAN and most of the PRD, in addition to the vote of the PRI and the PVEM, ensured the approval of this reform, which will guarantee the availability of open television broadcast and facilitate the transition from analog to digital communication signals.

The President and his party have certainly found a great dialog mechanism in the Pact for Mexico, and they are confident that the remaining reforms – among which the fiscal and energy reforms seem to be the most crucial – can be fostered by the major political forces in the country thanks to this pact. The four parties represented in the agreement's governing council support the general notion of structural reforms and now their goal is to pursue energy and fiscal reform during the next regular session period.

Peña Nieto has stated that Mexico's economy will grow at a rate of 5% to 6% if the upcoming structural reforms are implemented. The Pact for Mexico aims to set the conditions that will test that prediction before the apparent calm surrounding the new administration vanishes. The President knows that the political sea he is successfully navigating will only get rougher as new reforms tackle over-privileged interest groups and election periods approach.

THE BALANCE OF POWER IN CONGRESS

Mexican President Enrique Peña Nieto inaugurated his six-year term with a powerful slogan: "It is time to take Mexico forward". Since then, he has promoted several reforms related to the government's five pivotal goals for the next six years, which have been included in the Pact for Mexico. In order to achieve these and other goals, significant structural changes must be made to Mexico's institutional framework. Mexico's Congress is, consequently, the biggest stepping stone in enabling President Peña Nieto to implement his National Development Plan.

Mexico's Congress is composed of two chambers, each comprised of representatives from seven political parties. The biggest political force in both legislative bodies is Peña Nieto's PRI, followed by the right-leaning PAN, which held office for the last two presidential terms. The third largest legislative group in both chambers is leftist opposition PRD, and the PRI's electoral ally, PVEM, follows in a distant fourth place. Together, these four parties occupy 121 of the 128 seats in the Senate (94%) and 455 of the 500 seats in the Chamber of Deputies (91%). If these four main political parties support the reforms proposed in the Pact for Mexico, the approval process could be expeditious.

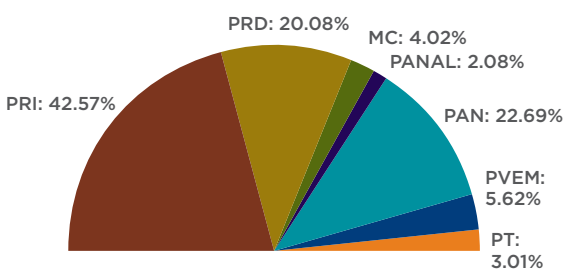
Nevertheless, the Pact is not a binding resolution and it does not guarantee the vote of the signatories' representatives in Congress. With 213 deputies, the PRI does not control the lower chamber, and the PVEM, expected to align with the government in all legislative matters, only holds 28 seats in the chamber, which does not suffice to make the PRI-PVEM electoral coalition an absolute majority. The distribution of the Senate is very similar; despite being the biggest political force, the PRI's 54 senators are not an absolute majority, and the PVEM's small legislative group of seven does not tip the balance of power.

Consensus with either the PAN or PRD regarding any of the proposed reforms would guarantee their approval. However, if both opposition parties decide to vote against reform, the remaining small parties who make up only 6% of the Senate and 9% of the Chamber of Deputies would become very important. Of these three, Movimiento Ciudadano and PT, two leftist parties often seen as more radical than the PRD, would be unlikely to support the PRI's initiatives, especially regarding energy reform. The other, Nueva Alianza, has 10 deputies in the lower chamber, which would be enough to form a majority with the PRI and the PVEM, but this coalition would still need three more votes in the Senate.

The appointment of experienced politician and former PRI leader Pedro Joaquín Coldwell as Energy Minister was an early sign of the new government's intentions of rallying support in Congress for an energy reform. Joaquín Coldwell has a political career spanning more than 30 years and has been both a deputy and a senator. In addition, he has been President of the PRI's National Political Council. Therefore, his influence over his party's groups in Congress will allow him to effectively pursue an energy reform and ensure a cohesive effort in its favor within both chambers.

The PRI is definitely in an advantageous position to seek for the structural changes Peña Nieto promised during his presidential campaign. This situation might change, however, after the midterm elections of 2015 when a new political party might alter the electoral scenario. For example, former presidential candidate Andrés Manuel López Obrador and his projected political party, Morena, could emerge as a noteworthy contender in the midterm elections. It is now up to the PRI to utilize its favorable position and move the country forward before 2015, lest it lose its golden opportunity to do so.

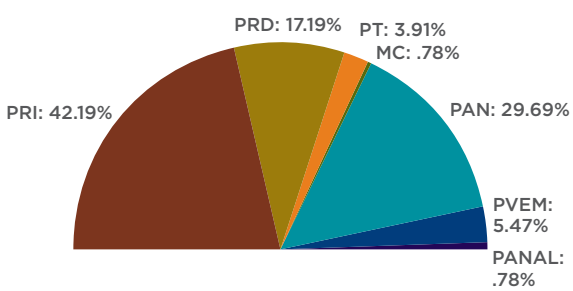
DEPUTIES BY POLITICAL PARTY



NUMBER OF SEATS

- PRI: 213
- PVEM: 28
- PT: 15
- PAN: 114
- MC: 20
- PANAL: 10
- PRD: 100

SENATORS BY POLITICAL PARTY



NUMBER OF SEATS

- PRI: 54
- PVEM: 7
- MC: 1
- PAN: 38
- PT: 5
- PANAL: 1
- PRD: 22

Source: Secretaría de Gobernación

STRATEGIC PRIORITIES IN THE ENERGY MINISTRY

PEDRO JOAQUÍN COLDWELL
Energy Minister of Mexico

Q: What are the strategic priorities that will enable Mexico to achieve energy security in an efficient manner and boost the nation's economy during President Peña Nieto's term?

A: The Energy Ministry is committed to guaranteeing energy security for Mexico. We understand energy security to be the reliable, diversified, and sustainable procurement of quality energy within our national territory at affordable costs.

Mexico possesses vast energy wealth, and President Peña Nieto is well aware of this. Hence, a substantive and in-depth transformation of the Mexican energy system will be promoted during his term. The platform to design this transformation is the Pact for Mexico, a series of agreements that President Enrique Peña Nieto signed along with the country's main political forces on December 2, 2012. The agreements cover diverse areas of public life in Mexico. In terms of energy, it was agreed to undertake an energy reform that will drive investment and development. On this basis, the reform that will result from Pact for Mexico will enable us to guarantee energy security for the country and grow at higher rates than at present.

Q: How do these priorities differ from the focus of past administrations, and in which areas are they a continuation of past energy strategy?

A: President Peña Nieto has remodeled Mexico's energy policy, primarily in two ways: firstly, through the conversion of energy policy decisions into state policy. Developing the energy sector has been granted priority status, given that energy is imperative for social and industrial development of our nation. Secondly, this administration has broadened the scope of Mexico´s energy debate. Pemex will not be privatized; it will remain a public company, property of all Mexicans. This is not under discussion. The debate should center on how we can strengthen the organization and increase investment and performance in the hydrocarbons sector. This is also enshrined in the Pact for Mexico.

Adopting a comprehensive approach to deal with issues that had not been granted much weight in the past has also been proposed. These proposals entail, primarily, the capacity to invest in the electricity sector, the promotion of sources of renewable energy, and an overall review of our policy on subsidies, among other subjects.

Q: What is the significance of the energy sector in President Peña Nieto's political agenda, and which level of urgency is given to energy reform?

A: The growth and dynamics of the energy sector are a priority on President Peña Nieto's agenda. Mexico has a vast quantity of resources, and this administration is determined to exploit our country's great energy potential. Nevertheless, our production has dropped from 3.4 million b/d in 2004 to 2.5 million b/d today. If this trend continues, our country could face an energy deficit by 2020. The purpose of the new energy policy we are pursuing is to stop this trend and return to positive growth figures.

Q: What will be the optimal timeline for successful energy reform. How does the calm approach that President Peña Nieto has taken towards achieving the necessary political compromises first, fit into that timeline?

A: The Pact for Mexico is very clear regarding the timetable agreed upon for the reforms. It establishes that, during the first half of 2013, design of the energy reform will begin, followed by an exchange of points of view and the development of technical objectives and arguments to back the proposal. Once this effort comes to fruition, necessary amendments to the existing legislation can be presented. The reform proposal will be discussed and we expect it to be approved before the end of the year, so as to begin implementing the significant changes that it will entail.

Q: What is the importance of achieving a more comprehensive energy reform that takes the entire sector into consideration, rather than just centering on Pemex?

A: While it is true that some progress was made as a result of the 2008 Energy Reform – such as the creation of the National Hydrocarbon Commission and bolstering the planning of the National Energy Strategy – it is important to recognize that there is still much to be done if the sector is to develop in an optimal way. The importance of the sector must be taken into account within the overall spectrum of economic activities in the country. Hence, planning must necessarily take into account the interactions both within

| ENERGY MINISTER'S TRACK RECORD

On December 1st, 2012, the 62-year old Pedro Joaquin Coldwell was appointed as Energy Minister in President Enrique Peña Nieto's cabinet, only hours after he resigned as President of the PRI. In this position, which he held for just under a year, Coldwell worked closely with campaign manager Luis Videgaray, the current Finance Minister, on the successful election campaign of that resulted in the PRI reclaiming the presidency after 12 years of rule by the PAN.

After graduating with a law degree from the Universidad Iberoamericana in Mexico City, Coldwell was elected deputy to the Congress of his home state Quintana Roo at the age of 25. He served four years as Secretary General in the Quintana Roo government, and became a Federal Deputy in 1979. Two years later, Coldwell was elected Governor of Quintana Roo at only 31 years of age, a position that he held until 1987. He subsequently served as Director General of Fonatur (National Fund of Tourism Promotion), and was Mexico's Tourism Secretary from 1990-1993 in the PRI-led government of President Carlos Salinas de Gortari. Coldwell's long history of involvement and leadership in the PRI – which also included a post as Mexican Ambassador to Cuba between 1998-2000 and a term as Senator between 2006-2012 – has positioned him as a key member of the party. According to José Merino, a political science professor at ITAM, "If you open up a dictionary and look for the word PRI, the definition could include Pedro Joaquin Coldwell."

"He is distinguished by his bargaining, dialogue, and openness. It is an appointment that will lead to a honest and healthy discussion and debate with Mexican society, with the potential to build public policies that will help the country," says Senator David Penchyna, President of the Senate Energy Commission. "Mexico needs someone who has a lot of political muscle to push through a comprehensive energy reform and make it a reality."

Coldwell will also have to deal with multiple issues during his tenure as Energy Minister, which include maintaining and increasing current oil and gas production levels, improving and expanding transportation infrastructure, increasing Mexico's refining capacity, and ensuring that Mexico's power generation and transmission infrastructure is able to meet the rising demand to fuel the country's forecasted economic growth. Most importantly, Mexico's Energy Minister will be instrumental in achieving meaningful, wide ranging energy reform.

the sector itself and in combination with other elements of the national economy.

Q: Under the National Energy Strategy 2013-2027, social development and energy equality are mentioned as principles to achieve long-term economic growth that is socially inclusive for the country. How does this contrast with the current Pemex mandate to focus on value creation?

A: The National Energy Strategy complements the mandate to create value for Pemex - and for the Federal Electricity Commission in terms of power generation - and takes the government's objective of social inclusion into account.

The strategy is geared towards maximizing the opportunities that are contained in the legal framework in force, for the benefit of all Mexicans. Hence, it proposes a series of undertakings to identify, promote and take advantage of areas in which the social and private sectors can legally participate. The strategy mentions that the subsidies that for years were granted in a generalized manner to the population – including high-income sectors and even companies and industries – will henceforth focus on lower income groups through various types of support programs.

Q: What are the possibilities of opening the non-core businesses of Pemex to private investment, so that the NOC can focus its investment efforts on becoming more efficient at what it does best?

A: A modernizing reform will doubtlessly seek to increase autonomy in the administration of Pemex. With increased autonomy, the company will be able to make decisions that will optimize its profitability and the creation of economic value. At the same time, this approach envisions the participation of the private and social sectors in the non-essential activities of Pemex, as well as in projects that are not to be included in the investment portfolio.

An initial step has already taken place as a result of the 2008 Energy Reform through the establishment of integrated service contracts for exploration and production, which have allowed Pemex to increase its execution capacity while remaining Mexico's sole oil proprietor. In regard to the rest of the value chain, Pact for Mexico mentions that the energy reform will seek to create an environment of competition in the economic processes of refining, petrochemicals and transportation of oil, and do so without privatizing Pemex's assets. In this manner, we are seeking the complementarity between public and private investment.

Technology **Knowledge** **Service**

petrolink

- Drilling Optimization
- 3rd party software integration
- Geosteering, frac and completions monitoring

ENERGY STRATEGY 2013-2027

President Enrique Peña Nieto presented the National Energy Strategy (NES) 2013-2027 at the end of February this year. The NES is the policy guideline for the energy sector, established by the federal government and ratified by Congress. The plan has a long-term vision, taking into account the next 15 years, and establishes the framework for the growth and maintenance of energy supply and exploitation.

EXPLORATION

The NES mentions the need to continue investing in exploration projects, technological development, and regulatory definitions. With the help of technological advances made in recent years, one of Pemex's objectives is to evaluate the potential of hydrocarbons in the country's currently unexplored basins, as well as re-evaluating those that have been explored but that might present new opportunities. The NES also underlines the importance of acquiring and processing 3D seismic information in areas that still have not been analyzed using this technology. As for unconventional resources, the NES points to the importance of a detailed exploration program in shale regions, with the aim of reducing uncertainty in the size of the resources and potential productivity of the fields. On the other hand, balancing exploration and production activities is considered essential to maintaining the 100% 1P reserve replacement rate that Pemex has achieved over the last two years. One important way to do this is to move 3P and 2P reserves from possible and probable to proven reserve status.

PRODUCTION

The NES acknowledges that Pemex's easy oil extraction phase, based on production at the supergiant Cantarell field and the country's current largest producer Ku-Maloob-Zaap, is over. Most of the NOC's prospective resources are located in deepwater, mature fields, or in reservoirs where geological complexity makes extraction challenging. New technologies, such as advanced seismic acquisition and processing, non-conventional drilling, and enhanced recovery techniques will play a central role in facilitating future oil production. The NES also recognizes the need to capture the potential of extra-heavy oil and non-conventional resources. The strategy emphasizes the importance of promoting Pemex's integrated service contracts (ISCs) to multiply the technical execution and accelerate the adoption of state-of-the-art technologies. This is particularly the case at complex reservoirs such as Chicontepec, which are the subject of the third round of ISCs. To be able to maintain production in the medium-term, the current time span of five years between the discovery of a field and first production should be lowered.

DEEPWATER

The NES considers the probable existence of geological structures that contain hydrocarbons in the deepwater Gulf of Mexico and that some structures, called transboundary reservoirs, could be shared with the US. An agreement is currently being negotiated between both governments. It has the aim of allowing efficient, equitable and environmentally responsible exploitation, to provide legal certainty and respect the sovereign rights of each country to its natural resources.

SHALE GAS

Mexico has an estimated 60.2 billion boe of unconventional reserves, of which 53% is expected to be shale oil, with the remaining 47% proportionally divided into condensate and dry gas. Shale gas could contribute significantly to meeting Mexico's needs in the long term. However, the NES underlines the importance of understanding the ecological impact of exploiting non-conventional reserves, particularly in reference to the use and recycling of water for hydraulic fracking, the correct foundation of the wells and the effects of the chemicals used in the process. It also considers that a part of the resources are in regions with limited water access; therefore, effective water management is critical.

REFINING

The NES aims to create a permanent, efficient, and adequate supply of refined products at competitive prices. In this context, and due to the lack of a functioning market for heavy distillates such as fuel oil, the need to revitalize the production infrastructure of the National Refining System (NRS), and adapt it to current market conditions, is critical. In order for the infrastructure to be able to meet domestic fuel demand, it is necessary to increase the efficiency of current refineries by reducing the gaps with international standards regarding refining capacity, performance of distillates per barrel of processed crude oil, energy use, and maintenance scheduling. It is crucial for Pemex to renovate its current production infrastructure to develop the capabilities of the NRS. On the other hand, the NES emphasizes the need to identify, promote, and take advantage of the areas where the current legal framework allows for the participation of private players, such as for combined heat and power (CHP), hydrogen supply and water treatment, among others.

SENATE PRIORITIES FOR A COMPREHENSIVE ENERGY REFORM

David Penchyna, President of the Senate Energy Commission

"The 2008 Energy Reform was incomplete and ineffectual in achieving the political agreements needed for progress in the energy sector," argues David Penchyna, President of the Senate Energy Commission. "In order to look for those political agreements, the technical and economic value of the Mexican energy sector was ignored and the reform failed to constitute a step forward in the search for energy independence."

According to Penchyna, the energy reform passed five years ago actually put more obstacles in the way of Pemex as it attempted to provide the means for the country to pull through a tough economic environment, rather than removing them. He believes that the necessity for a new reform today stems from three principles that the last government failed to address during the last amendment process.

"The first point is to clear up the misconceptions regarding privatization. This reform will not touch Mexico's sole proprietorship of the energy resources within its borders," says Penchyna. "The nation will continue to be the owner of all energy resources found in its territory." This represents a big communication challenge for the government, of which the President of the Senate Energy Commission is aware. "As politicians, we have failed this country by using the lack of knowledge about the Constitution to gain political advantage. This has brought high costs for Mexico in terms of energy," he regrets. "We have to introduce a concept of sovereignty where the nation owns the energy resources to foster the required productivity and get rid of the taboos that drive Mexico to keep flaring gas instead of using it. Then we have to pass this notion to the people, in order to create a reform that won't divide Mexican opinions."

Penchyna's second principle has to do with opening the industry to private investment. "It is impossible to imagine an efficient and effective energy reform if the possibility of combining private investment with public investment is not legally certified," he points out. "This is all based on the country's ownership of its energy resources. As Lázaro Cárdenas stated, 'the future of the energy industry depends on the development of combined formulae for private and public investment.'" This, together with comprehensive fiscal reform, will allow Pemex to better distribute its financial resources and develop the energy needed to satisfy growing national demand.

The third consideration for a successful reform is that it should consider the entire energy sector, not just the oil and gas industry. "Mexico has always looked to produce a reform for Pemex, and we have failed," Penchyna recalls. "The Senate is aiming to reform the whole sector, so that changes made to the oil industry will complement and help the electricity sector and the gas sector, and vice versa." By planning to reform the whole sector simultaneously, the country's economy can slowly move away from its dependence on oil.

Even when ideological disagreements and public misconceptions of privatization create challenges for the reform, Penchyna is optimistic for two reasons. "The braveness that President Peña Nieto showed when campaigning through his taboo topic, energy, has helped in the consecution of the political agreements among parties. This was a must to set a good tone for the energy and fiscal reforms to be passed in the Congress," he says. "At the PRI we are aware of the political challenge that showing we can govern represents after losing power for 12 years. We accept the responsibility that reforming the energy sector represents for our children and our country, and we're willing to do anything to achieve it – especially with the paradigm shift that shale gas has brought."

The other factor that encourages Penchyna to be positive about the amendment process is the educational agenda that the Senate Energy Commission is following to learn about international best practices and how they can be applied in Mexico. "We are learning about Brazil, Norway, Colombia, the UK's regulatory institutions, Azerbaijan's gas accomplishments, among many other models to build our own adapted prototype of energy reform," Senator emphasizes. "The Senate is having educated and ordered discussions about what is best for the country, leaving our political agendas behind. At our first meeting, we began discussing the most productive energy sector legislation of the last 25 years. We are on the right path; we just need to keep following it to be able to pass the reform."

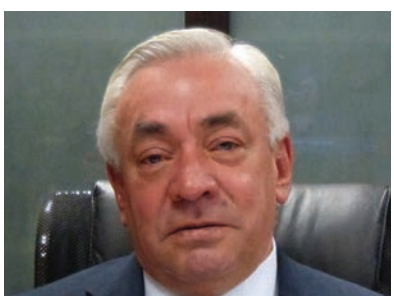
PRIORITIES FOR COMPREHENSIVE ENERGY REFORM

1. Good communication: energy resources will continue to be the nation's property
2. Fiscal reform to move the country's finances away from its reliance on oil
3. Opening the industry to private investment
4. Comprehensive energy reform for the whole sector – not just Pemex

ENERGY REFORM OPPORTUNITIES AND OBSTACLES

"Pemex has historically been the main contributor to Mexico's federal budget, but in order to make it something more than a revenue mechanism we must reform the energy sector to generate jobs, improve competitiveness, and boost our economy," claims Deputy Marco Antonio Bernal, President of the Chamber of Deputies Energy Commission.

The main reason Mexico has not been able to achieve this is because the country has a deep nationalistic connection to oil, according to Bernal. In essence, "what makes us feel Mexican and what we have learned since elementary school is that our resources belong to us," he explains. For this reason, any serious mention of energy reform is not taken lightly by the Mexican public or its political parties, but after the Energy Reform of 2008 there seems to be a growing consensus regarding the need to talk about further reform of the energy sector. Bernal firmly believes the 2008 reform was the first step in a long process that will eventually make Mexico a leader in the oil and gas industry because of the three main virtues of the 2008 reform: "the beginning of the end of nationalistic ideologies connected to oil, a new sense of freedom awarded to Pemex to negotiate directly with foreign companies, and a strong realization by the government of the need to further open up the energy sector."



"Our priority is to find a way to change certain constitutional articles that proclaim the rules and regulations of Pemex without touching Article 27"

Marco Antonio Bernal,
President of the Chamber of Deputies Energy Commission

Having a strong base from where to begin, there is a strong sense of optimism regarding the different priorities and needs for a successful reform. According to Bernal, the Energy Commission is focused on "proposing, debating, and passing the energy reform, on talking about and deciding what will happen to the shale gas reserves recently discovered, and finding cheap alternative energy sources. Our priority is to find a way to change certain constitutional articles that proclaim the rules and regulations of Pemex without touching Article 27—which defines all hydrocarbons as Mexican property."

To succeed, Bernal believes that a comprehensive reform encompassing every aspect of the energy sector must be pursued. In order to make Pemex a competitive company, he believes "we must give it the freedom to decide its own policy." Currently, Pemex lacks the resources necessary to achieve all of its objectives, so the energy reform must find a way to invite private companies to invest in Mexico and reward their investment with oil revenue without violating Constitutional Article 27. "This is an internal debate we are currently having and that we need to resolve before we take any other steps towards passing a reform."

One of the obstacles that could hinder the passing of the energy reform is the different ideological views of the political parties at the Chamber of Deputies and the Energy Commission at the Senate, but Bernal does not believe this is the case because of the peaceful nature of the legislature. According to Bernal, "the PRD has already publicly proposed their version of a reform and the PRI and PAN are still working on it," but this will not hamper their ability to eventually pass the reform because "everyone accepts the obvious fact that a comprehensive reform is needed. Dialogue between different political parties will be paramount to the success of the reform, but does not consider this to be a problem because everyone is conscious of the positive effects this reform will bring to Mexico in economic, social, and political terms." Regarding the different views of the Energy Commission at the Senate and the Chamber of Deputies, Bernal claims this will not interfere in the passing of a successful comprehensive reform because "the presidents of both energy commissions come from the same political party and both share an electoral base that is demanding an opening to private industry in the energy sector."

Even though Bernal is highly optimistic about the potential success of the energy reform, he believes the greatest challenge will be to change the cultural connection between Mexico and oil. In order to pass the reform, Bernal knows they must make Mexicans realize that "we will not interfere with Constitutional Article 27, and the reform will only bring positive outcomes for the country." This will be the greatest challenge because the elected officials in the Chamber of Deputies and Senate will have to find a way to change one of the cornerstones of Mexican cultural identity, since the reform "will be redesigning the link between Mexico and its historic relationship with oil and a positive breakthrough for Mexico."

MEXICO'S OIL ADDICTION HINDERS THE LIBERALIZATION OF PEMEX

Even though Mexico's economy is showing healthy growth, its taxation policy has placed the country firmly at the bottom of the Organization for Economic Co-operation and Development's (OECD) country ranking for total tax revenue as a percentage of GDP. Although Mexico's tax-to-GDP ratio increased from 17.7% in 2007 to 19.7% in 2011, Pemex still provides between 30% and 40% of the Federal Government's annual budget through the high level of taxation.

Ernesto Marcos Giacoman, Founder and Senior Partner of Marcos y Asociados, firmly believes that the high dependency of Mexico's federal budget on oil revenue has to be tackled. Marcos Giacoman, who served as Pemex CFO in the early 1990s, is convinced there is a high cost in maintaining the energy monopoly in Mexico. "It is very costly for Pemex to develop the entire oil and gas sector by itself." This eventually interferes with its ability to be efficient in budget management and to be profitable in all the activities it performs. "There are so many opportunities that Pemex can look at, but it does not have sufficient budget to invest in them, since it is pushed to explore other opportunities that will not bring extra value or profits."

"It is very costly for Pemex to develop the entire oil and gas sector by itself"

Ernesto Marcos Giacoman, Founder and Senior Partner of Marcos y Asociados

The way the NOC allocates its budget is closely related to the country's energy needs and the agenda of the government. "The oil industry in Mexico is operated according to fiscal targets," Marcos Giacoman explains. "With that in mind, Pemex's budget allocation is as rational as it can be. If you construct a mathematical model with the objective of maximizing tax revenues for the year in question, activities such as exploration have to be minimized. The closer the exploration budget gets to zero, the more taxation can be leveraged from production." He speculates that, although this is what justifies the way the government allocates Pemex's funds, it is also why current regulations need to be changed, starting with the fiscal regime. With this in mind, liberalizing the oil and gas industry in Mexico would also mean liberalizing Pemex. "It would be very reasonable for Pemex to operate as a company: focusing more on running itself as a business, and not as a government entity."

Giacoman suggests that energy reform should be focused on opening up investment in areas that would not be attractive for Pemex as a profit-oriented company. "I do not mean limiting Pemex's exclusivity in the areas the NOC covers adequately with its expertise and budget," he clarifies, "but to open the market in three different areas where Pemex is not being successful: unconventional resources, deepwater, and refining." When talking about unconventional resources, Giacoman is not shy about saying that it is not a very appealing subject for Pemex. "Shale gas development is going to be very costly, so it requires an operating flexibility that is obstructed by its current structure and lack of specific managerial expertise required, although Pemex has the required technical capabilities." Regarding deepwater, Marcos Giacoman thinks that oil discoveries in Perdido open up the opportunity to offer production-sharing contracts for development and production with better conditions than before finding anything. "It is the ideal time to look for joint venture schemes from a position of strength. Pemex would not be giving up concessions, but rather participating together with other companies, distributing risks and allocating them in a more rational way to maximize potential returns." Finally, Marcos Giacoman considers that, under the current structure, the Mexican government has exhausted its justifications to pour additional investment into refining. He believes the government should stop paying gasoline subsidies, and, instead, gradually increase prices by decree and push for liberalization of the refining sector.

If this opening up were not to happen, Giacoman proposes alternatively to free Pemex to operate in a commercial way. Freedom to act as a business would allow Pemex to choose its own financing structures, without having to rely on what the government or the public think. Marcos Giacoman is convinced that this is the right way to correct the Mexican energy sector's course. "Pemex is not really sacrificing anything by opening up these areas. Every investment coming from the private sector would be in addition to the US$30 billion that Pemex has to invest," he explains. With liberalization, Pemex can continue to concentrate on being profitable at what they do best, while providing extra resources in collaboration with the private sector.

DEBUNKING THE MYTHS BEHIND THE CONSTITUTION

IVÁN ALEMÁN ALEKSEI

Chief of the Legal Unit at Mexico's Energy Ministry

Q: What are the realities and the myths behind the 27th and 28th Articles of the Constitution in terms of national and international participation within the Mexican oil and gas industry?

A: The reality is that all hydrocarbons located within national territory are property of the nation. This will not change: it is the same everywhere in the world. There is a myth that, by opening up certain activities within the industry to the private sector, the resources will no longer be owned by the nation. The important point here is to design a scheme under which Pemex is allowed to arrange different types of agreements with private companies, even when the NOC maintains control of the resources. These are the kind of amendments to the Constitution that should be discussed.

Another important subject to be debated is whether Pemex should become a decentralized organism. If it is decided that Pemex should act more business-like, it should then be established as a business from the legal standpoint. This is also a constitutional reality: only decentralized organisms can perform strategic activities. Therefore, to drive a state-owned company such as Pemex towards the execution of crucial activities, the Mexican Constitution would have to be modified.

On the other hand, the strictness of our regulation is also a myth. In the US, for example, legal security of individuals is profoundly advocated, restricting the modification of the terms of concessions earned. If we were as strict as we vow to be in Mexico, the same thing would happen: openness in the shale gas market would mean that the government could not modify terms in a concession and would necessarily have to keep certain standards and legal requirements to validate its strictness. Our legislation is not strictly closed; it actually allows many variables and options, but only if we know how to exercise that freedom. If we do not take advantage, the results will still be the same, and reforms will continue to be the central talking point.

Q: One of the perceptions in Mexico is that if privatization is allowed, Mexico will lose its sovereignty. What is your perspective on this?

A: This is definitely a myth. It would be exactly the same deal if Pemex would extract the hydrocarbon and ended up selling it locally or through exports. The only variation from these two scenarios is that, if hydrocarbons are sold within the country and the subsequent activities of refining, transport, storage, and distribution take place within Mexico, it would bring more national wealth in the form of job creation than if it is exported in its crude form. If oil were always exported, the main business in the industry would only consist in extracting and trading hydrocarbons, which by themselves, would maintain the sovereignty of the country.

Q: With the inclusion of ISCs, international companies are allowed to work more autonomously in production projects. What is the difference between this and allowing private operatorship?

A: What this new contracting model adds to the previous one is supplementary components in the economic structure of the contract. At the end of the day, these agreements are still service contracts: the only thing that Pemex is doing through them is form agreements with private sector companies to support its activities, which has always happened. The difference lies in the fact that the law now recognizes certain indicators as the basis for rewarding good performance from service companies, plus additional remuneration when that performance involves technological progress and production advancement.

In a strict sense, this is not privatization, but a service-providing contract. Privatization means that the only ones allowed to extract and exploit hydrocarbons would be private companies, and not state-owned companies. It is important to differentiate between this and the fact that Pemex leans on third parties to improve efficiency in its operations. The only debate within these contracts is the remuneration schemes and the incentives implied. Obviously, due to constraints in the regulatory framework, companies cannot be paid in hydrocarbons. However, that does not mean that their effort should not be recognized or that a payment scheme that rewards or penalizes performance cannot be established.

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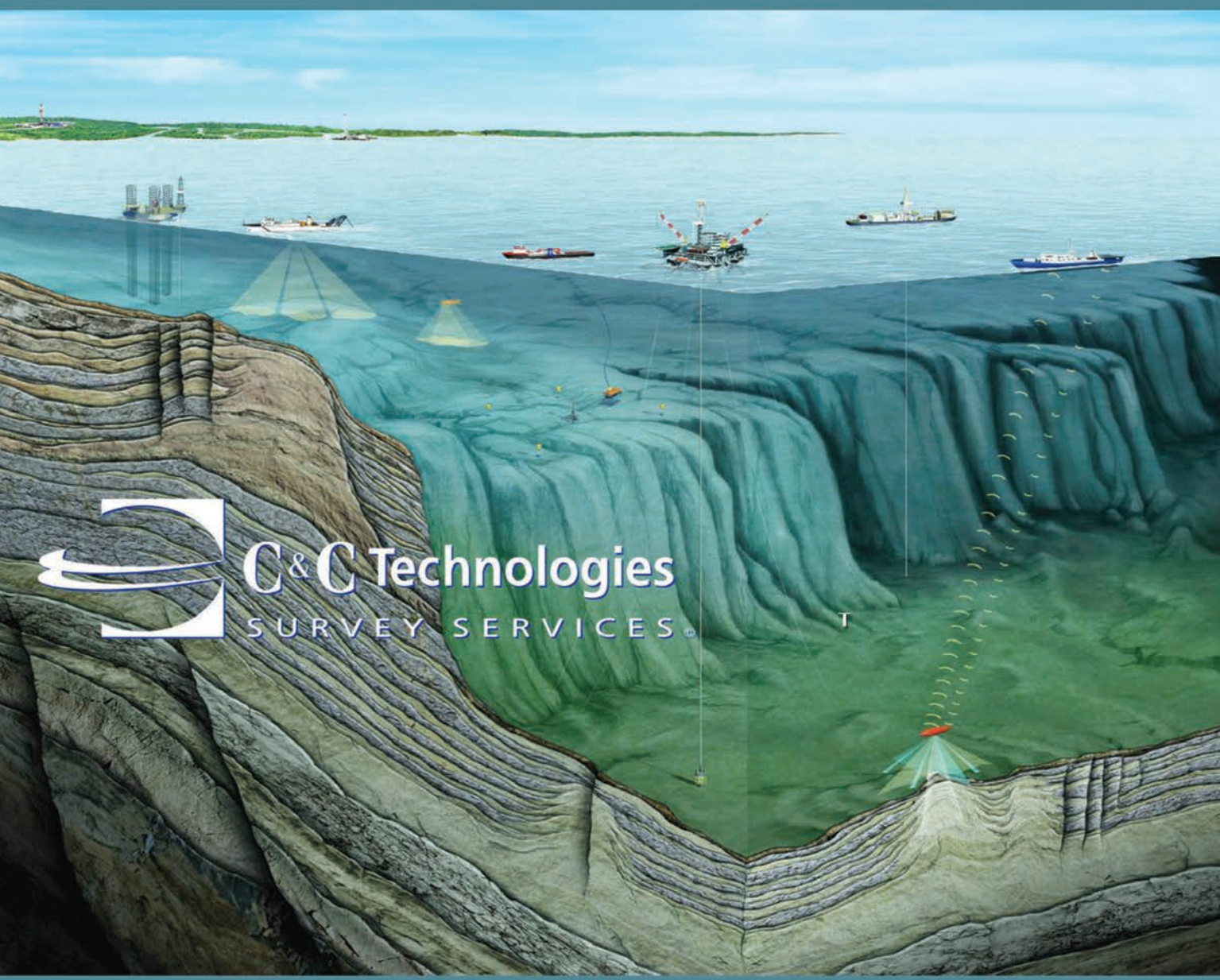

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LEGACY OF THE 2008 ENERGY REFORM

JESÚS REYES HEROLES

CEO of EnergeA and Former CEO of Pemex

Q: What do you expect to be the impact of the 2008 Energy Reform on upcoming reform?

A: The new energy reform should not only acknowledge what happened in the 2008 Energy Reform. It clearly did not achieve all its objectives, because no constitutional amendment was negotiated, but it created a foundation on which we can build the upcoming energy reform. For example, there is no need to reopen a process to build positive public opinion, as this was already achieved in 2008 and most of the key arguments are still valid. We know what has to be done; the issue is how we will do it. This has to do more with how to negotiate the modifications that have to be made to laws, regulations, and the institutional framework under which the energy companies operate, than with how to draft them. The objective is not to make this an ideological contest, as it happened when I was in the middle of the 2008 Energy Reform as CEO of Pemex. We all agree that we have to act pragmatically and get off the path that keeps leading to more missed opportunities and a weaker energy sector. The shared view is already there; we only have to build on it and work out how to execute the changes.

Q: What is your greatest frustration about the 2008 Energy Reform?

A: Energy reform in Mexico has been happening in stages, starting in 1992 with the opening of the natural gas market and the emergence of Independent Power Producers (IPPs), but there has never really been a comprehensive reform. Regarding the 2008 Energy Reform, my greatest frustration is that it did not go as far as it should have; we needed a reform that involved constitutional change, so when it was decided that the Constitution was not going to be amended, the reform became insufficient. That is the main reason why, five years later, we are discussing another energy reform. Also, the opposition's last minute change of mind to not allow us to open up the pipeline transportation sector to private participation was devastating; it was a last minute reversal of an agreement that was already there, and I really regret that this happened.

Q: What limitations does Pemex still face that were not fully addressed in 2008?

A: Today, Pemex is not allowed to partner with other companies through operating agreements. There are some exceptions in which the industry has opened up to private sector participation since the 1980s, but the 27th Article of the Constitution remains paradoxical at best. On one hand, it states that all hydrocarbon resources belong to the country, and that Pemex has the advantage of being the sole company to exploit those resources. Yet it says, after the comma, that Pemex has the responsibility to do it all by itself. In other words, Pemex can hire other companies to drill or to provide certain services, but it cannot enter into a joint venture with private companies to explore or exploit the reserves. That is a terrible limitation; there is no other oil company in the world that has the same restriction. To change this was one of the failed objectives of the 2008 Energy Reform, and therefore, it is still the most critical modification that has to be pursued.

Q: Although progress was made in 2008, one of the key obstacles to passing meaningful energy reform remains society's views on oil and Pemex. How should these sentiments be handled?

A: Well, there is a lot of sensitivity when dealing with these topics; however, one of the most important contributions of the 2008 Energy Reform was that it actually made the public realize that talking about oil should not be a taboo. Thanks to this, energy reform became part of the political agenda of every presidential candidate, with differing opinions obviously, which is a major change compared with past elections. Today, everyone understands that energy reform is a topic of major importance on the political agenda, and every party is willing to participate in the reform discussion.

Q: What are the political lessons President Peña Nieto should learn from President Calderón with regard to energy reform?

A: The main lesson is that, within any political party, there are always sympathizers for a fully-fledged energy reform. Therefore, Peña Nieto has to focus on gathering enough sympathizers to be able to pass the reform through Congress and Senate. So far he has been successful in passing reforms in various sectors because the plurality of Mexico, politically speaking and reflected in Congress, is a reality that can be taken as an advantage with the right negotiations.

PERSPECTIVE ON ENERGY PRIORITIES FOR MEXICO

During his tenure as Pemex CEO from December 2006 to September 2009, Jesús Reyes Heroles was one of the main advocates of making significant structural changes in the way that Pemex operated and the national oil and gas industry was managed. As the 2008 Energy Reform advanced through Mexico's different political forums, several modifications were made to its original framework, frustrating the aspirations that key executives had for transforming the industry. Reyes Heroles, who now works as the CEO of consulting company EnergeA, shares what the lessons learnt in this process mean for the issues that must be addressed in order to achieve a comprehensive energy reform in 2013. The central issues that he believes should not be neglected for the energy reform to leave a significant stamp on progress are presented in the table below.

SUCCESS FACTORS FOR MEANINGFUL ENERGY REFORM

1. Build on the foundation created by the 2008 Energy Reform process
2. Amend the mandate of the 27th Article of the Constitution that forces Pemex to exploit all the national hydrocarbon resources
3. Allow Pemex to form partnerships with other companies, transforming its mandate from a constitutional decision to a business decision
4. Give Pemex and CFE budgetary independence from the Finance Ministry and reform the corresponding articles in the Constitution
5. Limit the responsibility of the Energy Ministry to defining the country's energy policy
6. Allow Pemex to obtain the financial resources required for its operation and investment plans
7. Design a new scheme to fight corruption
8. Protect Pemex from the interests of the Finance Ministry as a tax collector
9. Convince Pemex's Labor Union (STPRM) to contribute in the company's upturn
10. Avoid the mistakes made in the 2008 Energy Reform approval process.
11. Align the political strategy, critical path, timeline, and communication plan with the proper variables for success

"Mexico is an energy-rich country. However, our story in the past few years has been a tale of missed opportunities," he explains. "It is frustrating to see that the resources are there, within our grasp, and we cannot take advantage of them in order to contribute to faster growth for the country." Leaving his dissatisfaction with the ways the industry has moved in the past few years aside, Reyes Heroles believes that the future is bright for Pemex with an energy reform looming, but asserts the importance of not missing the opportunity to really leave a mark.

The first step towards building a more comprehensive energy reform means acknowledging what happened with the 2008 Energy Reform, learning from it, and building on it. "The energy sector has been overdiagnosed: we are the same group of people having the same discussions," he says. "Most of the key arguments that we discussed five years ago are still valid: we know what has to be done. We just have to establish how we will do it and that means negotiating the required modifications to laws, regulations, and the industry's institutional framework to make it happen."

With his pronouncement on what needs to be done for 2013, the former CEO of Pemex believes that two crucial changes have to happen in the construction of a new reform. "The energy reform has to embrace both Pemex and CFE as its cornerstones, but put them into real perspective: as part of the energy industry and not the energy itself," Reyes Heroles argues. "The central change that the reform should aim for is allowing Pemex to partner with other companies at the percentage it deems adequate for the specific projects where it believes it needs assistance." A change to the 27th Article of the Constitution would certainly mean that Pemex would finally act as a business, being relieved of the mandate to exploit all national hydrocarbons by itself.

While IOCs are interested in entering the Mexican oil and gas market, they prefer to do so in schemes where both risk and reward are shared within the operators. "The ability to form joint ventures with IOCs is relevant for every activity that Pemex carries out, but especially for the exploitation of the recent deepwater discoveries made by Pemex," Reyes Heroles explains. "Pemex cannot execute all these projects on its own; not because of the technical capabilities of the company, but because of the risk distribution, risk management, and financing issues of such big operations." With other companies that have the necessary experience for this kind of operations, Pemex would have the time to learn and the teachers to learn from.

"The energy sector has been overdiagnosed: we are the same group of people having the same discussions. Most of the key arguments that we discussed five years ago are still valid: we know what has to be done"

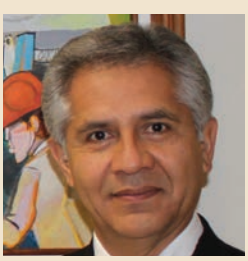
Jesús Reyes Heroles, CEO of EnergeA and former CEO of Pemex

According to Reyes Heroles, the next step in working out the structural changes needed for the industry includes "pulling out" Pemex and CFE from the federal budget. By liberating the two companies from the fiscal constraints that the Finance Ministry currently exerts on them, there will be more freedom to enhance productivity and efficiency within the energy industry. Clearly establishing the role and position of the Finance Ministry and limiting them from acting as the energy authority in the country would contribute to a better administration of Pemex, Reyes Heroles believes. Self-management by the NOC would further allow it to get additional resources to execute its operation. The US$69.4 billion dollars that the company had to pay in tax and duties in 2012 represents the biggest fiscal charge in the entire world. While Pemex is one of the companies in the world with the highest EBIT margins, its operation becomes limited with such a heavy tax burden.

The Energy Ministry's role should also be clearly defined as the organization in charge of defining energy policy. "Many institutions overlap, causing challenges to appear – sometimes from within the company, sometimes from the Energy Ministry, and sometimes from the Finance Ministry," Reyes Heroles states. "Everybody believes they have a say over Pemex, and the NOC cannot listen to all of them at the same time. These issues could be solved if the government were to give more autonomy to the CEO of Pemex. By eliminating the Public Administration Ministry, current President Enrique Peña Nieto has contributed in removing some of the overlap and obstacles that came from it."

The final steps to achieve the comprehensive reform that the sector needs involve aligning all of its components – operational, technical, scientific, administrative, but overall, human resources – in the same direction. With the correct alignment of all the different segments of the company, it would be easier to pursue the same goals along the organization. "Pemex requires a major shake-up; you cannot have several isolated areas that barely coordinate with each other," Reyes Heroles says. "I think the current CEO will be able to consolidate all the managerial capabilities of the company; people at all levels of the administration would then need to follow his lead."

WHAT WILL THE MEXICAN OIL AND GAS INDUSTRY LOOK LIKE AT THE END OF THE YEAR?

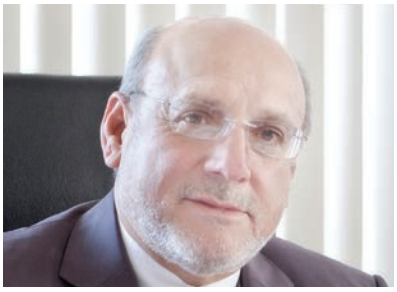


Adán Oviedo Pérez, Director General of COMESA

Right now, there are many things on the table in Mexico related to the oil industry. We can split these subjects into at least three different topics: the legal issue, the reorganization of Mexico's national oil and gas company, and companies' technical and economic visions related to new ventures and opportunities. From the legal point of view, it seems that a big reform is appearing on the horizon. My personal point of view is that it is needed for the country in order to fully exploit and monetize the vast reserves and resources that lie both in conventional and unconventional reservoirs. Things seem to be going in the right direction. There will be some very tough discussions in Congress and in the country in general, but I think good things will come from having these discussions. I don't know how long it will take for reform to happen, but I am sure it will occur.

I also believe that the reorganization of Pemex is a positive step for the industry. Since 1992, Pemex has been running its activities through four different divisions. 20 years ago, this was a good approach in order to improve the results of each division, but over time, the entire value of this structure has been lost, and as a country we are losing a lot of value. A typical example of this loss of value is Pemex concentrating the vast majority of its investment activities in the upstream sector, and forgetting that it also needs to support downstream. Pemex's E&P division has seen incredible results, but it has caused a lot of pain in the downstream performance. Mexico is the only country in the world that produces so much oil and imports so much refined product. I hope that this talk of restructuring will become a reality, and Pemex can make the transition to not just vertical integration, but also horizontal. Finally, from the point of view of new actors in the industry, the energy reform and the restructuring of Pemex will provide a much better investment scenario.

TRANSFORMATION: FOCUS ON STRATEGIC THINKING



LUIS VIELMA LOBO
Director General of CBM Ingeniería Exploración y Producción

Q: What is your perspective on the potential restructuring of Pemex?

A: Instead of talking about what Pemex needs in order to boost the Mexican oil and gas sector, Mexico should focus on what needs to be done to improve the whole oil sector, and Pemex with it. The main problem is that everyone believes that Pemex is the oil industry, but it is not. In order to change this perspective, there needs to be a transformation of mentality. This means the roles and responsibilities of each one of the institutions related to the oil industry, starting with the Energy Ministry, must be revisited and analyzed in order to decide what specific role each institution plays and should play. I do not think Mexico needs an energy reform, but Mexico badly needs a transformation of mentality.

Q: How do you achieve this transformation of mentality?

A: In the petroleum world almost everything has already been done by someone else, so what you really need to do is look for best practices that fit your culture and needs, and adapt and implement them. Mexico has to look for people with strategic minds. In the end, this means that Mexico needs politicians who can direct the industry through strategic rather than political thinking. They can do this by bringing people in from outside to advise and help implement this much needed mentality transformation. A strategic planning group should be created to make an objective analysis of the entire oil and gas sector and decide what is best for Mexico, instead of what is best for Pemex, the Energy Ministry, the Finance Ministry, or the government.

Q: Who can set this transformation in motion; the Energy Ministry, Pemex, the CNH, or President Peña Nieto?

A: The Energy Ministry has to lead the transformation of the Mexican oil and gas sector, and go beyond the restructuring of Pemex. For the Energy Minister it would be easier to reform Pemex than the whole industry, because reforming the whole sector would require reforming the Energy Ministry itself, and people are generally reluctant to change. However, transformation is essential because Mexico is facing serious challenges and nobody seems to be reacting to them. For example, the USA and Canada have agreed to build the keystone pipeline to connect Alberta with Texas. Once completed, this pipeline will be able to transport around 2.5 million b/d of crude to Texas, our largest consumer. Who is thinking about the threat this poses to Mexico? In essence, what I am trying to say is that Mexico is failing to see many threats and is missing opportunities. For this reason, there needs to be a transformation, to make the sector more competitive and more flexible to react to these threats and seize more opportunities.

Q: What should be the role of the private sector in this transformation?

A: So far the private companies in the oil sector have been passive with regard to change: they are waiting to see what type of opportunities Pemex will offer. Until now, I truly have not seen any initiatives or proposals from the private sector to reform Pemex or the oil industry. For example, in the refinery business no one has approached Pemex and offered any kind of deal; they have been passive at a time when there are enough potential investors to boost the Mexican oil and gas industry in multiple areas such as gas, refining, and petrochemicals.

Q: Why is everyone in the private sector so afraid to be proactive in demanding change?

A: Probably because of the political environment they witness in the media. If we want the private sector to be involved and speak out, then we must give them the right communication channels and opportunities to participate. If they spoke out freely nothing would happen to them, except public criticism since we live in a democracy, but they do not want to criticize the Mexican government or Pemex and risk hurting their possibilities of acquiring contracts.

I have been in Mexico for 10 years, and even before I arrived here, there were people from Shell, ExxonMobil, Chevron, Petrobras, and BP in the country, and they are just waiting. I think they are here because they have high hopes the oil sector will open to private investment in the near future, but sooner or later they will have to take a decision. Hopefully they will decide to be more involved and help lead this transformation.

Q: How many divisions should Pemex have, and what would be the ideal structure?

A: The success of Shell illustrates that the number of divisions does not really matter, what matters is how well organized the company is. If a company is decentralized enough to make all kinds of decisions rapidly, but centralized enough for the effective implementation of an integrated strategic plan, then of course you can be successful. But an organization like Pemex, which is centralized in every aspect, will never be able to reach its full potential. Can Pemex become something similar to Shell? Of course it can, but they need to change their mentality. Until Mexico defines exactly what kind of oil sector it wants to have, it will be putting the entire burden on Pemex.

Q: Would you be in favor of creating an advisory council that advises the board of Pemex made up of former CEOs of companies such as Shell, Exxon, Chevron?

A: You can have this group as a sort of special council that can advise and recommend, but Pemex would be petrified to give these people the right to criticize and interfere in the decisions relating to how Pemex should be run. However, large successful companies are built by people who take risks, and if Pemex wants to improve and grow to become one of the leading oil and gas producers worldwide, it must take such risks.

FUTURE OF THE PEMEX BOARD

In the past, the board of Pemex primarily consisted of many members of the executive branch of the government, including the Ministers or Undersecretaries of Foreign Affairs, Economy, Labor, Finance, Environment, and Energy. Mexico has already tried to reduce the number of 'political board members' – today the board includes the Energy, Finance, and Economy Ministers, and the Hydrocarbons, Planning and Energy Transition, and Public Revenue Undersecretaries – and introduced independent professional board members.

The next energy reform might further improve the composition of the Pemex board. As a result, the board's composition would continue shifting from being populated by people whose primary interest is extracting money from Pemex to finance the government's agenda to people who are focused on creating value for Pemex. That is the mandate that we should set. I am not saying that the past composition of the Pemex board was wrong, but it was not optimal and it is evolving. The boards of IOCs such as Exxon, BP, and Shell are different, and generally consist of independent advisors and the CEO. We are getting there.

Edgar Rangel, Commissioner of CNH

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PETROFIED POLITICS NO MORE?

Duncan Wood, Director of the Mexico Institute at the Woodrow Wilson International Center for Scholars

Mexico is currently at a tipping point, according to Duncan Wood, President of the Mexico Institute at the Woodrow Wilson International Center for Scholars. If the right reforms and initiatives are implemented, the country will be able to take advantage of the multiple political, social, and economic opportunities available. However, if the necessary steps are not taken to achieve comprehensive fiscal and energy reform, Wood believes that by 2015 or 2016, Mexico's oil production could begin to drop drastically, and the country could potentially face a serious economic and energy challenge. For this reason, Wood feels it is of vital importance for the Mexican government to overcome the various obstacles to a comprehensive energy reform.

The most important obstacle is political, since the balance of power in the Congress and Senate depends on the PAN's willingness to cooperate with the PRI or ally itself with the PRD. "If the PAN Senators establish a working relationship with the PRI, we will be in an optimal position to pass an energy reform," Wood explains. "But if they decide they are not going to agree to anything because of political pride, then neither the fiscal or energy reform will ever pass."

There was a lot of skepticism about the possibility of any of the three reforms passing – labor, fiscal, and energy – but since the labor reform was passed in November 2012, followed by broad support for education and telecommunication reforms, people are optimistic about the prospects of the other two. However, Wood warns there is a limit to this positive outlook because there might not be sufficient political capital to agree on all three issues. One of the reasons for this skepticism is the PAN's fervent desire for a shale gas reform. This could have a potential negative effect on a comprehensive energy reform because two separate energy reforms would be counterproductive.

Nonetheless, Wood seems quite optimistic about a fiscal reform – which in his opinion is crucial for a comprehensive energy reform: "It would be easier to agree on a fiscal deal than it would over energy. This is because, apparently, the

ISCS AS PRODUCTION DRIVERS

"The bigger the reform, the bigger the benefits, that is how the Mexican oil and gas community has to understand it. If the reform starts shrinking, the benefits will become smaller. The risk is that this reform will end up like the 2008 Energy Reform, which would generate much disappointment."

Guillermo Pineda, Energy Specialist at PricewaterhouseCoopers

"It seems that a major reform is looming on the horizon. My personal point of view is that it is needed for the country in order to fully exploit and monetize the vast reserves and resources that lay both in conventional and unconventional reservoirs."

Adán E. Oviedo Pérez , Director General of Comesa

"The new energy reform not only has to acknowledge what happened with the Energy Reform of 2008, but also build on top of it. The 2008 Energy Reform clearly did not achieve all its objectives, because no Constitutional amendment was negotiated. This new administration should start by recognizing the discussions that were made for the past reform."

Jesús Reyes Heroles, former CEO of Pemex

"Without the reform there is no space for growth; with the reform, we are talking about real modernization and bringing a lot of resources into Mexico, creating wealth for the country and the company, which is a win-win for everyone."

João Geraldo Ferreira, Vice President of GE Oil & Gas Latin America

PRI and the PAN have finally worked out a way to cooperate in Congress." However, even though the fiscal reform is key to a successful energy reform, the Mexican economy is starting to pick up, growing at 3.9 percent for the full-year of 2012 and aiming for 6 percent at the end of Enrique Peña Nieto's presidential term. This economic growth, which stems from Mexico's ability to diversify its exports, would reduce the federal government's dependence on Pemex. In turn, this means that a drop in oil revenue would not have such a big impact as previously thought, especially if favorable economic policies are implemented in the US, once a meaningful fiscal reform is implemented.

Wood believes Mexico is in an advantageous position to further grow and attract foreign investment because Peña Nieto is regarded as a brave, bright president, coming in with an exciting team, who can get things done. His reputation places him in an ideal position, but if he is not able to pass the energy and fiscal reform, foreign investors could react very quickly, and the honeymoon phase would be over. However, if the fiscal reform goes through, the odds of Mexico passing a successful and comprehensive energy reform would improve, which would bring foreign investment and ameliorate energy security for Mexico and the US. "On a regional basis, one could argue that North America is energy secure," Wood believes. "But in terms of where we want to get to and what is coming up, energy security begins to look a lot more like energy vulnerability. Mexico needs to change from being vulnerable to being sensitive to be able to make adjustments as changes occur." In order to continue down the positive economic, social, and political path, Mexico needs a comprehensive energy reform that gives Pemex the necessary tools to adapt to the current energy challenges and further improve energy security in North America.

Even though Wood seems skeptical about North America achieving energy security anytime soon, he is extremely hopeful Peña Nieto will show the expected political strength and wit. "From an international standpoint, Mexico looks very good right now; the strong fiscal position, particularly the international debt position that Calderón has built up, combined with the hope that things are now going to start happening, make the situation look very positive," concludes Wood. During President Barack Obama's visit to Mexico the controversial topic of foreign investment in Mexico's oil industry was not brought up publicly in his meetings with President Peña Nieto, leaving further North American energy cooperation an ambition rather than policy for now.

> "The amount of investment that could come into the energy sector as a result of reform could really turn things around in Mexico and take the country to the next level. For example, Shell invests around US$30 billion in its projects around the world; Pemex invests US$20 billion just for its projects in Mexico, which is still not enough, because the challenge is huge and the potential is great."
>
> *Alberto de la Fuente, President & Director General of Shell Mexico*

> "Mexico cannot ask Pemex to pay 100% of its revenue back to the government in taxes: the world does not work this way. This is the reason that a fiscal reform is also urgent. Pemex needs to be taken out of the federal budget, and become an independent, profitable company."
>
> *Héctor Moreira, Professional Member of the Pemex Board*

> "The energy reform would be a total sucess if it allowed Pemex to partner with private companies in order to increase production, and modify Pemex's legal corporate structure to transform it into a profitable and efficient company."
>
> *Rogelio Gasca Neri, Professional Member of the Pemex Board*

> "There is no reform in Mexico as important as energy sector reform, beacuse it impacts many sectors: a good energy reform would impact the electricity industry, which in turn will impact gas and the cost of alternative energies. The idea is to make the whole sector more competitive. The reform, besides increasing the amount of money being sent to the federal budget each year, will create many good jobs, bolster energy security, and improve power supply to the nation's key industries."
>
> *David Penchyna Grub, President of the Senate Energy Commission*

3

In order to successfully participate in Mexico's upstream market as a supplier or service provider, knowledge of two aspects of the oil and gas landscape are critical: the fields that currently offer most opportunities for contractors due to the priority that Pemex has given the projects, and the contracting systems by which companies can win work at projects in Mexico.

In this chapter, we investigate the lifecycle of Mexico's main fields, from mature shallow water fields like Cantarell and Ku-Maloob-Zaap to newer opportunities in Litoral de Tabasco and onshore regions, as well as the blocks that have been, and are about to be, awarded to private operators through the integrated service contracts. We are also speaking with the winners from previous two rounds, and the legal and consulting teams that helped them to win those contracts.

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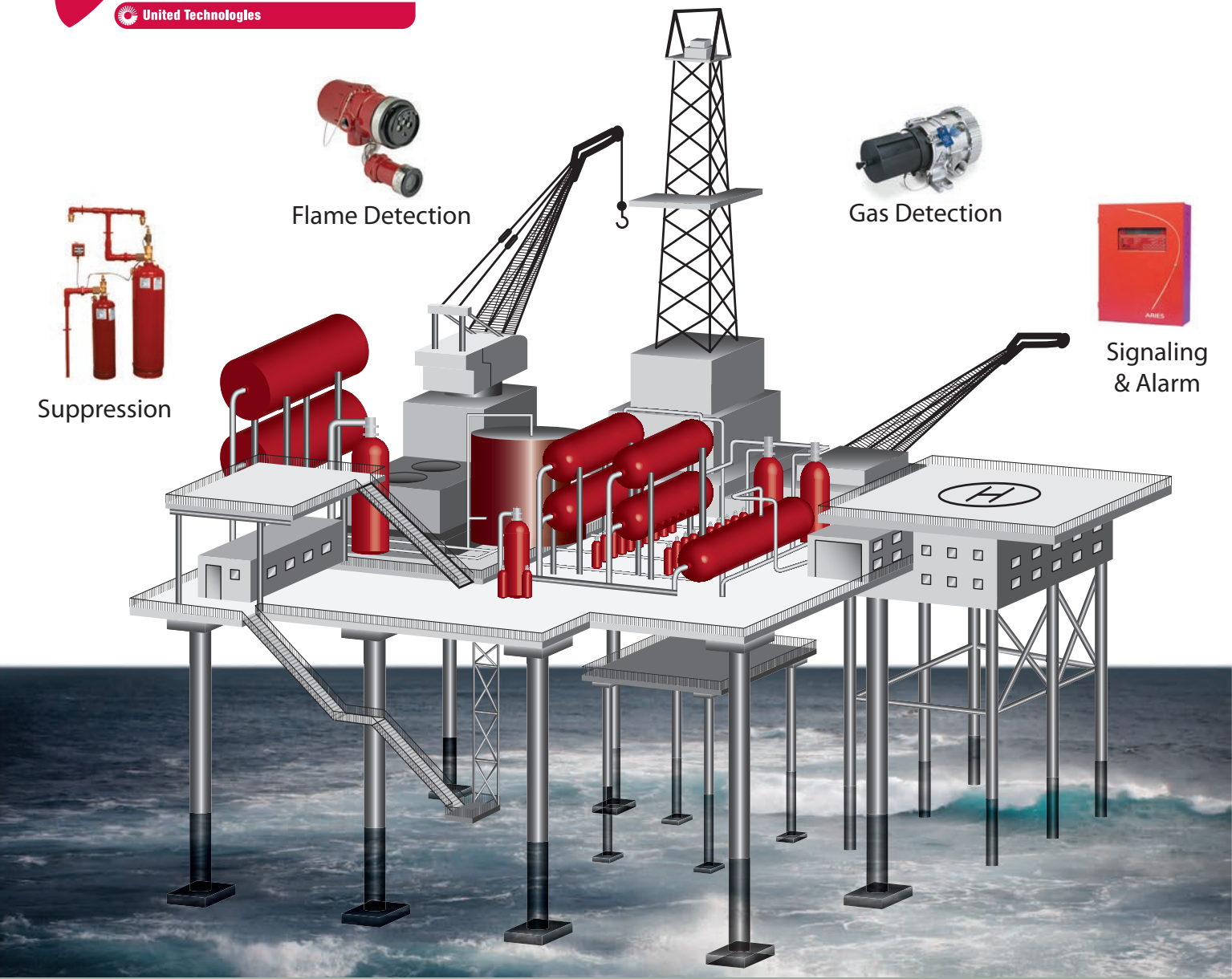

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STREAMLINING UPSTREAM ACTIVITIES

CARLOS MORALES GIL
Director General of Pemex Exploration and Production

Q: What were the most important factors in the last six years that led to Pemex's upstream success in 2012?

A: Without a doubt, the most important factor contributing towards this year's success was that both the government and Pemex's administration understood the lifecycle of the oil and gas process, and were patient enough to authorize an increasing amount of financial resources for the exploration and development of new reservoirs. The administration was also patient in terms of allowing Pemex to grow its capacity to execute projects through new contracting methods.

Q: What are the production targets for 2013, and what technologies will be required to achieve these targets?

A: Production-wise, we expect to reach 2.7 million b/d by the end of the year. In terms of the technologies needed, we will require horizontal wells, fracking, and steam injection or secondary recovery to reach our goals at mature fields. For Tsimin and Navegante, the key factors will have to do with improving drilling efficiency.

One of the technological changes that we are implementing in Tsimin is in our approach to platform design. Traditionally, our platforms were designed to provide production infrastructure for up to 12 wells, but we have realized that we can drill additional wells by optimizing our rig design. Therefore, we are preparing platforms to drill with dual rigs, which can come in combinations of two fixed platform rigs, or one fixed platform rig and one jack-up rig. This flexibility is production-driven.

Another change is the inclusion of separation systems for the management of very light fluids and oil, and the cutting-edge compression systems being installed in Tsimin's production facilities. We are also using new well completion techniques – such as a new cementing technology – and the packers as well as the set of valves that we are utilizing in those wells are also cutting-edge. These are basically the changes we are introducing in these development areas, which are very technology-oriented.

Q: What role does the recently created development division play in introducing new technologies?

A: The people in charge of the development division, led by Javier Hinojosa Puebla, are certainly technology-oriented and open to innovation. They have been doing a great job of introducing the use of valuable technologies on recent projects. Clear examples of this are the new designs for wells, FPSOs, and platforms we are starting to see in the Lakach area in deepwater and in Ayatsil, where heavy oil needs to be produced. The development division is also responsible for incorporating new technologies for the design of fixed platforms in Tsimin.

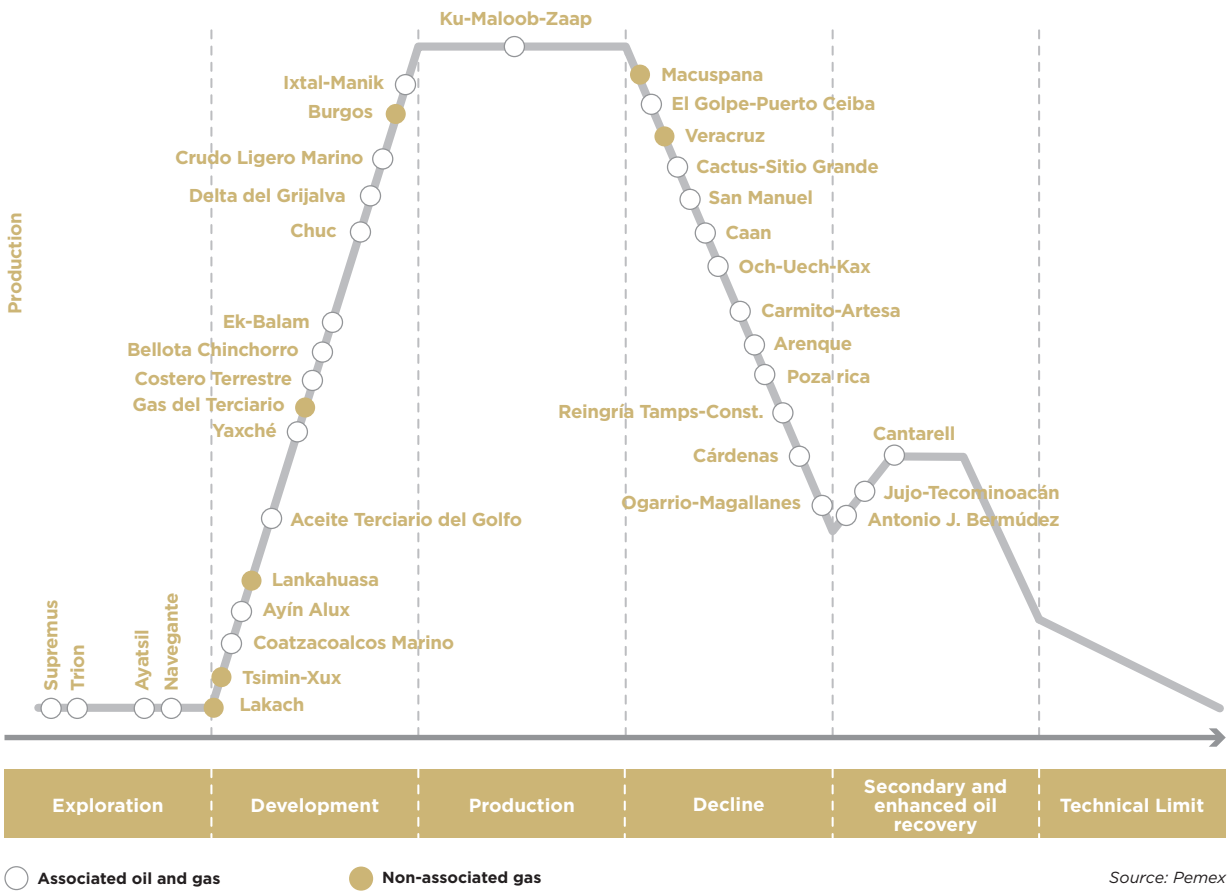
Q: How will the achievements of the development division impact Pemex's performance in the short and medium-term?

A: Their role is definitely crucial. The development division has its sights set on one single decisive objective: to reduce the amount of time between the discovery of an oil field and the first production returns. If we do not achieve that, then we have failed, and that failure will be evident in both the short and mid-term. We have already seen the fruits of the effort that is being put into this objective in Tsimin: the field started producing in August 2012, exactly one year after its discovery. However, Tsimin is somewhat of a conventional field; the real tests for the development division will be in Lakach, which holds very heavy oil, and Ayatsil, which is a very deep reservoir.

Q: How will success be measured at Lakach and Ayatsil? What is the timeframe for the start of production at these fields?

A: It depends on the progress that each project has already made. The first milestone in the process is to define the specifications of the equipment that will be needed. Lakach is already past that stage, while Ayatsil is at that stage at the moment. The main challenge at Ayatsil will be the complexity of the FPSO technology needed to process the very heavy crude oil. Once the design stage is completed, and provided that the project goes well in terms of placing orders and supervising the manufacturing of the equipment, the green light is granted to move to the next phase, which is the execution process. Lakach is already moving to that stage, and we expect to move forward from that stage in the next six months. Ayatsil

LIFECYCLE OF MEXICO'S MAIN FIELDS



Source: Pemex

is still in the design phase, but we expect to start the execution phase in the next few months. The process is based on milestones against which progress is constantly checked. Pemex communicates when each milestone is completed and if progress is on schedule or not.

Q: Is there anything that can be done to streamline contracting processes and accelerate the development process?

A: This is a concern that emerged even before the implementation of the Pemex Law. We all agree that the Pemex Law was a positive step towards improving the contracting process. It has given Pemex a more robust foundation for contracting and a better basis for analysis. The problems emerge in the several approval stages that the contracting process involves: at the moment there are five approval stages through which every contract must pass, and the value added in each is marginal. We believe that two can be eliminated, streamlining the procedure without losing any value in the process.

The main thinking behind this idea is that the value added in the last two approval stages does not justify the costs of the time lost. Reducing this lost time is critical, since it represents money. One could argue that the additional two months that these stages take do not represent much time when talking about contracting, but looking at it from the production perspective it represents a lot of money.

PEMEX DIVERSIFICATION STRATEGY

Following the decline of Cantarell, Pemex launched a strategy to diversify Mexico's crude oil production. Pemex's efforts have not been in vain, as Mexico's dependence on Cantarell has significantly decreased. In 2004, Cantarell was responsible for more than 63% of the country's total production, a figure that today stands at only 17.8%, while Mexico's overall production has stabilized at around 2.55 million b/d.

Today, Ku-Maloob-Zaap is Mexico's largest producing field, representing 33.6% of total production in 2012, an increase from only 9% in 2004. Litoral de Tabasco has also gained increasing prominence in Mexico's production portfolio, moving production from 2% of total production in 2004 to 12.5% in 2012. The success of Pemex's diversification strategy is best illustrated by the fact that Mexico's crude oil production increased by 847,317 b/d since 2004 if we do not take into account the production at Cantarell. Pemex's diversification plan also includes mature fields such as Chicontepec, where production increased from 30,000 b/d in 2009 to 75,000 b/d in the initial months of 2013.

STABLE PRODUCTION REMAINS PEMEX'S PRIORITY AT CANTARELL

Since Cantarell began producing oil in 1979 it has had a unique production policy of extracting as much oil as possible in order to increase the public finances of the country. Unlike Abkatún, Pol, and Ku-Maloob-Zaap, production at Cantarell was maximized because of the magnitude of the oil field – which represented 36.7% of the country's total production in the 1980s, 40.8% in the 1990s, and 56.8% from 2000 to 2007. Even though many critics have branded this policy as detrimental to the long-term productivity of the field, Cantarell Administrator, Miguel Ángel Lozada Aguilar, would not call this policy a mistake because it was justified and made sense at the time of implementation. However, he believes it did have several effects on the long-term productivity of the field.

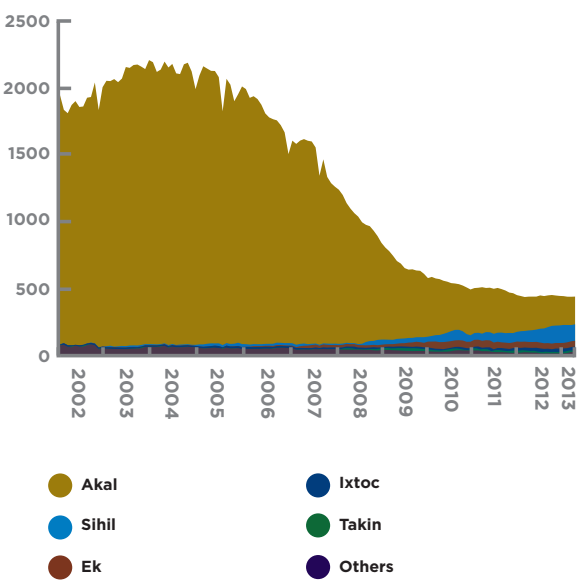
After realizing the policy of maximizing the value that could be potentially achieved from the field could not be sustained any longer, Pemex decided to change its strategy and acquire a sustainable production plateau to increase the ultimate recovery factor. As a means to achieving this goal, the NOC focused on increasing production by drilling new wells, changing from gas lift to electric submergible pumps (ESPs), and applying new technology and processes to its water and gas management infrastructure. However, Pemex had multiple difficulties in achieving this objective because during 2011 they were unable to acquire all of the required jack-up rigs, due to a lack of offers and because there was still a lot of pressure from the federal government to maintain production.

Currently, Cantarell has a 42% recovery factor – which is equal to 12 billion barrels. However, Lozada Aguilar believes they will be able to stabilize production at 472,000 b/d and increase the recovery factor to over 50%. This change of strategy, of prioritizing stable production at the complex, can be achieved through a variety of different means, but the essential ones will be the application of innovative technologies and enhanced oil recovery techniques.

The most important process currently being used that will allow Pemex to stabilize production is the injection of a double displacement surfactant in several areas inside the field. Cantarell currently has a gas cap at the top, an oil layer in the middle, and a large water deposit at the bottom. In order to increase its recovery factor, Pemex is injecting surfactant foam to wash and release as much oil from the rock as possible. Gustavo Hernández, Subdirector of Planning at Pemex Exploration and Production, explains: "After you inject the surfactant foam it slips very slowly into the pores, fractures the rock, and moves around the gas cap through oil molecules, which eventually slip down to the oil layer because of its molecular weight." In addition to this double displacement technique, they are also working on increasing pressure at Cantarell through nitrogen injection. According to Javier Estrada Estrada, Commissioner of CNH, the pressure level at Akal – Cantarell's main field – has not achieved a steady level because pressure is still declining while the gas-oil ratio is increasing.

Pemex is spending so much of its budget on these new enhanced oil recovery techniques in mature fields like Cantarell because – despite its declining production levels in the last 10 years – the NOC believes it can extract around 3 billion barrels more from the complex. "Even though Cantarell is reaching its production limit, due to the size of the oil reserve and the technological processes

CANTARELL OIL PRODUCTION



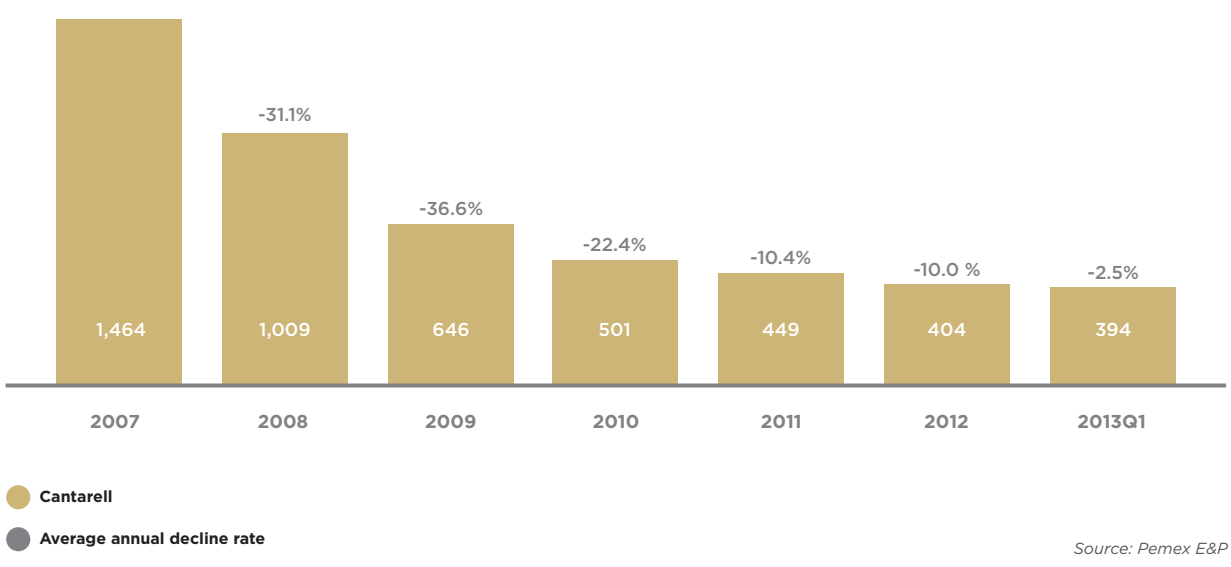
LOCATION OF THE CANTARELL ASSET

Source: Pemex

and enhanced oil recovery techniques available, it is worth Pemex's time and money to invest in the field and explore and develop new areas," Lozada Aguilar stresses. However, despite the fact that the production at the complex is no longer declining, and it is the NOC's short-term goal to reach a production plateau here, the strategy of increasing investment in exploration and development projects all over Mexico, implemented in 2008, should not be neglected.

Despite the fact that the decline rate of Cantarell's oil production has slowed down from 31.1% in 2008 to 10% in 2012, there are still various obstacles to overcome before stabilizing production. First and foremost, the federal government needs to pass a fiscal reform in order to rely less on Pemex for the federal budget – which at times has been up to around 40%. Secondly, in order to reach a production plateau and increase the recovery factor, the NOC has to invest, explore, and develop new regions around Mexico, but also in Cantarell, where they are focusing on extracting more oil from existing reservoirs and planning on drilling nonconventional wells with low rock permeability, such as the are doing at Sihil-Calcarenitas. "This might prove to be a complicated job because the global demand for drilling rigs is very competitive right now; therefore, if we do not acquire the necessary number of rigs to drill all the wells needed to stabilize production, we will not be able to increase the recovery factor at Cantarell," Aguilar Lozada concludes.

STABILIZING THE DECLINE OF CANTARELL

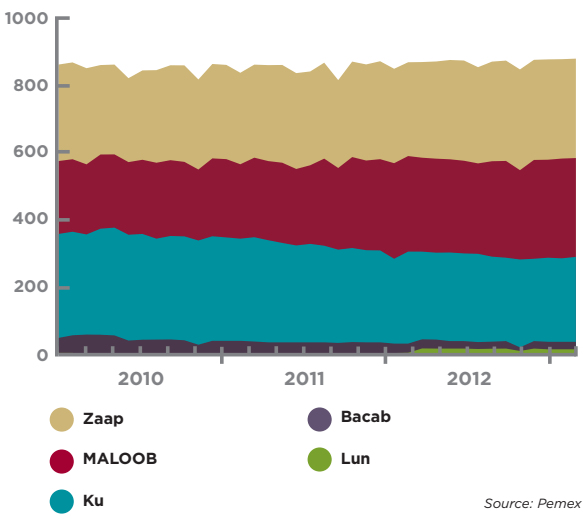


Source: Pemex E&P

KU-MALOOB-ZAAP: MEXICO'S MAIN PRODUCING FIELD

Ku-Maloob-Zaap (KMZ) has been the Mexican main oil producing field since it overtook the declining Cantarell field in January 2009, and produced an average of 855,190 b/d in 2012. Pemex is aiming to maintain a production plateau of around 850,000 b/d until production is expected to start declining in 2017. "In order to achieve this goal, we have adopted an operational philosophy based on reservoir management best practices focused on establishing criteria and standards in regard to production limits, areal distribution of fields, maintenance of reservoir pressure, and the implementation of an extensive real-time monitoring campaign for wells," details Félix Alvarado Arellano, Administrator of Ku-Maloob-Zaap.

KU-MALOOB-ZAAP OIL PRODUCTION



Source: Pemex

As a means to acquire and implement all these practices and technologies, increase productivity, and maintain the production plateau, KMZ has allocated 39% of its investment budget to production and 61% to field development. In reference to production, the investment was directed towards production infrastructure maintenance and well conservation, while the development investment was concentrated on construction, modernization, modification, and optimization of production infrastructure, specifically marine platforms and pipelines. Alvarado Arellano adds that Pemex is working on other vital technology projects focused on dehydration and desalinization of crude, multiphase pumping of heavy crude, and electric submersible pump technology.

While the KMZ administration is allocating investment to production and development, it is not responsible for exploration activities in the area. "According to the structural organization of Pemex E&P, exploration activities are programmed and executed by the Exploration Subdivision of Pemex E&P. It is up to them to promote the exploration of new regions," Alvarado Arellano stresses. However, the exploration program for 2013 contemplates the drilling of two wells in the heavy oil fields of Tson and Tekel, which will be drilled by the Field Development Divison, and later transferred to the Ku-Maloob-Zaap administration to be exploited, according to the protocol established by Pemex.

In addition to the technological challenges that Pemex is facing at KMZ, there are also geological issues that need to be considered. "The three main fields – Ku, Maloob, and Zaap – are composed of three layers: a gas cap at the top, an oil layer in the middle, and a large water deposit at the bottom which connects the three reservoirs; therefore, in order for each reservoir to not be affected negatively, we follow a strategy of maintaining pressure through monitoring, and nitrogen injection in each of the three fields to prevent the rise of the water-oil boundary," explains Alvarado Arellano.

LOCATION OF THE KU-MALOOB-ZAAP ASSET

Furthermore, due to the importance and magnitude of the Ku-Maloob-Zaap complex – which produces one third of Mexico's oil output – several domestic and international companies support Pemex to ensure that the most advanced technology is applied and customized to the particularities of the KMZ complex. "Currently, private contractors are not only providing material, tools, and equipment, but also technology that is first tested and implemented only after proving its effectiveness," Alvarado Arellano adds.

Ku-Maloob-Zaap will continue to be Mexico's most productive oil field in the near future, however, due to the resource limitations at the field, Alvarado Arellano believes that, by 2017, Ku-Maloob-Zaap's production will decline, even though Pemex will try and maintain a constant production plateau for as long as possible.

LITORAL DE TABASCO FIELDS GAIN PROMINENCE

Discovered in 1989, Litoral de Tabasco is a shallow water complex located in the southwestern area of the Campeche Basin, which is the country's most important petroleum province. It consists of a set of 11 fields of light oil and condensate that range from 30°API to 51°API. The Litoral de Tabasco complex is part of the Pemex E&P's Southwest Marine Region and covers an area of more than 11,000km^2. Maximum water depth in this area is 35m, with the main reservoirs being Kimmeridgian dolomitized oolitic banks and Cretaceous fractured carbonates deposited in an open platform. The Litoral de Tabasco project has been developed with 44 wells and 24 platforms using shared facilities, while the main production facility – the CA Litoral-A Compression gas facility – is located at a water depth of 26m.

Originally yielding around 6,000 b/d of oil and 6 mcf/d of gas, Litoral de Tabasco's production was increased significantly with the addition of the project Och-Uech-Kax in 1996, hitting a peak of 94,000 b/d of oil and 200 mcf/d of gas. Subsequently, three new projects were added by 2002 – Crudo Ligero Marino, Yaxche and Ayin-Alux – further boosting production to record levels around 120,000 b/d of oil and 265 mcf/d of gas. The discoveries of May, Bolontiku, Tsimin, Xux, Kab, and Yum increased the importance of Litoral de Tabasco to being the third ranked asset in both oil and gas production with averages of 319,219 b/d of oil and 735.77 mcf/d of gas in 2012, according to CNH figures.

According to Luis Vielma Lobo, Director General of CBM, Litoral de Tabasco is one of the most interesting areas that Pemex is developing right now because of the easy oil conditions it still presents. "The Litoral de Tabasco area is perhaps the most important opportunity for Pemex, due to the very low water content, wells that can reach production levels of 10,000 b/d, and a low average ratio of oil to gas production," he explains.

"The productivity of the Litoral de Tabasco asset is so high that Pemex is developing the whole project with traditional technology"

Luis Vielma Lobo, Director General of CBM

Given these production conditions, Litoral de Tabasco has become one of the most lucrative areas for Pemex to invest. "The place where we get the best return on investment is Litoral de Tabasco," explains Carlos Morales Gil, Director General of Pemex E&P. "It is one of the most profitable areas for the company, since it involves very cheap oil at wells with high pressure, and very high temperature, where even at the deepest reservoirs production costs are under US$5 per barrel."

CRUDO LIGERO MARINO

Pemex E&P started production of the Crudo Ligero Marino Project in 2003, with the Sinan field, which is located off the coast of Tabasco and Campeche. The May, Bolontiku, Tsimin, Xux, Kab, and Yum fields were subsequently put into production and last year collectively produced an average of 163,058 b/d, which add up to 51% of total crude production in the Litoral de Tabasco asset. Gas production in the field averaged 610.2 mcf/d, which is 83% of the asset's total production for this hydrocarbon. With the recent start of exploitation activities in Tsimin-Xux, Pemex expects to yield around 300,000 b/d of oil from the whole complex by 2016. The operational strategy consists of drilling 63 exploratory wells, 73 geological studies, and the acquisition of 2,318km^2 of seismic information, a plan that the company hopes will maximize production in the shortest possible timespan.

YAXCHÉ

The Yaxché field is located off the coast of Tabasco, approximately 13km northwest of the port of Dos Bocas. It was originally discovered in 2008 and reached an average production of 56,012 b/d of oil and 27.2 mcf/d of gas in 2012, according to CNH figures. Averaging a 33°API density, Yaxché's oil assets amount for 66 million bbl 1P reserves, 149 million bbl 2P reserves, and 258 million bbl 3P reserves. The field also contains 43 bcf 1P reserves, 98 bcf 2P reserves, and 171 bcf 3P reserves of gas. The strategy for Yaxché's production stages includes the exploitation of 203 million bbl of oil and 120 bcf of gas by 2034. This is planned to be performed by drilling 20 wells and finishing 21 additional development wells; performing 159 well interventions, of which three would be major repairs, 105 would be minor repairs and the rest would consist of stimulations and 35 well blockages.

EVERY BARREL FROM ABKATÚN-POL-CHUC COUNTS

Abkatún-Pol-Chuc is located in the Campeche basin, between the states of Campeche and Tabasco, and approximately 132km northeast from the Port of Dos Bocas maritime terminal. The field started production in 1980, and after peaking in February 1996 at 754,934 b/d it is forecasted to produce 265,000 b/d in 2013. Now a mature field, Abkatún-Pol-Chuc has so far produced 5.54 billion barrels of oil and 6.35 tcf of gas. "Pemex has been working at this asset for almost 33 years," says Gustavo Hernández García, Subdirector of Planning for Pemex Exploration and Production. "Since peaking in the mid-1990s, production has declined steadily until reaching current levels."

After production peaked, Pemex tried a number of enhanced oil recovery techniques, the most successful of which has been water injection. "Oil production at Abkatún-Pol-Chuc is water-driven, so we have been trying production techniques that involve water use," Hernández García explains. "We inject water to add more pressure to the reservoirs and extract the hydrocarbons that are still present in the oil banks of the field." Oil remaining in the field is estimated at a total 414 million barrels of proven reserves, 984.1 million barrels of probable reserves, and 1.14 billion barrels of possible reserves. Turning 3P reserves into 1P reserves is the main challenge at Abkatún-Pol-Chuc, and to this end water and gas injection techniques are being introduced in the field: once the reserves can be turned to 1P it means that the operator has the technology to produce the oil. The amount of gas that remains in the geological formations adds up to 833.6 bcf of proven reserves, 1.62 tcf is classified as probable reserves, and possible reserves total 1.70 tcf.

"Abkatún-Pol-Chuc is still an extremely important field for Pemex, because of the viscosity of the oil produced there," explains Hernández García. "The oil extracted from its reservoirs is extremely light, between 37°API and 40°API. Its production combined with the oil extracted from Litoral de Tabasco, amounts to almost half a million b/d. We send out 130,000 b/d out of that quantity to the Yuum K'ak' Naab, Pemex's FPSO, where we blend it with the 860,000 b/d of heavier oil from Ku-Maloob-Zaap to produce Mayan blend oil of almost 20°API. This enables us to keep producing a large quantity of crude with the same API gravity as Cantarell, so that we can export our excess production to refineries on the US Gulf coast, where we have a captive market." Hernández García explains that although the investment at Abkatún-Pol-Chuc is much lower than at Pemex's other shallow water fields, it remains an extremely important field for this reason. "Every barrel from Abkatún-Pol-Chuc counts," he states.

Within the asset, the Abkatún, Pol, Chuc, Caan and Taratunich fields have declined over the past five years, while the Batab, Ixtal, and Kanaab fields experienced a production increase. Despite the fact that new fields Che, Manik, Tumut, Kuil, Etkal, and Onel started production over this time period, the asset's average oil production declined from 308,019 b/d in 2008 to 266,248 b/d in 2012. This decline was mainly driven by Caan, which lost an average of 43,528 b/d of production in the period; Taratunich and Manik together lost an additional 21,223 b/d over the period, contributing to the decrease. On the other hand, Homol experienced a production increase from 10,833 b/d to 45,026 b/d over this period.

Gas production has suffered a similar decline during the period, decreasing from 568.84 mcf/d in 2008 to 523.45 mcf/d in 2012. The decline was also driven by Caan's lost average production of 82 mcf/d. However, to compensate

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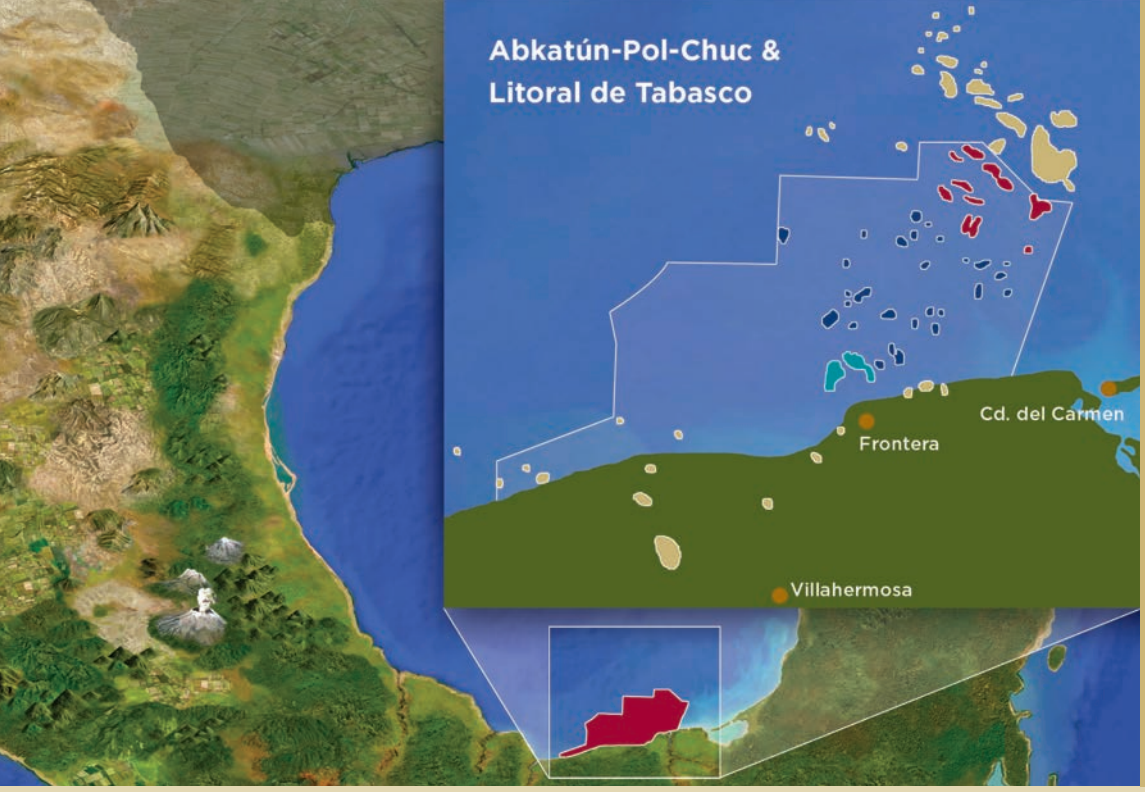

ABKATÚN-POL-CHUC

During almost 33 years this mature asset has produced 5.54 billion bbl of light crude oil. Production is forecasted to reach 265,000 b/d in 2013.

LITORAL DE TABASCO

Discovered in 1989, this shallow water asset last year produced 319,000 b/d of light oil and condensate (30°API to 51°API)

TSIMIN-XUX

Tsimin-Xux produced its first light crude oil in July 2012. Tsimin holds an estimated 1.1 billion boe in 3P reserves, with Xux holding 836 million boe of 3P reserves.

for this decline, Pemex increased production at several other fields. This was achieved through the addition of new reservoirs following exploration success, and putting into production of previously discovered fields, and increasing the production of already producing fields. Che started producing in June 2010 and, while it had before yielded a maximum 20,073 b/d of oil and 1.95 mcf/d of gas, it averaged 9,132 b/d of oil and 0.64 mcf/d of gas in 2012. In August 2011, Tumut began production, yielding a peak of 6,668 b/d of oil and 6.55 mcf/d of gas since then. During 2012, Tumut averaged production of 4,024 b/d of oil and 4.09 mcf/d of gas. Finally, Kuil started contributing to the asset's total production in August 2012. With an average of 21,871 b/d of oil and 13.51 mcf/d of gas in December 2012, and a growing production curve, this is a field that promises to remain an important contributor to production at Abkatún-Pol-Chuc. In the first two months of 2013, its production already went up to 45,868 b/d and 28.5 mcf/d. During 2012 Abkatún-Pol-Chuc ranked as Mexico's sixth largest natural gas producing asset, after Burgos, Cantarell, Litoral de Tabasco, Samaria-Luna, and Veracruz.

The planned exploitation strategy for Chuc includes the drilling of 25 development wells, seven exploratory wells, and 12 major repairs. An additional eight maritime structures will be constructed in the area, and 86km of pipelines will be built. The strategy for the block also includes the application of high-pressure gas injection techniques in order to boost production, and stop the decline that the Chuc field has suffered since 2006 and keep balancing out the total production at the asset. As part of the strategy to develop the Abkatún-Pol-Chuc asset, Cal Dive International has recently been awarded a contract by Pemex E&P for the EPC, installation, and commissioning of 12km of eight-inch (20.32cm) subsea pipeline. The company has also been awarded the contract for developing tie-ins to four platforms already located within the complex. Offshore construction is expected to begin in the second half of 2013.

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POZA RICA-ALTAMIRA: MEXICO'S OIL ROOTS

Poza Rica-Altamira is currently the 10th most productive asset for Pemex in terms of oil and ranks 11th in natural gas production. Averaging 67,770 b/d of oil and 119.95 mcf/d of gas in 2012, the Poza Rica-Altamira complex consists of 73 producing blocks. The most important blocks of the asset are Poza Rica and Altamira, which give the complex its name, and the blocks awarded during the second round of integrated service contracts (ISCs): Arenque, Atún, Ébano, Pánuco, San Andrés, and Tierra Blanca.

5.44 billion bbl of oil and 7.51 tcf of gas have already been extracted from the complex. However, the CNH reports that the asset holds an additional 229.1 million bbl of 1P reserves, 404.1 million bbl of 2P reserves, and 521 million bbl of 3P reserves of oil and 361.8 bcf of 1P reserves, 619.6 bcf of 2P reserves, and 751.1 bcf of 3P reserves of gas. Around 26% of the total production from this asset has come from the Poza Rica block.

FIRST PRODUCTION

The first successful well drilled in Poza Rica-Altamira was located in the Altamira block. In 1926, Altamira-30 started producing oil from naturally fractured limy-clayey rocks at the Upper Cretaceous formations of the San Felipe-Agua Nueva reservoir, which had impregnated oil thicknesses of 150 to 190m, at a depth of 379 to 376m. Maximum production from this well totaled 10,170 b/d during 1926, after which it gradually decreased to a current production of 1,100 b/d.

Located on the coastal plains of the Gulf of Mexico, in the northern area of the State of Veracruz and the southeast-central region of the Tampico-Misantla geological province, the Poza Rica block is expected to reach an accumulated production target of 166.2 million bbl of oil and 203.2 bcf of gas, at an expected cost of US$3.51 billion between 2011-2025, of which US$1.73 billion would be used for capital investment and US$1.79 billion for operational costs.

The planned strategy for development and production includes acquiring 1,130 km^2 of seismic information, to further drill and complete 121 wells, execute major repairs at 262 wells and continue to use water injection techniques for enhanced oil recovery. Pemex has analyzed and evaluated three alternatives for the development of the asset, which include using primary recovery techniques as well as water injection techniques, with the use of both vertical and horizontal wells and simple well-completion solutions as the first option, multiphase pumping as the second option, and twin-well-drilling as the third option.

The Altamira block, tendered in Pemex's second round of ISCs, is also located on the coastal plains of the Gulf of Mexico, approximately 40km northwest of Tampico, in the south of Tamaulipas. Covering a surface of 1,625km^2, it is located in the north part of the Tampico-Misantla Basin.

Today Altamira has relatively low quantities of hydrocarbons remaining in its geological formations. Its remaining oil reserves stand at 4.7 million bbl of 1P reserves, 8.6 million bbl of 2P reserves, and 10.9 million bbl of 3P reserves; while its remaining gas reserves stand at 0.5 bcf of 1P reserves, 0.9 bcf of 2P reserves, and 1.2 bcf of 3P reserves. This area produces heavy and extra-heavy oil, with viscosity ranging from 10°API to 13°API coming mainly from the San Felipe-Agua Nueva reservoir

at a 13% recovery factor. Low porosity (fluctuating around 8% phi to 12% phi) and low permeability (which varies from 1mD to 1,100 mD) allow for extraction at a depth of 150 to 500m. The conditions within the block have allowed Altamira to produce 10.89 million bbl of oil and 17.39 bcf of gas in its 87-year history.

In the period between 2006 and 2011, 32 wells were drilled and a plan to drill in 71 additional locations was presented. Pemex already has 700km of 2D seismic data, of which only 82.8km has been processed. The information obtained from data processing is extremely variable in terms of quality, because of the irregular coverage of the area. Several technical difficulties have been found with the results, making data interpretation a difficult task. Pemex and the CNH have both agreed that reprocessing is needed for a more accurate analysis of the area.

CONTRACTING FROM THE SENER PERSPECTIVE

Iván Alemán Aleksei, Chief of the Legal Unit at Mexico's Energy Ministry, states that in order to achieve the change that the current President is aiming for in the energy sector, the first step would be to review the industry's regulatory framework. "There are several changes that need to be made within the current regulatory framework of the energy industry," Alemán Aleksei explains. "The first that comes to mind is the Pemex Law: this regulation should allow a better flexibility in the NOC's operation, rather than holding the company back." The current Pemex Law, though, is not the problem. "The issue has more to do with the way we interpret the law, rather than the law itself," Alemán Aleksei says. "Nowadays, Pemex E&P's contracting process, for example, has to undergo four different approval processes: the Pemex E&P Board, the Pemex E&P Board of Directors, a committee within the Pemex Board of Directors, and the Pemex Board of Directors. This is not obliged by law; but rather by the internal regulation of the NOC. With a simple change within that internal regulation, two of the instances could be eliminated, streamlining the process while still complying with what the law orders."

Alemán Aleksei believes that in order to optimize the impact of reform of the country's regulatory framework, a basic change needs to take place within the working culture of the industry. "We can have a proper regulatory framework, but if we do not have the ability to change our working culture, it will not lead to success," he stresses. This remark implies that Mexico must break the paradigms which have long ruled the energy industry. Efforts have to be made in the regulatory, educational, and cultural sense.

Civil servants, authorities, and private players do not usually know about all the legal options that contracting with Pemex allows today. "Contracts in the private sector require a contractually agreed domicile to be defined, so all controversies are solved under the law of the place selected," Alemán Aleksei explains. "For some reason, all of the contracts in the oil and gas industry have established Mexico City as the contractually agreed domicile. This creates additional risks for international companies that might prefer to be regulated under different legal terms. It has become part of the Mexican contracting culture: even when we are not obliged to submit our contracts to Mexican jurisdiction."

"The second topic that should be discussed is the Constitution," Alemán Aleksei says, even though it will ignite a heated political debate. He believes that people within the new administration and energy experts should exchange considerations on the opening of certain segments of the industry, such as transportation or even shale gas. "It is also pertinent to eliminate the distinction that Mexican law makes on basic and non-basic petrochemicals," Alemán Aleksei affirms. "Mexico is the only country in the world that has this distinction, and this hinders development and openness for the whole petrochemical value chain."

Most of the subjects that Alemán Aleksei discusses would mean major alterations to the Constitution's 27th article, but he also believes that, in order to achieve legal consistency, other articles should be modified. "Several changes need to take place through a set of reforms that addresses the Constitution, the Pemex Law, the regulatory law for Article 27, and related secondary laws – such as the CNH Law to strengthen the regulatory power of the Commission and clearly define its role, the CRE Law, the Foreign Investment Law – among several others."

The main role today of the Legal Unit at Mexico's Energy Minister is to advise Pemex on what can and cannot be done to obtain greater flexibility in its contracting practices. "The Energy Minister is there to debunk the false perception of restrictions that constrain Pemex's operations," Alemán Aleksei explains. "Pemex needs additional flexibility in the way it works, and the law already allows this. We work as intermediaries to clearly define the limits of the regulatory framework, enumerate the existing alternatives for Pemex, and assist the company in its decision-making processes. At the end of the day, the regulatory framework grants certain flexibility in the decision-making process, but this is only going to work if decisions are approached with the required consideration, assessing all alternatives and documenting the process," Alemán Aleksei concludes.

"We can have a proper regulatory framework, but if we do not have the ability to change our working culture, it will not lead to success"

Iván Alemán Aleksei, Chief of the Legal Unit at Mexico's Energy Ministry

SECOND ROUND ISC PROGRESS

In January 2012, Pemex announced the second round of bidding for integrated service contracts (ISCs) with the hopes of attracting private investment to increase production at 22 mature fields, spread across six onshore and offshore blocks located in Tampico-Misantla Basin. The conditions under which Pemex offered these contracts include a fee that the winners will receive for each barrel of incremental production, and 100% of exploration costs and 75% of development costs will be reimbursed. As of December 2011, production at the 22 fields involved amounted to 12,300 b/d.

A total of 31 companies participated in this round, and in June 2012, Pemex announced the results. The four onshore areas – Altamira and Pánuco in Tamaulipas, and San Andrés and Tierra Blanca in Veracruz – were successfully awarded, but allotment of contracts regarding the two marine areas – Arenque and Atún – was unsuccessful. Whereas the NOC failed to receive a satisfactory offer regarding Arenque, the bidding for the Atún contact was declared deserted.

The Altamira block was awarded to Cheiron Holdings Limited. The Egyptian company placed an offer of US$5.01 per barrel, with an initial investment of US$33 million. Cheiron is now reactivating the field's 87 wells – of which only 25 were operating – and drilling new wells in order to increase production. The company created Mexican subsidiary Compañía Petrolera de Altamira (CPA) and chose former CNH Commisioner Alfredo Eduardo Guzmán to spearhead it. Handover of the tendered area was completed in October 2012, after which CPA proceeded to implement an ambitious work program that includes an extensive 3D seismic coverage of the area, optimization and debottlenecking of current production facilities, introduction of new down-hole and drilling technologies (including EOR applications), and exploring promising in-field and near-field plays. However, this aggressive plan has been stalled by the opposition of the local communities to CPA's incursion. Therefore, production at the asset remains stable at 1,600 b/d.

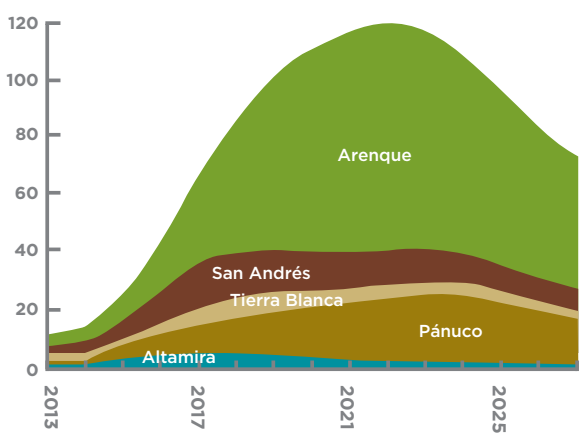
Petrofac, in joint venture with Schlumberger, was awarded the Pánuco area following a bid of US$7 per barrel and initial investment of US$25 million. The consortium, dubbed PetroPSM, formally took over operatorship on March 27, 2013. Production enhancement works in the block's four mature fields – where only 200 of 1,600 wells are currently producing 1,500 b/d – are expected to begin this year.

The Tierra Blanca block was awarded to Monclova Pirineos Gas, which proposed a fee of US$4.12 per barrel and an initial investment of US$24 million. The area has a total of 380 drilled wells, of which 49 are currently operating. The same consortium was also awarded the contract for the San Andrés block, where only 50 wells, out of a total of 356, were in operation. The joint venture proposed a fee per barrel of US$3.49 and a startup investment of US$24 million for this tender. San Andrés and Tierra Blanca harbor a combined volume of 137 million boe in prospective resources.

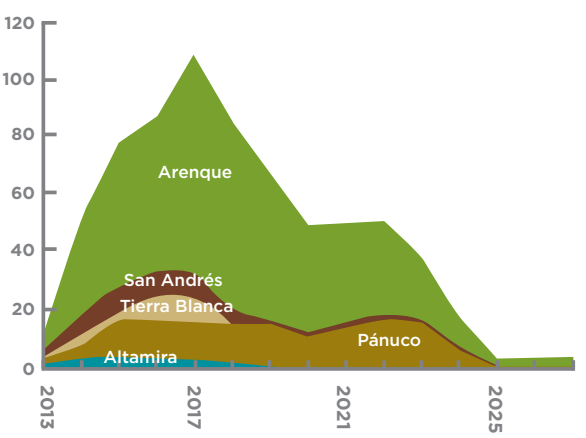
Out of all the blocks included in the second round of ISCs, Arenque is the largest one with 994 millon boe in prospective resources. After the contract was initially not awarded, Petrofac made Pemex a second offer for the tender, lowering its fee from US$12.50 per barrel – which originally landed the company in second place for the best offer – to US$7.9 per barrel. Initially, the NOC had established a maximum of US$7.25 per barrel, but accepted the offer. Petrofac will commit around US$50 million in capital expenditure for the project, to reactivate production at its 51 wells, of which only 17 are currently in operation.

Together, the five contracts awarded will generate investment of over US$2.9 billion throughout the first six years, according to Pemex. The NOC also expects to register a combined production of over 120,000 b/d at the five blocks by 2022, which would have fallen to 40,000 b/d if Arenque was not awarded. Therefore, in spite of the fact that no contract for Atún was awarded, the second round of ISCs can be considered a success.

PRODUCTION FORECAST 2ND. ROUND (MBD)



INVESTMENT FORECAST 2ND. ROUND (MBD)



1 ALTAMIRA

The Egyptian company Cheiron Holdings, that was awarded the contract at a rate of $5.01 per barrel, is currently acquiring 3D seismic data covering the area, debottlenecking the field's current production facilities, commencing a workover and drilling campaign, introducing new down-hole and drilling technologies, and exploring the most suitable enhanced oil recovery applications. Altamira is currently producing an average of 1,636 b/d.

2 PÁNUCO

The Pánuco area in Veracruz was awarded jointly to Schlumberger and Petrofac. As operator, Petrofac committed an initial investment of US$17.5 million for the first two years. For the remaining 28-year period capital expenditures are to be committed on a per barrel basis ($7.00 per barrel), and 75% of development expenditure will be reimbursed via the contract's cost-recovery mechanism. Panuco currently produces an average of 744 b/d.

3 TIERRA BLANCA

Monclova Pirineos Gas and Alfasid del Norte won the contract for Tierra Blanca. The asset is comprised of Capopote Núñez, Cerro Viejo, Vara Alta, Potrero del Llano-Horcones, Temapache, Alazán and Álamo-San Isidro fields. The crude produced in these fields is heavy with density varying from 15 to 27 API and the current pressure varies from 66 to 76kg/cm^2. Tierra Blanca currently produces an average of 417 b/d.

4 SAN ANDRÉS

San Andrés was awarded to Monclova Pirineos Gas and Alfasid del Norte and is comprised of San Andrés, Santa Lucía, Remolino and Hallazgo fields. The asset is still in the exploration and production phase, and has 356 wells out of which 50 are operating, 250 are shut-in, and 56 are plugged and abandoned. San Andrés currently produces an average of 1,644 b/d.

5 ARENQUE

The offshore field Arenque was not awarded to any company during the initial bidding round, but after a second round it was awarded to Petrofac at a base tariff of US$7.90 per barrel. Arenque is the largest area in the second round in terms of reserves, with 1P reserves standing at 76 million Boe and 3P reserves of 100 million Boe. Arenque is currently producing an average of 4,955 b/d.

6 ATÚN

Pemex did not receive any bids for the field of Atún, which began production in 1968. 1P reserves at Atún stand at 9 million Boe and 3P reserves at 26 million Boe. Original volume at Atún was 406 bbl of crude and 983 Mcf of gas. 72 wells have been drilled in this area and only two remain in operation.

NEGOTIATING ISC CONTRACTS

MANUEL CERVANTES
Founding Partner of MCM Abogados

Q: How has the demand for legal services in the Mexican energy sector been impacted by the introduction of the integrated service contracts?

A: MCM Abogados is part of the wave of newer companies that are trying to bring fresh ideas to the table in order to advance the energy sector accordingly. We believe that it does not make sense for potential clients to look for advice at a large firm when they can deal directly with our experienced lawyers who have worked on several important contracts that relate directly to the projects they are looking to pursue. With these credentials, we have secured consulting projects with clients that perform interesting projects in the country, which include Compañía Petrolera de Altamira (the Cheiron Holdings Ltd. subsidiary in Mexico). Some of the people inside the law firm, including me, had already worked with other Egyptian companies of the same corporate group, so Cheiron realized that it could trust our law firm for consulting purposes.

Q: What made the integrated service contracts particularly attractive for Cheiron?

A: The main business for Cheiron is brownfield projects, an area in which they are experts: they are currently the most important operator in the Gulf of Suez, where mature fields abound. We met them while our lawyers were promoting the second ISC round for mature fields at international forums in the US. Executives from the company were interested and approached us, beginning a discussion about several alternative ways to make the situation work. They were interested in the profitability schemes of the project and the different areas of opportunity to improve production. The company was already familiar with contracting schemes where companies are bound to restricted participation and profit-sharing schemes are forbidden, which really helped Cheiron's executives to understand the economic model behind the ISCs.

Q: What were Cheiron's concerns about the ISC contracting conditions and what was your role as a consultant in expediting the process?

A: The main problem with ISCs is that, since reserves cannot be booked, the large oil companies are less keen to participate; however, the terms ended up being amenable to Cheiron, since 100% of exploration costs and 75% of development costs will be reimbursed. Our main role as consultants was to submit a simple bid proposal according the agreed deadlines: we were the first company to fully submit all the necessary documents in the pre-qualification stage. We have also helped by submitting the operating reports and budget of the field to Pemex for approval. This might sound like a restriction, but since the contract labels Cheiron as the expert, it gives the company flexibility over how many wells to drill and which technologies to use, amongst other operational specifications.

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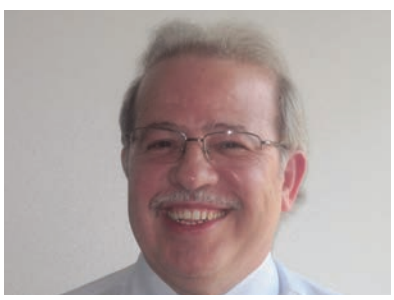
THE BEGINNING OF A SECOND ROUND OF FIELD DEVELOPMENT

With a history of providing services to Pemex under the former multiple service contracts at the Pirineo and Nejo blocks since 2005, Monclova Pirineos Gas is an excellent example for small and mid-sized companies that wish to compete for Pemex's new integrated service contracts. In the second round of these contracts, which were awarded in June 2012, the company was awarded two of the six areas on offer, Tierra Blanca and San Andrés. According to Ignacio Layrisse, CEO of Monclova Pirineos Gas, the new integrated service contracts are a positive evolution for service companies, because the tariff that companies are paid for incremental production pushes the service provider to optimize production and efficiency.



"The new integrated service contracts are a positive evolution for service companies, because the tariff that companies are paid for production pushes the service provider to produce more, and do it more efficiently"

Ignacio Layrisse, CEO of Monclova Pirineos Gas

"While the new contracts are definitely better, they are still far from perfect," Layrisse says. "The best way forward would be to have a tariff and leave the contractor to deal with everything, because at this point we have spent too much time establishing the best way to deal with Pemex. We end up hiring too many people to do the paperwork, who in turn hire too many people to revise the paperwork. This should be addressed in future contracting rounds."

"In the current Mexican oil and gas environment, profit comes from providing services at a good price," he adds. "With the new integrated service contracts, having an exploration and production mindset is added as a necessity, because you need to find resources and produce them. Although the winning companies on these contracts do not own the reserves or have to commercialize the oil, if they cannot find hydrocarbons and optimize the production, they will fail." Layrisse goes on to say that care has to be taken in this activity, since drilling costs are relatively high in Mexico, thanks to the fact that for so many years, there has only been one operator, and additionally, the large service companies have taken a share of the market that would be disproportionate in a more open operating environment.

Monclova Pirineos Gas is a consortium of Mexican, Venezuelan, Spanish, and Colombian interests; Layrisse explains that the combination of a Mexican service providers, Venezuelan exploration and production expertise, Spanish financial backing, and Colombian participation through Vetra make the perfect combination and profile for the integrated service contracts.

"Like many mature fields in Mexico, San Andrés and Tierra Blanca have not seen much investment in recent years, despite the high reserve levels in place. In the past, Pemex exploited the fields with the intention of producing as much and as quickly as possible, but these service contracts allow us to develop the blocks with the latest technologies, such as seismic surveys and horizontal drilling, which was previously not an option for Pemex because of the cost." Layrisse emphasizes the big opportunities that San Andrés and Tierra Blanca represent for Monclova Pirineos Gas, because there are still oil deposits that had been left untouched by Pemex during its initial field development.

Layrisse's strategy for the development of the two fields will focus on optimizing the wells that are currently in production at each of the two fields, specifically looking to improve the current artificial lift methods that are in place. The company has also identified wells that are not producing in formations that Layrisse believes have a lot of potential. This approach is to be combined with exploration, drilling, and development. "Our strategy is to get the most out of what we have, and then pursue exploration and development opportunities. One of the advantages of the awarded blocks is that there is already some infrastructure in place, which can be used to speed up incremental production," he explains.

Current EOR methods being used at the field by Pemex include water injection, and Layrisse expects that horizontal drilling will be extremely important in the successful development of the two fields. "The greatest challenges at the blocks lie in the geology and the characteristics of the reservoir. We must define a very good strategy, and once we have that we can start drilling the locations we have determined. Our initial calculations show that we will drill between 300 and 400 new wells across the lifetime of the fields, but of those, the final locations have only been decided for 50 to 60 wells."

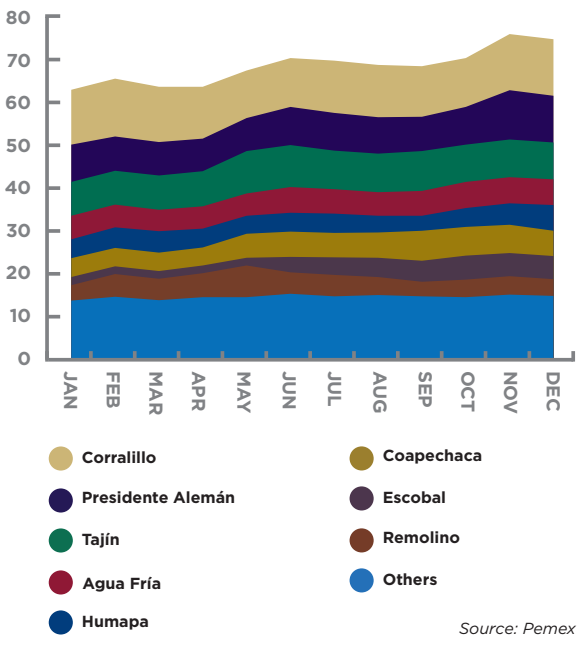
THE CHICONTEPEC BASIN

Located in the northern regions of Veracruz and the northeastern regions of Puebla, the Chicontepec paleocanal covers 3,785km^2 over 12 different municipalities: nine in Veracruz and three in Puebla. The paleocanal is a geological basin located between the southern province of the Tampico-Misantla basin and the western areas of the Tuxpan platform (Faja de Oro), and consists of numerous reservoirs filled with hydrocarbons. Most of these reservoirs were created millions of years ago during the Cenozoic or Tertiary geological age, in the Lower Eocene and Upper Paleocene formations.

Within the boundaries of the region known as Chicontepec, the first commercially successful wells were drilled in 1926, producing small quantities of oil. A major field was discovered in 1973, containing extra-heavy crude that was considered commercially unviable for extraction due to special refining needs. While most of the reserves within Chicontepec have a viscosity lower than 15°API, pockets of light oil and natural gas are also found in the basin.

In addition to being economically and technically challenging due to its unconventional characteristics – low porosity and permeability – the basin's development also faces social complications because the areas overlapping it are densely populated by the Otomí people, an indigenous ethnic group of the region. Moreover, Veracruz has traditionally been a state that supports leftist ideologies against the opening of the industry to foreign private companies. This manifests itself in the amount of protests and blockages that people from local communities organize to prevent service companies from working properly.

OIL PRODUCTION CHICONTEPEC 2012 (THOUSAND B/D)



Source: Pemex

Today, the importance of Chicontepec for Mexico rests in the amount of reserves still left within its geological formations. The asset is believed to hold around 10.95 billion barrels of possible (3P) oil reserves and 28.40 tcf of probable gas reserves. The complexity of the basin lies in converting possible and probable reserves into proved reserves (1P), of which the paleocanal only has 569 million barrels of oil and 881bcf of gas. Oil production in the Chicontepec formation has been steadily increasing since 2009, when it averaged around 30,000 b/d, until 2012, when average production reached around 69,000 b/d.

The field labs at Chicontepec prove that enhancing production is not done through a stationary formula. "The first lesson learned at Chicontepec's field labs was that the same technology cannot be applied at all the different wells across the field," Hernández García recalls. "The second lesson that we learned is how to increase general productivity. We are identifying which unconventional wells can produce more and drill them to streamline our operation in the basin." Through the learning experience that Pemex has undergone with the leading service providers in charge of field labs at Chicontepec, the NOC has widened its understanding of the unconventional reservoirs and plays in it. "Pemex is finalizing the learning process of how to produce better at Chicontepec, while implementing technologies to actually yield the results from those educative experiences in hydrocarbons extracted."

The next step is to integrate this learning into the integrated service contracts (ISCs) that will be awarded at Chicontepec later in 2013. "We are working on ISCs where research institutions, technology providers, and private companies all participate together to find technological solutions from the lab tests, testing the concept, up to the pilot test," explains Pedro Silva López, Subdirector of Technical Resource Management for Pemex E&P. "We expect these operators to implement new technology solutions for each particular situation and, thus, create an opportunity for us to learn and share experiences with them."

The team efforts between Pemex and each of the operators assigned to the different fields have yielded results already, since most of the production accretion has come through the field labs strategy that Pemex devised for the region back in 2010. Technologies such as directional drilling and multi-stage fracking have proven to be successful in different locations throughout the basin. This strategy has also worked to draw Pemex nearer to service companies – and vice versa – and strengthen their relationship as partners: exchanging ideas and technologies and learning throughout the process; with Pemex's new openness to technologies a key factor in the success of the strategy.

FIELD LABS IN CHICONTEPEC

The five field labs that were established in 2010 comprise the Coyotes, Agua Fría, Corralillo, Presidente Alemán, and Remolino fields.

1. Coyotes Field
Operator: Tecpetrol

2. Agua Fría Field
Operator: Schlumberger

3. Corralillo Field
Operator: Baker Hughes

4. Presidente Alemán Field
Operator: Weatherford

5. Remolino Field
Operator: Halliburton

FIELD LAB STRATEGY

In 2010, five different field laboratories were awarded to experienced companies in production-enhancement solutions, in order to test new technologies for eventual implementation in the Chicontepec project. "We have been working with several top-notch service companies at five different field labs," explains Gustavo Hernández, Subdirector of Planning and Evaluation for Pemex E&P. "Each field lab has had different degrees of success, since different technologies are being used at each one: multi-frack, water injection, horizontal wells, and combinations have been used accordingly by each of the five different companies that were assigned to work in the labs."

1 COYOTES

The Coyotes field was awarded to Tecpetrol, a subsidiary of the Techint Group that is in charge of executing exploration and production activities for oil and gas fields in Argentina, Bolivia, Colombia, Ecuador, Mexico, Peru, Venezuela, and the United States. In Coyotes, Tecpetrol executed surveys, drilling, and well repairs, as well as field operation and maintenance, managing to increase average production from 1,178 b/d in 2009 to 2,591 b/d in 2012.

2 AGUA FRÍA

The field lab in the Agua Fría field was assigned to Schlumberger, one of the world's leading oilfield services companies. The company's objectives include the application of water injection techniques and the PowerSTIM methodology, which has proved successful in Burgos projects. Through stimulation-treatment design using this methodology, production within the field increased slightly from an average 5,325 b/d in 2010 to an average of 5,627 b/d, while also reducing drilling times from 24 to five days and lowering costs of production.

3 CORRALILLO

Drilling expert Baker Hughes was the company assigned to work in the Corralillo field lab. Through close collaboration with Pemex, the company managed to increase average production from 2,665 b/d in 2009 to 12,315 b/d in 2012. This production boost was driven specifically by Baker Hughes' focus on understanding each different reservoir's geological conditions to outline a specific plan with tailored technologies according to the analyzed characteristics. Specific well evaluation and analysis, as well as proper technology selection, was key in achieving success in Corralillo, according to Luis Moncada, Vice President of Baker Hughes' Mexico Geomarket.

4 PRESIDENTE ALEMÁN

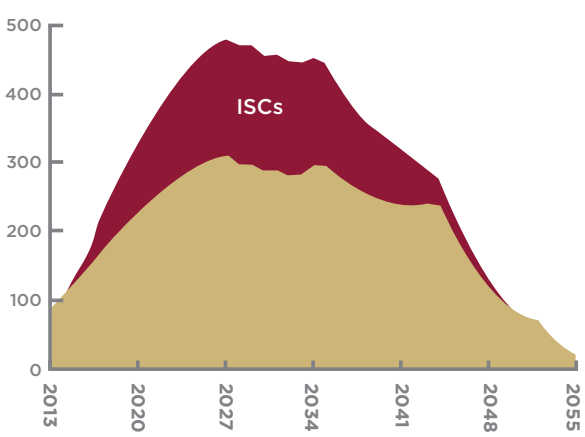
Weatherford, one of the largest oilfield service companies, was assigned to work on the Presidente Alemán field with Halliburton, one of the world's largest providers of products and services to the energy industry. Through 2D/3D seismic and log interpretation, static geomodel development, reservoir modeling, production stimulation techniques and engineering, and well planning and drilling, both companies managed to increase production from an 836 b/d average in 2009 to an 8,762 b/d in 2012.

5 REMOLINO

The Remolino field was awarded to Halliburton. Through several horizontal drilling techniques and other well-completion solutions, they managed to raise average production from 400 b/d in 2009 to 4,729 b/d in 2012.

Initially, Pemex considered Chicontepec to be the best opportunity to offset declining crude oil production in the ageing Cantarell field. No more than five years ago, optimistic plans included the drilling of over 19,000 wells to boost crude oil production in Chicontepec to 606,000 b/d by 2027. Following the slow production increase – 26,800 b/d in 2008, 29,500 b/d in 2009 – and the scaling down of Pemex's Chicontepec production target for 2010 from 176,000 b/d to 48,000 b/d, Pemex's business model for the field started its evolution towards value creation through the implementation of field labs operated by world leading drilling and oilfield service companies. Since then, production volumes and recovery factors are on the rise – reaching 41,000 b/d in 2010, 52,800 b/d in 2011, and 68,600 b/d in 2012. The graph below illustrates how Pemex plans to boost production based on the field lab experience, as well as obtain extra production through the implementation of integrated service contracts, which will be awarded in the summer of 2013.

PRODUCTION FORECAST 3RD ROUND (THOUSAND B/D)



Source: Pemex

On December 20, 2012, Pemex announced a call for bids to participate in Mexico's third round of integrated contracts at six mature fields in Chicontepec. Possible (3P) reserves for the six blocks selected by Pemex amount for a total of 3.2 billion boe, which is a figure close to 15% of the total 3P reserves of the paleocanal of Chicontepec. The 953km^2 area also holds prospective resources for 976 boe with oil viscosity ranging from medium (27°API) to super-light (44°API).

To participate in this round, bidding companies will have to certify their previous experience as field operators, preferably in low-permeability, low-pressure non-conventional reservoirs, with a proved production of at least 5,000 b/d. Contracts will last for a period up to 35 years, with three months designated for the transition period and up to 24 months for the initial production period.

Due to the extensive amount of oil still resting below the surface of the six Chicontepec blocks tendered, expectations are high for the third round of ISCs. "The target for Chicontepec in 2013 is to get to 100,000 b/d. For 2014, we expect to produce 140,000 b/d, with 20,000 b/d coming from the ISCs. We expect that figure to move up to 60,000 b/d in 2015, 90,000 b/d in 2016, and finally 140,000 b/d for 2017," says Hernández García.

1 AMATITLÁN

Amatitlán is a 230km² area of mature fields that holds 5.2 million barrels of oil in 1P reserves that range from 34°API to 44°API. The area also stores 7.8 bcf of 1P gas reserves. Discovered in May 1962, the area has the Amatitlán, Ahuatepec, Cacahuatengo, Coyol, and Sitio fields which have so far produced 176,900 barrels of oil and 893.7 mcf of gas, averaging 37,000 b/d of oil and 112.9 mcf/d of gas during June 2012. It is believed to still hold 605.8 million barrels of oil and 1.6 tcf of gas in 3P reserves and its prospective resources are estimated at 151 million barrels of oil and 418 bcf of gas.

2 HUMAPA

Discovered in March, 1956, Humapa covers a 128km² area that includes the mature fields of Coyol and Humapa. This block holds 12.4 million barrels of medium viscosity oil (27°API) and 18 bcf of gas in 1P reserves, and has already produced 0.52 million barrels of oil and 0.27 bcf of gas, at a pace of 1,170 b/d and 2.1 mcf/d respectively, as of June 2012. The area is expected to hold 3P reserves equivalent to 206.9 million barrels of oil and 557.3 bcf of gas, while having prospective resources of 101 million barrels of crude and 234 bcf of gas.

3 MIAHUAPAN

Already having produced 42,200 barrels of oil and 5.7 mcf of gas at a pace of 348 b/d and 0.37 mcf/d of gas respectively as of June 2012, Miahuapan is a 128km² area that contains the Miahuapan, Corralillo, Agua Fría, and Humapa fields. The area, discovered in February 1948, is slated to have 1P reserves equivalent to 2.3 million barrels of oil with a 33°API viscosity, and 3.4 bcf of gas. 3P reserves in the block are expected to add up to 296.3 million barrels of oil and 805.9 bcf of gas, while its prospective resources are predicted at 68 million barrels of oil and 200 bcf of gas.

4 MIQUETLA

112km² in area, the Miquetla block was discovered in March 1948, and includes the Miquetla, Coyol, and Palo Blanco fields. With June 2012 production rates of 886 b/d of 35°API oil and 2.5 mcf/d of gas, the block has managed to amass an accumulated 10.7 million barrels of oil and 2 bcf of gas. Miquetla still holds in its geology 15.9 million barrels of oil and 24.2 bcf of gas in 1P reserves, and 163.8 million barrels of oil and 436.8 bcf of gas in 3P reserves. Its prospective resources sum up to 59 million barrels of oil and 141 mcf of gas.

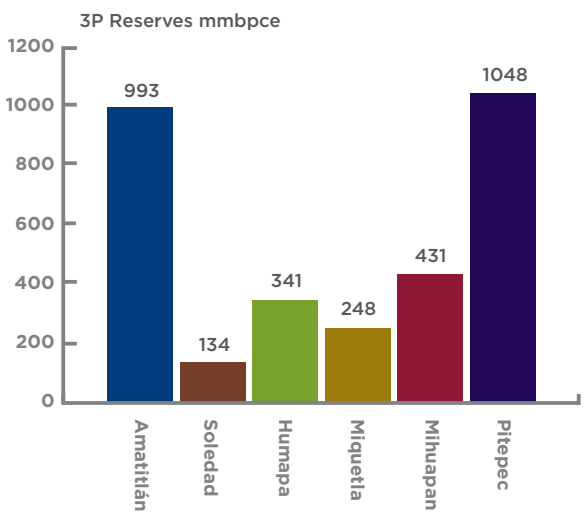
5 PITEPEC

The 230km² area comprised by the Aragón, Ahuatepec, Tlacolula, Sitio, Pastoría, and Coyotes field composes the Pitepec block, which was discovered in August 1943. These fields have already produced light and super-light oil of 32°API to 40°API that add up to 822,800 barrels along 583 mcf of gas, at a daily pace of 61 b/d and 40,600 cf/d of gas in June 2012. The area has 151 million barrels of oil and 418 bcf of gas in prospective resources. Its 1P reserves are estimated at 7.9 million barrels of oil and 11.8 bcf of gas, while holding 3P reserves of 637.6 million barrels of oil and 1.70 tcf of gas.

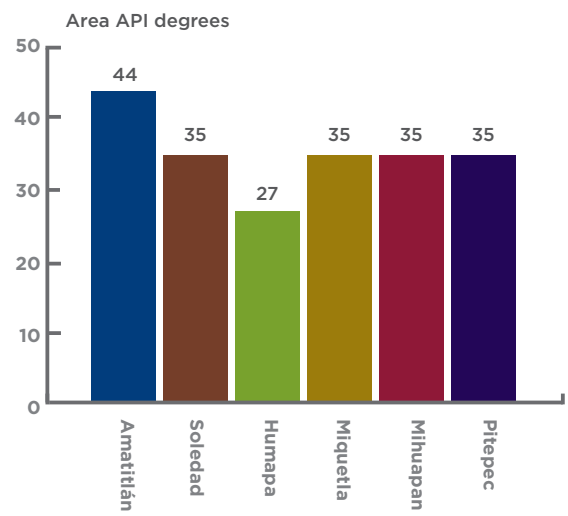
6 SOLEDAD

Discovered in November 1943, the Soledad block contains the Aragón, Ahuatepec, Agua Nacida, Gallo, Palo Blanco, Coyotes, Soledad, and Soledad North fields. As of June 2012, the block kept producing light oil varying from 32°API to 37°API at a pace of 3,400 b/d and gas at 8.1 mcf/d. Its total production adds up to 39 million barrels of oil and 5.7 bcf of gas, while it is expected to have prospective resources of 73 million barrels of oil and 226 bcf of gas. The fields in the block still hold 34.1 million barrels of oil and 55.3 bcf of gas as 1P reserves and probable reserves (3P) add up to 85.8 million barrels of oil and 201.1 bcf of gas.

CHICONTEPEC THIRD ROUND ISC RESERVES



CHICONTEPEC THIRD ROUND ISC CRUDE QUALITY



Source: Pemex

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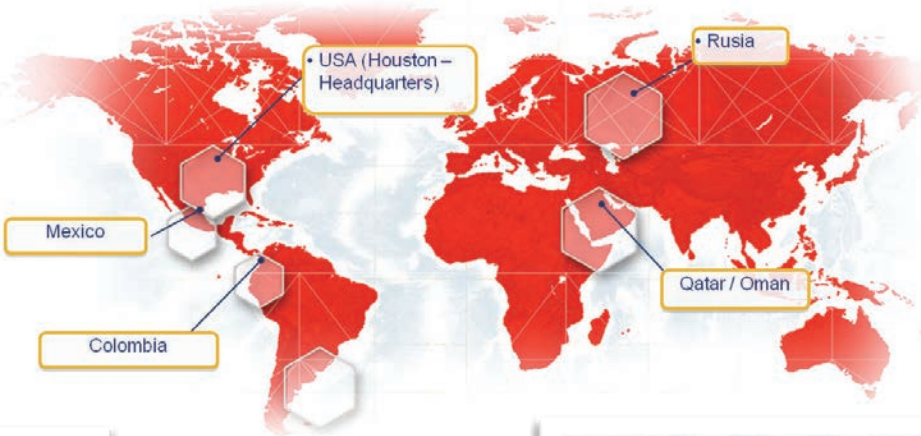

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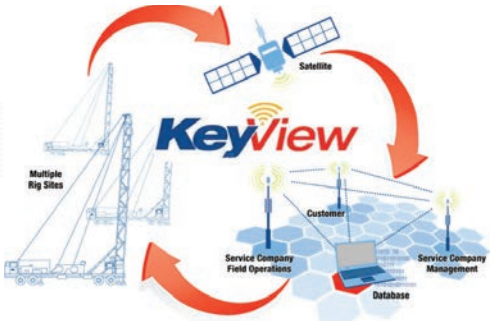

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UNDERSTANDING SAMARIA-LUNA

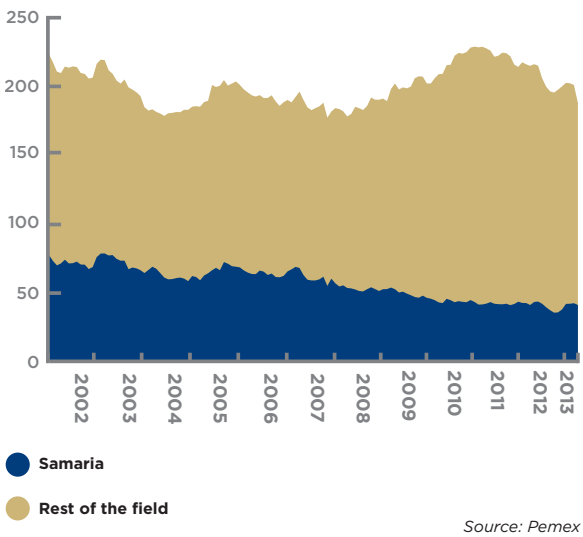
The onshore Samaria Luna asset is located 20km northwest of Villahermosa, Tabasco. It was discovered in 1960 and holds mostly heavy and extra-heavy oil reserves in the mature fields of Samaria, Íride, Carrizo, and Patatal, as well as the other 11 fields. The total 3P reserves in its 15 fields account for 259 million bbl of oil, with a current recovery factor of 20%, and 38 bcf of gas, with a recovery factor of 3%, while 1P reserves for the field tally 63 million bbl of oil and 21 bcf of gas. The first producing well drilled in the complex was Samaria-2, which produced only 96 b/d of 14°API oil. After drilling 110 wells in total and having 70 currently operating wells – of which 59 produce heavy oil and 11 produce extra-heavy oil – total production figures accumulate 205,128 b/d of oil and 695.9 mcf/d of gas.

SAMARIA FIELD

The Samaria field delivers around 40,000 b /d of oil, which makes up for just over one fifth of the asset's total daily oil production, and 52.5 mcf/d, which represents only 7.5% of the total daily gas production in the field. The field is composed of a 4.4km^2 heavy oil area and a 7.9km^2 extra-heavy oil area. The porosity found within the field is around 20-40% PHI, while the water saturation varies from 10-20% Sw in the extra-heavy oil zone and 10-30% Sw in the heavy oil zone. Rock permeability also changes from zone to zone; while it deviates from 3,000 to 5,000 milidarcys in the extra-heavy oil areas, it goes from 400 to 4,000 milidarcys in the heavy oil areas. The density of the extra-heavy oil found there varies from 5-10° API. The heavy oil found, on the other side, has an API of 12-18°. The Samaria field has undergone four different stages in its production life cycle. The first stage, from 1964 to 1976, saw Samaria undergoing its development stage and early production phase. During this stage, 20 development wells were initially drilled, and production topped off at a figure of 2,800 b/d. The second stage consisted of three difficult years from 1977 to 1979, during which the major highlight was the discovery of oil within the Mesozoic formation. After the discovery, Samaria had to be closed due to maintenance problems. This led to the field's third stage. Maintenance and repair services had to be performed on the wells within Samaria to get it back to optimal production, and Samaria's production peaked at 2,900 b/d.

The field was reactivated in August 2007, starting the fourth stage of its productive cycle. Since then, 71 wells were drilled and 74 major revamps were performed. Enterprise resource planning (ERP) software SAP was installed and the working units within the field pushed for flow improvement, resulting in better production results. Since 2009, tertiary recovery techniques were used in the field to enhance production in the form of cyclic steam injection. This technique was applied using both cold steam and hot steam; eight wells were drilled with cold steam, with a 100% success factor at the different geometries (four vertical, three horizontal, and one directional), while an additional 11 wells were drilled with hot steam, and two injection cycles per well, with a success factor of 65%. The objective of the project was to reduce the viscosity of oil by injecting steam into the reservoir. This would allow an increase the oil mobility and maximize the production of the well. In the same time, cold water injection was to be experimented with to see the results it could bring. Extra-heavy oil was extracted from cold steam injection, with a cost oil of 70 b/d in vertical wells and 300 b/d in horizontal wells. This confirmed that cold water injection was viable in the field. On the other side, with hot steam injection, the cost of oil went up from 70 b/d to 1,200 b/d but the technique managed to improve the hydrocarbon flow in the wells.

SAMARIA-LUNA OIL PRODUCTION



Source: Pemex

ÍRIDE FIELD

The Íride field accounts for only 6.4% of the total complex's daily oil production – 13,050 b/d of both heavy and extra heavy oil. Porosity is somewhere between 18-30% PHI in the 4.8km^2 extension of the field, while it varies from 25-32% in the 7.1km^2 where extra-heavy oil can be found. Water saturation ranges from 17-57% Sw in the heavy oil area and from 15-50% Sw in the extra-heavy oil portion of the field. The density of the extra-heavy oil found in Íride varies from 5-10° API, while heavy oil ranges between 12-23° API.

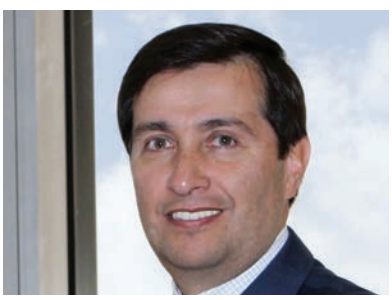
CARRIZO FIELD

The field is divided in two areas: one reservoir of 3.2 km^2 containing heavy oil and a 4.3 km^2 reservoir with extra heavy oil. Porosity ranges from 18-22% PHI in its heavy oil and is consistent at a 24% figure in extra-heavy oil. Water saturation within the field is of 35% Sw and the density of the heavy oil most recently found varied from 18-24° API. The Carrizo field was awarded to Schlumberger in the first round of integrated service contracts.

BURGOS BASIN: CENTER OF NATURAL GAS PRODUCTION

Located in northeast Mexico, Burgos has historically been the country's main producing natural gas asset. The 120,000km^2 area, delimited under the commercial name Burgos Integral Asset, reaches out across almost the whole northern region of the state of Tamaulipas, and some regions within the states of Nuevo León and Coahuila. It is bounded by the US in the north and the Gulf of Mexico in the east, while covering 34 municipalities within the aforementioned states (12 in Tamaulipas, 12 in Nuevo León, and 10 in Coahuila).

Since the year 2000, Burgos has yielded an average 22% of the country's total gas production and 60% of the country's total non-associated gas production, averaging a 1.27 bcf/d of production. This amounts to more than double the production of the Macuspana-Muspac asset, which is the other important region for the production of non-associated gas.



"We still need to produce in Burgos, which employs around 29,000 people. We are not a private company that can lay off employees to increase the profitability of our projects"

Gustavo Hernández, Subdirector of Planning and Evaluation for Pemex E&P

Two of the four Mexican basins that produce non-associated gas are included within the Burgos asset: Burgos basin and Sabinas basin. The first stage of the development of the Burgos basin goes back to 1945, when the Misión field was discovered. Production kept increasing steadily and, after inaugurating the Reynosa Gas Processing Complex in 1956, the basin's production reached a peak of 620 mcf/d, driven particularly by the Reynosa, Monterrey, and Francisco Cano fields. Exports started to decline in the early 1970s as Burgos experienced steadily decreasing production levels. However, the development of fields in the Sabinas Basin gave the asset a second period of elevated production, averaging 560 mcf/d during 1979. Production went through another decline until January 1993, when it fell under the 200 mcf/d limit.

Following the internal structural change of Pemex in 1992, and the ensuing reallocation of budgets, Pemex E&P decided to turn its sights to exploration in the Burgos Basin, performing 3D seismic surveys to determine the amount of potential reserves. This led to an increase in the volume of natural gas reserves for the basin. New drilling designs and well completion solutions were developed to further streamline the new stages of the project, thus reducing the overall exploration and production cost for the field. All of these factors steered Burgos towards a new period of prosperity, starting in 1994. Production rose at a faster rate, with the Arcabuz-Culebra, Arcos, Cuitláhuac, and Corindón-Pandura fields leading the charge. The discovery, identification, and development of the reserves within these fields were key in the continuation of Burgos' productive profile. In addition, the multidisciplinary team philosophy, implemented through specialized consulting, and the investment injection that the basin received in 1999, helped to break the 1bcf/d production milestone. This level of production remained constant at the asset for the next four years, through an intensive drilling program complemented with well repairs and maintenance. Drilling efficiency continued to increase consistently, while more advanced operationing practices and new technologies were implemented at the asset: the concept of reservoir engineering was introduced around 2003 to boost productivity, reaching production levels that represented almost one quarter of the country's total natural gas production.

Between 1997 and 2010, 26,967km^2 of 2D seismic were acquired along with 26,787km^2 of 3D seismic, while 342 exploratory wells and 3,917 development wells were completed. The infrastructure at Burgos includes a pipeline network that extends for 2,037km with 228 different pipelines and 3,791 discharge lines that cover a 9,621km length. An additional processing plant was built in 2004 within Burgos, known as the Burgos Gas Processing Complex, which increased the asset's wet gas processing capacity.

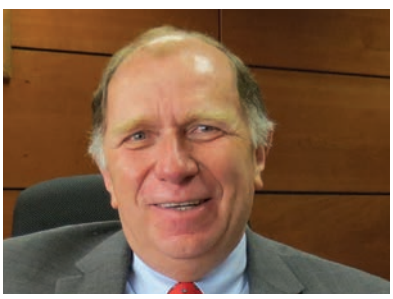
Burgos is also important for Mexico from a socioeconomic perspective. By 2011, Pemex E&P had generated 75% of the 6,939 direct jobs in the region, while total indirect jobs added up to 21,926, of which 95% were awarded to Mexican people. Pemex has strong views in this regard. "We are a socially committed company," says Gustavo Hernández, Subdirector of Planning and Evaluation for Pemex E&P. "We still need to produce in Burgos, which employs around 29,000 people. We are not a private company that can lay off employees to increase the profitability of our projects."

THE LAKACH PROJECT MOVING FORWARD

When Pemex finally decided to begin deepwater exploration, its first target was located in the Catemaco folded belt, within the Holok-Temoa asset. The NOC focused on two geological targets: Noxal and Lakach. Located 131km northeast of Coatzacoalcos, within the coastal waters of the Gulf of Mexico, Lakach-1 became the deepest well that Pemex had ever drilled, at a water depth of 988m.

While companies on the US side of the Gulf of Mexico had been exploring the Catemaco folded belt since the end of World War II, Pemex only started drilling during the final presidential term of the 1990s. The difficulty that deepwater drilling presented, because of its tough conditions and the little experience the NOC had in this area, meant that the profitability of the project was low, and eventually Pemex decided to delay the project. Pemex finally began drilling operations on the Lakach project, which covers 100km^2, on July 10, 2006. After 131 days, Pemex discovered two different reservoirs: the first anticipated to produce 25 mcf/d of non-associated gas, while the second had a forecasted production of 30 mcf/d.

The Lakach field currently holds 451bcf of 1P reserves and 850 bcf of 3P reserves, giving Pemex a vast supply of natural gas for the future. The challenges of developing the field are similar to the challenges that the NOC faced at its first projects in Catemaco: current natural gas prices in the US limit the profitability of deepwater gas projects, especially given the high investments required. However, Pemex has decided to move forward with the development of Lakach. "While it might not be the best time to develop Lakach in terms of profitability, the field offers a strategic opportunity to progress along the learning curve for deepwater development," says Carlos Morales Gil, Director General of Pemex E&P.



Nevertheless, in May 2012, the CNH rejected Pemex's development plan for Lakach, citing the need for detailed geophysical studies, further information on the contracts and administrative tasks related to each of the stages of the project, development of industrial safety aspects and a revision of the NOC's financial outlook on the project. In fact, one of the biggest concerns of the upstream regulator was its profitability. Whereas Pemex considered it to be a positive project, basing its numbers on an expected natural gas price of US$5.93/MMBtu, the CNH believed Lakach could not be profitable if international estimations of US$2.50/MMBtu were taken into account.

Despite the setback of the CNH report, the front-end engineering and design (FEED) stage of the project is now complete. According to Emiliano Pescador, Mexico Country Manager for Technip, the EPC company that was awarded the pre-front and engineering contracts for the field, the Lakach project holds both financial value and the prospect of technical learning for Pemex: "It is a marginally positive project that could become even more positive if gas prices increase, which I think they will, since they are at the lowest levels they could be, and if Pemex follows through on its plan to link other gas fields to the Lakach infrastructure, the project could become even more valuable."

Morales Gil reveals that "the breakeven natural gas price for the development of Lakach is US$3, which means that if gas prices rise above this figure, then the project could be profitable." With the proximity of Lakach to other recently discovered gas fields in the Catemaco folded belt could justify the initial investment. On one hand, the subsea infrastructure planned for Lakach could be used in the future to transport natural gas from other fields to the shore for processing. Recent discoveries in the region, at Kunah and Piklis, might serve to raise the profitability of producing gas in deepwater, according to Gustavo Hernández García, Subdirector of Planning for Pemex E&P: by sharing infrastructure for production, transportation, storage and processing, gas production would be more profitable than it would be if the three fields were developed separately. On the other hand, being Pemex's first deepwater project, Lakach could become an important precedent for other deepwater projects, such as the reservoirs at Perdido.

"The breakeven natural gas price for the development of Lakach is US$3, which means that if gas prices rise above this figure, then the project could be profitable"

Carlos Morales Gil, Director General of Pemex E&P

Production for the field is expected to start during 2014 under an average rate of 400mcf/d and with the objective to extract 650bcf by the end of 2023.

Pemex's Business Plan for 2012-2016 states the strategic objective of increasing the country's hydrocarbon reserves through new discoveries and the reclassification of prospective resources. One of the strategies planned to achieve this goal is to intensify the evaluation of Mexico's shale gas potential, clearly defining the geological provinces where Pemex expects to find shale resources and identifying the amount of resources that the country posesses.

MEXICO'S SHALE GAS RESOURCES

Shale oil and gas have gained increased importance in the global energy landscape, driven by an intensifying search for domestic energy sources in the United States to both strengthen energy independence and the country's trade balance. In 2012, unconventional hydrocarbons were estimated to account for 6% of the world's total crude production. By 2035, it is expected that the unconventional share of production will double to 12%. It is expected that close to 70% of recoverable shale gas resources will be found outside of North America.

In Mexico, Pemex started exploration activities targeting shale resources at the beginning of 2010. Through its E&P arm, the NOC identified the geological provinces of Burro-Picachos, Sabinas, Burgos, Tampico-Misantla, Veracruz, and Chihuahua as prospective regions for shale gas and oil. The original surveys led Pemex E&P to establish three different scenarios, which differ strongly from the Energy Information Administration figures, estimated Mexico's shale gas resources at 681tcf. The study by Pemex established that Mexico holds at least 150tcf of prospective resources, with a potential maximum of 459tcf. The expected prospective resources, though, amounted for 297tcf of shale gas. Because of Mexico's geographic proximity to the US, plays within the Upper Cretaceous Eagle Ford formation – Ojinaga, Eagle Ford, and Agua Nueva – continue into Mexican territory. These plays have been distributed amongst the Chihuahua, Sabinas, Burro-Picachos, and Burgos basins. The Haynesville formation from the US also extends into Mexico, with its Upper Jurassic plays La Casita and Pimienta distributed amongst the Chihuahua, Sabinas, Burgos, and Tampico-Misantla Basins.

The unconventional learning curve developed by McKinsey & Company places Mexico at the second of three stages in the exploration phase, where uncertainty is reduced through exploratory drilling and information acquisition. According to Pemex's shale gas plan, it will still have to

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develop a pilot for shale gas, and optimize well design and drilling, before entering into the development phase and consolidate the activities that have taken place to date.

From the six areas that Pemex E&P marked as prospective regions, the Tampico-Misantla basin has the most potential in shale oil, with 30.7 billion bbl of prospective oil resources, and 20.7tcf of wet gas. Both the Sabinas basin, with 49tcf, and the Burgos basin, with 44.3tcf, constitute the most important prospective regions for dry gas. Completing the list, Burro-Picachos is expected to hold 4.2 billion boe and Veracruz 0.6 billion boe, with Chihuahua still under analysis. The development of these areas depends heavily on five different factors. The first factor is, of course, the price of gas: if gas remains under US$4/MMBtu, then these projects will struggle to become profitable. Better well designs and drilling technologies need to be developed to reduce the cost of wells. Infrastructure for collection, transport, and distribution needs to be built for shale projects to be profitable, and a special fiscal regime has to be developed for this kind of project, allowing additional deductions that could increase the interest in developing Mexico's shale gas resources. Finally, a timely investment needs to be allocated to accelerate the pace at which the country develops shale reservoirs.

Comesa, the IMP, and Pemex are currently involved in a project funded by the Conacyt-Sener-Hydrocarbons fund to perform seismic surveys in the geological provinces that are expected to have shale resources. This will also enable Pemex to identify the areas with the greater short-term potential for profitable shale oil and gas development, allowing Pemex to establish a hierarchy of projects based on these factors. Once the information is obtained, exploratory wells will be drilled for concept and productivity testing to be executed. Some shale wells have already been drilled to assert their potential. The Emergente-1 and Habano-1 wells were the ones that originally confirmed the continuity of the Eagle Ford play's dry and wet gas resources into Mexican geology. Percutor-1 also proved the extension of the play into the Sabinas basin, while Nómada-1 and Montañés-1 have so far yielded no results. On the other side, the Arbolero-1 well proved the existence of shale gas in the Upper Jurassic formations of the Sabinas basin. Anhélido-1 was also successfully drilled in the Upper Jurassic formation of the southern Burgos basin, already yielding 288 b/d of shale oil. During this first stage of Pemex's shale exploration strategy, drilling operations for a total of 172 additional wells are planned, including drilling Nuncio-1 in the Upper Jurassic formation of the southern Burgos basin.

The next stage in the strategy will be to reduce uncertainty through the geological characterization of the provinces that hold prospective shale resources. Studies that have so far been conducted by Pemex to define the maturity of the resources, the organic content, and the structural complexity of the well have determined that the Burros-Picachos and Tampico-Misantla basins are the two geological provinces next in line in Pemex's hierarchy. The Burgos basin comes closely ranked after that, followed by the Sabinas, Veracruz, and Chihuahua basins. The company plans to implement an integrated field lab strategy for the discovered reservoirs at the Burros-Picachos and Burgos basins. The objective behind this business model is to determine the reservoirs' behavior and productivity in order to go through the shale learning curve that will eventually lead to mass development.

If the exploration strategy yields the expected results for Pemex, the NOC is expected to continue its shale endeavor by identifying and assimilating technologies to enhance productivity and minimize environmental risks, thereby reducing the costs of the project. The development plan for the eventual massive exploitation of shale gas is destined to include new fracturing technologies to increase production, cost efficiency, and sustainability. This final stage could lead to the country's mass development of shale plays, by drilling an approximate 27,000 additional wells for future extraction.

LIABILITIES IN MEXICO'S OFFSHORE PROJECTS: THE RIGHT BALANCE?

By Nicolas Borda. After Macondo the world has changed, and all companies involved in providing equipment or services to the offshore oil and gas industry, as well as the operators, need to understand the risk allocation and mitigation. Currently, environmental pollution liability is one of the most critical issues for service providers to Pemex. Therefore, it is important to understand the four different types of liabilities pursuant to Mexican law: civil, administrative, environmental and criminal.

CIVIL LIABILITY

Liability for breach of contract arises when a party to an agreement fails to comply with its obligations. Force majeure or acts of God are not considered as a breach of contract. The non-breaching party may choose between specific performance under the contract, if possible, or rescission of the obligation; plus the payment of damages and lost profits. Damage is the loss or reduction in the patrimony by the lack of compliance with an obligation, and lost profit is the deprivation of any lawful gain that should have been obtained through compliance with the obligation. Damages and lost profits must be an immediate and direct consequence of the lack of compliance with the obligation. In the event of claim for the payment of damages and/or lost profits, the plaintiff shall prove the existence of the damages and/or lost profits as well as the corresponding amount. Pursuant to Mexican law, the parties can stipulate the payment of liquidated damages in the event that an obligation is not fulfilled. If such stipulation is made, they will not be able to claim damages and/or lost profits. The compensation stipulated as liquidated damages cannot exceed the value of the amount of the main obligation established in the contract.

Mexican legal provisions regulating liability arising out of illegal acts provide that the injured party has the option to claim from the breaching party to do what is necessary to revert to the original condition (restore things as they were before the harmful result occurred) whenever possible, or pay damages and lost profits. Anyone acting in an illegal manner that causes injuries or damages to another person shall indemnify the victim, unless it is proven that the damage was caused due to the fault or gross negligence of the victim. Strict liability is when a person makes use of mechanisms, instruments, apparatus or substances which are inherently dangerous, due to the speed they may develop, due to their explosive or flammable nature, due to the energy of the electric current which they carry, or for other analogous reasons, such person is obliged to respond for the damage caused, even though he is not acting in an illegal manner, unless it is proven that such damage was produced by fault or gross negligence of the victim. Operating an ROV, a rig, vessel or many other onshore and offshore devices, equipment, among others, may result in strict liability to the contractor.

ADMINISTRATIVE LIABILITY

When a federal governmental authority acts unlawfully, the law establishes legal procedures for individuals or other authorities to file a claim against the federal authority for the irregular administrative activity and, if applicable, to annul the administrative act. Administrative entities, in the event of an unlawful conduct, may impose several sanctions to its public servants. Pursuant to the Mexican constitution, individuals are entitled to be indemnified in accordance with the guidelines, limits and procedures established by law for damages caused to their rights and assets for unlawful administrative activity of the State. Pursuant to the law, the indemnity shall correspond to full compensation for damage and, if appropriate, for the personal and moral damage.

ENVIRONMENTAL LIABILITY

These liabilities may arise from the lack of compliance with the environmental legal provisions, whether federal or local. The environmental authorities may impose the following penalties or measures: temporary suspension of business, seizure of materials and hazardous waste, analogue actions to prevent pollution, fines, arrest and suspension or revocation of permits, concessions or authorizations. Federal and local criminal codes establish the crimes and penalties regarding violations in connection with the environment provisions which may be imprisonment, fines, actions to restore the environment, suspension, modification or demolition of constructions, works or activities, as deemed appropriate, which constituted environmental crimes, return of materials or hazardous waste or specimens of flora and fauna to the country of origin, and prohibitions to be designated as public servant. It is important to mention that pursuant to the new legal framework for the energy sector, Pemex shall implement actions to prevent and repair damages to the environment caused by works or operations of the oil industry, and it is obliged to cover the associated costs, when found liable by resolution of the relevant authority in terms of the applicable legal provisions. This is limited to force majeure and illegal acts by third parties.

CRIMINAL LIABILITY

Individuals who commit a crime will be penalized pursuant to the criminal code, whether federal or local, depending on the type of crime. Companies may be required to pay damages for the loss caused to the victim of a crime, when the crime is committed by their employees, representatives or contractors in the exercise of their authorized activities. Damages include restitution of the situation as it was before the crime was committed, restitution of any benefits obtained from the crime, payment of non-pecuniary damages, pain, suffering and mental distress caused by the crime, payment of any financial loss and payment of loss of wages or salary and benefits, in case of injuries that result in the inability to work. According to the criminal laws, the most relevant sanctions that can be imposed to a company under criminal law are: suspension of activities of companies, dissolution of companies, prohibition of carrying out specific operations or businesses, and removal of officers.

RISK MITIGATION

According to Mexican law there are no punitive, indirect and consequential damages (other than direct loss of profit) as in US law. By having a Mexican subsidiary in the form of a stock corporation or limited liability company (S.A. de C.V. or S. de R.L. de C.V.), there is additional protection for the shareholders, including that the responsibility of shareholders as well as the partners is limited to the amount of their participation in the company's capital. In Mexico, courts rarely pierce the corporate veil. Therefore, forming a Mexican subsidiary and having Mexican law as the governing law in a contract with Pemex will provide additional protection to the investor. If the investor is from Canada or the US, Chapter 11 of NAFTA will provide additional protection in the event of a measure equivalent to expropriation. If a contract is wrongfully terminated by Pemex there could be grounds for filing an arbitration claim pursuant to ICSID rules.

The Petroleum Law indicates that the petroleum industry acts that are not foreseen in the Petroleum Law, will be considered as commercial acts and shall be governed by the Commerce Code and by the provisions of the Federal Civil Code. This principle is also included in the Regulations to the Pemex Law, indicating that *"the covenants, agreements and other legal acts that Petróleos Mexicanos and the subsidiary entities execute or subscribe to, as a consequence of the compliance of its respective purpose shall be regulated, in addition to the administrative provisions, by the common legislation that corresponds by subject matter, in accordance to their nature".*

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MPG is aware of its responsibilities and commitments to the country, its workers, the society and the environment and that is why we initiated the campaign "Sembrando Conciencia"- "Seeding Awareness" - which will allow both the company and its workers to support various initiatives that will contribute to the preservation of the environment.

Sembrando Conciencia

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Pursuant to the Mexican Federal Civil Code, *"anyone may waive his rights and release all or part of any obligation due to him, unless otherwise prohibited by law".* Could Pemex waive the right to damages and direct lost profits in the event of damages to the well or reservoir?

The Mexican Federal Civil Code indicates that *"no person may be exempted by agreement, from the observance of the law, nor may alter or modify it. Private rights can only be waived when they do not directly affect the public interest or impair the rights of third parties".* Therefore, Pemex could not waive such rights because oil reserves are owned by the Nation and such waiver may affect the public interest. In addition, the Mexican Federal Civil Code establishes that such waiver *"shall not be effective unless it is made in clear and precise terms, so that there is no doubt as to the rights being waived".* Regarding the above, only the private rights that do not affect the public interest or third party rights, may be waived, provided that such waiver is made in clear and precise terms. Liabilities before third parties cannot be agreed by the parties, since they are not in privity of the contract. Therefore, contracts need certain indemnities from Pemex against third parties.

The Pemex Law, which purpose is to regulate the organization, performance, control and rendering of accounts of Pemex, as well as to set the general basis applicable to its subsidiary entities, is of public interest. Therefore, provisions included in the Pemex Law may not be waived. Notwithstanding this, neither the Pemex Law nor its regulations contain provisions regarding liabilities, damages or lost profits, so there is no express prohibition to waive rights regarding such issues. The only reference made by the regulations to the Pemex Law is article 48, which indicates that the Procurement Guidelines shall include internal rules for the subsidiary entities that shall include, among other things, limits on the liabilities included in the contracts. Procurement Guidelines establish that the *"Project Administrator Area shall establish in the contracts the manner to determine the liabilities and their limits depending on the risk profile of the procurement. In any event, the liability limits shall be established in the contracts, following the recommendations issued by the Risk Assessment Area";* therefore, liabilities can and shall be limited depending on the type of service.

The Petroleum Law establishes that *"Petróleos Mexicanos shall carry out the actions to prevent and repair damages to the environment or ecological equilibrium caused by the works or operations of the petroleum industry and shall be bound to cover the expenses, whenever it is considered responsible by the decision of the corresponding authority, in terms of the applicable provisions"* and that *"Petróleos Mexicanos and its subsidiary entities, regarding activities constituting the petroleum industry, shall avoid wasting or spilling hydrocarbons, in the knowledge that Petróleos Mexicanos shall not be responsible for those events resulting from unlawful acts, force majeure or act of God".* On the other hand, the Petroleum Law establishes that Pemex shall not be subject, under any circumstances, to foreign courts regarding controversies related to contracts of works and services (not the purchase of goods) to be provided in the Mexican territory and in the zones where the Nation exercises sovereignty, jurisdiction and competence. Notwithstanding the above, the Pemex Law indicates that regarding legal acts of international character, Pemex and its subsidiary entities may agree in a foreign law of choice, the jurisdiction of foreign courts in business matters, and the execution of arbitration agreements when appropriate for the best compliance with its purpose.

It is possible to conclude that Pemex shall not be subject to foreign courts regarding disputes related to contracts of works and services performed within the Mexican territory. Nevertheless, Pemex can be subject to foreign courts regarding any matter (different from a dispute) in connection with works and services to be performed in Mexico, and can be subject to foreign courts and laws regarding any acquisition of goods, notwithstanding if such acquisition is made in Mexico or abroad. A *contrario sensu* interpretation, of the second paragraph of Article 6 of the Petroleum Law, is that no domestic contract (where the contractor is a Mexican company and the services will be provided in Mexico to Pemex or one of its four subsidiary entities) may be subject to a foreign law of choice.

The Procurement Guidelines indicate that Pemex E&P may establish provisions regarding early termination of the contract. The decision to terminate a contract early shall be fully justified by the corresponding areas of Pemex E&P. The contract may provide that early termination requires payments to be made by Pemex E&P to the contractor and how to quantify and cover these, as well as the obligations of the contractor in the event of early termination. An example of an offshore pipeline maintenance contract of Pemex E&P indicates that the contract may be terminated early by the following causes (which are in accordance with the Procurement Guidelines): (i) force majeure or acts of God, (ii) if it is not possible to determine the terms of the suspension of the contract, (iii) if there are causes that impede the implementation of the contract, (iv) when Pemex E&P determines so, and (v) when the contract is neither profitable nor convenient to Pemex E&P.

The new energy regulatory framework (mostly the Procurement Guidelines) indicates that Pemex E&P shall include in the contracts the events and consequences of the rescission of the contracts. Pemex E&P may administratively rescind (without judicial or arbitral order) the contracts if one of the following occurs:

a. The contractor does not fulfill its obligations under the terms of the contract
b. The contractor is subject to bankruptcy, insolvency or other similar situation
c. Any permit or governmental authorization necessary for the fulfillment of its obligations is revoked or canceled
d. The contractor unreasonably stops or abandons the works
e. The contractor, without written authorization from Pemex E&P, assigns or transfers the rights and obligations of the contract
f. The contractor does not comply with the anticorruption provisions

It is important to highlight that if the contractor decides to rescind the contract; the contractor shall obtain the rescission order from a judicial or arbitral court. Contractors may request the rescission of the contract in the following events: breach of payment obligations by Pemex E&P, if Pemex E&P does not grant access to the site where the services shall be carried out, and if Pemex E&P does not have the permits, licenses or authorizations required pursuant to the contract. Pemex E&P, prior to administratively rescinding the contract, may grant a cure period to the contractor to cure the obligations breached. During such period Pemex E&P may collect liquidated damages. If after such cure period the obligations breached are not cured, Pemex E&P may rescind the contract. A model contract issued by Pemex E&P for offshore pipeline maintenance establishes, in addition to the administrative rescission events mentioned above, Pemex E&P may also rescind the contract: if the contractor does not comply with the national content percentage indicated in the contract, and if the contractor does not comply with its obligations under the safety and environmental provisions included in the contract.

Under Mexican law, an order for seizure of assets cannot be issued against the institutions, services and agencies of the Mexican Federal Public Administration and of the States. Also, it is important to mention that in a litigation procedure, the court or arbitration panel may consider that such civil law prohibition may be applicable to Pemex E&P´s assets. Nevertheless, there is a court precedent indicating that a seizure order can be issued against the monetary funds of a decentralized entity (such as Pemex E&P). This opens the possibility of seizure of Pemex E&P´s bank accounts. Seizure of assets outside Mexico would be easier. As an example of provisions regarding seizure of assets, the new Integrated Service Contracts (ISCs) issued by Pemex E&P include text indicating that the parties waive any and all rights they have or may have to seek and receive seizure prior to an award. The Mexican law establishes the possibility to request and obtain conservatory measures in a legal procedure (such as an injunction). Such conservatory measures shall be granted by a judge (requested by the parties or by the arbitral panel). Pemex E&P establishes, in almost all of the agreements, that the disputes shall be resolved by arbitration (the International Chamber of Commerce (ICC) Arbitration Rules are the most common arbitration rules used by Pemex E&P in its agreements). Such arbitration rules allow the establishment of conservatory measures.

Pursuant to Mexican law, the agreements executed by Pemex E&P shall be governed by the applicable Mexican federal law, and domestic disputes shall be resolved by Mexican federal courts, unless the parties agree to resolve the dispute by means of arbitration. In the case of international legal acts, Pemex E&P may agree to apply foreign law and the jurisdiction of foreign courts in commercial matters and arbitration agreements. Finally, it is important to consider that contracts for procurement of oil and gas services in Mexico have a dual approach to the relationship with Pemex. On one hand, both commercial and administrative laws apply. Administrative law applies to the bidding process and commercial law applies to the contract executed with Pemex. The bidding process would be considered as an act of authority subject to amparo law.

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Greenberg Traurig, LLP is an international, full-service law firm with approximately 1,800 attorneys serving clients from more than 30 offices in the United States, Europe and Asia. Its Mexico City office provides international clients with strategic legal advice with a collaborative approach on issues ranging from handling major transactions to advise on dispute prevention and resolution.

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4

EXPLORATION & RESERVES

For the second year in a row, Pemex succeeded in exceeding a 100% 1P reserve replacement rate, confirming that the increasing investment in its exploration activities is paying off. Both conventional and non-conventional hydrocarbon exploration will continue to take place across onshore and offshore areas, with the objective of also raising Pemex's overall reserves replacement rate and boosting reserves from new discoveries.

In this chapter, we analyze the success of 2012 with the key players involved, look at the provinces where Pemex will be exploring in the coming years, and present the conventional and innovative technologies that Pemex will use to reduce exploration risk and discover new resources.

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CHAPTER 4: EXPLORATION & RESERVES

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PEMEX EXPLORATION STRATEGY

JOSÉ ANTONIO ESCALERA ALCOCER
Subdirector of Exploration at Pemex E&P

Q: What were the strategic decisions that really turned around Pemex's exploration strategy and established the foundations for the exploration success in 2012?

A: For several years, Pemex felt that it had enough hydrocarbon reserves to justify not exploring additional regions in Mexico. However, 10 years ago, we started to prepare for Cantarell's production decline, which led us to reconsider our exploration strategy. During President Calderón's administration, Pemex decided to change its budget allocation and increase investment in exploration. The results of this investment reinjection have been obvious: in 2000, we had a 14% 3P reserve replacement rate, which has increased over the years, reaching 100% in 2008. The strategy has been carefully aimed towards maintaining these numbers since: this will be our fifth consecutive year with a 3P reserves replacement rate that exceeds 100%.

However, this success was not only achieved through investment: the consistency of our strategy is crucial in addressing exploration challenges. It has also been critical to rank exploration projects across different prospective regions according to investment, risk, and potential profitability. Our strategy is clear: 55% of the budget will be allocated to hydrocarbon exploration in the well-known prospective areas, such as the onshore and offshore Cuencas del Sureste, 30% of it will be appointed to exploration projects in deepwater, and the rest will be dedicated to non-associated gas in Burgos and Veracruz, while starting to explore prospective shale oil and gas resources.

Another change is structural. Originally, the exploration division was in charge of technical tasks, ensuring the correct observance of regulations, without being in charge of the operation. During 2011, a change took place in our role, putting us in charge of all exploration activities, both of regulation observance and operation.

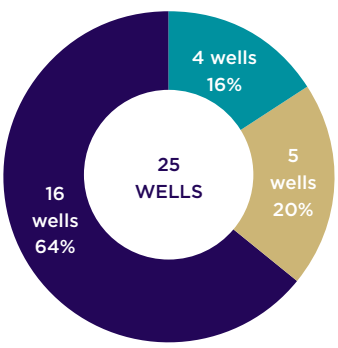
Q: What strategy is Pemex pursuing to maintain its 3P reserve replacement rate over 100%?

A: We expect onshore, shallow water, and deepwater fields to contribute equally to turning prospective resources into reserves. The portfolio will define the exact percentages, but we expect them to vary only slidely. We estimate that exploration will have a US$2.71 billion budget, from which we will assign US$1.16-1.24 billion to deepwater, around US$100 million to non-associated gas and wet gas in Burgos and Veracruz, and the rest to shallow water and onshore projects.

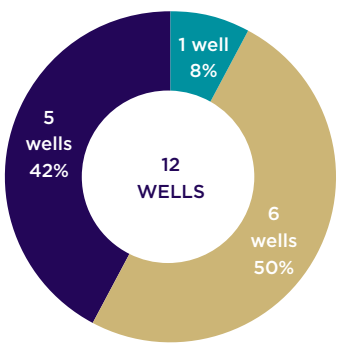
Q: What will be the pillars of Pemex's exploration strategy in the coming years?

A: Today we have a better understanding of where the resource potential is located in Mexican territory.

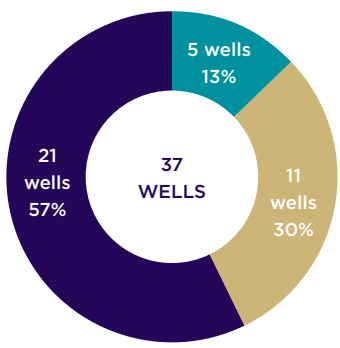
RESULTS OF UNSCHEDULED WELLS COMPLETED 2012



RESULTS OF SCHEDULED WELLS COMPLETED 2012



RESULTS OF WELLS COMPLETED 2012



commercial producing well | non-commercial producing well | non producing well

Source: CNH

MAIN DISCOVERIES IN 2012					
Asset	Well	Initial production Oil (b/d)	Gas (Mcf/d)	Hydrocarbon	
Burgos	Master-1		20.7	Dry Gas	4Q12
	Tepozan-1	34	2.2	Wet Gas	
	Paje-1	72	1.4	Wet Gas	
	Anhelido-1	432	1.9	Gas and Condensates	
Litoral de Tabasco	Kunah-1DL	103	33.4	Wet Gas	
Macuspana-Muspac	Teotleco-101	1,407	9.4	Gas and Condensates	
Poza Rica-Altamira	Supremus-1			Light Oil	
	Trion-1			Light Oil	
Samaria-Luna	Navegante-1	1,770	7.2	Light Oil	
Veracruz	Bedel-1	415	0.2	Light Oil	
Burgos	Arbolero-1		3	Dry Gas	3Q12
	Cuervito 201A	48	21.4	Wet Gas	
	Forcado 1		4.1	Wet Gas	
	Mandarin 1	19	2.3	Wet Gas	
	Organdi 1	26	1.9	Wet Gas	
Bellota-Jujo	Jolote 101	1,042	1.7	Light Oil	
Macuspana-Muspac	Sunuapa 401	1,397	1.8	Light Oil	
Burgos	Percutor-1		2.2	Dry Gas	2Q12
Litoral de Tabasco	Habano-1	27	2.8	Gas and Condensates	
	Kunah-1	143	33.9	Wet Gas	
Veracruz	Gasífero-1	820	0.3	Light Oil	1Q12

This was a long-term goal, reached through many years of experience that allowed us to determine a priority list for exploration. Secondly, authorities in the Mexican oil and gas industry, as well as most of the Mexican population, are convinced that exploration is an important part of the strategy for maintaining stable production for the future. Having understood the need to invest in exploration, it is easier for us to plan how to exploit our investment efficiently. With extraction processes becoming more and more complicated, we need to invest in new production technologies – this is where the development division comes in – and better exploration techniques

An important part of our strategy is keeping at least three or four rigs dedicated to deepwater exploration; the number of rigs could, however, increase according to the country's energy policy and the outcome of current deepwater exploration activity. Exploiting shale resources is not the most profitable activity for Pemex, so it is important to start thinking about bringing in additional investors to participate in this development. Whether we need to change the Constitution to achieve this should depend on what the circumstances call for and what is best for the country rather than discussing energy agendas. The transformation of the oil and gas industry happens by changing energy policy, and there are several different paths towards accelerating the search for hydrocarbons and increasing production quickly. It should remain clear that the resources are there, and through intelligent, innovative ways we have to first transform them into reserves, and then into production.

EXPLORATION SUCCESS IN 2012

For decades, Pemex did not focus on exploration due to the vast reserves available in fields such as Cantarell, Ku-Maloob-Zaap, and Chicontepec, and the lack of a sufficient exploration investment budget. But, as all good things come to an end, the decline of Cantarell, starting in December 2003, at 2.211 million b/d, brought pressure upon the NOC to adapt its exploration strategy and appoint the necessary budget to develop it. However, as José Antonio Escalera Alcocer, Subdirector of Exploration at Pemex E&P explains, "it was not until President Felipe Calderón's term that this task was prioritized again."

"Deepwater represented high-risk, high-profitability projects for Pemex. That makes them long-term projects that require big flexibility ranges"

Carlos Morales Gil, Director General of Pemex E&P.

While the 1990s might have been a lost decade in terms of oil discoveries and expansion of the country's reserves, the relevance of exploration started to regain strength in the period from 2000-2006, with the presidency of Vicente Fox. Proven oil reserves declined from 45.3 billion bbl of oil in 1990 to 10 billion bbl of oil in 2012, and resultingly Pemex faced the urgent need to engage in a more systematic and organized exploration campaign, and to adopt a diversification strategy that would allow the company to explore in onshore, shallow water, and deepwater regions. This strategy implemented in 2006, has been the main driver for Pemex exploration activities since, and has led the NOC to spend its budget across several different targets that will yield production at different moments in the coming years. With an increased enphasis on exploration going forwards and an expanded budget to achieve its goals – it increased from US$2.80 billion spent from 1994-2000, to US$9.60 billion from 2000-2006, and US$14.88 billion spent from 2006-2012 – the mission to incorporate new reserves was set in motion. "These numbers demonstrate Pemex's ongoing focus on finding new hydrocarbon resources in Mexico, as a means to continue being energy sustainable and recapture a positive oil production trend," Escalera Alcocer says.

Nevertheless, Adán Ernesto Oviedo Pérez, Director General of Comesa, argues that "Pemex needs to improve its budget allocation. Only 15% of last year's total investment was dedicated to exploration, but to capitalize on the conventional opportunities that still exist onshore and in shallow waters, Pemex needs to, at least, double its exploration budget." Escalera Alcocer emphasizes that "Pemex must never neglect onshore and shallow water exploration. These projects represent short and mid-term impact, while deepwater is focused on the long-term prospects for the country." Pemex's numerous achievements in shallow water and onshore exploration vouch for Escalera Alcocer's remarks. "After 15 years of pursuing exploration projects within Tabasco, we finally prevailed by discovering super-light oil (45°API) at wells drilled in the Navegante field, which was a real accomplishment due to the complicated technical challenges that it presented – high temperatures and high pressure – but also because of the environmental and social issues that the area presented," Oviedo Pérez states. The Navegante project was a geologically challenging endeavor for Pemex due to the complexity of Navegante-1, its first well. The area required cutting-edge seismic technologies and sophisticated equipment for drilling, which took longer than expected due to the underground saline layer where the hydrocarbons were located. "We could not fully evaluate the hydrocarbon column at first," Escalera Alcocer describes. "We could just see the top 320m, while another 300m of the column were left unseen." The success of Navegante confirms the validity of ongoing efforts by Pemex to maintain diverse sources for reserves. "Investments are still being made in onshore Veracruz and Tabasco and the rest of the Cuencas del Sureste area to acquire new seismic data with innovative and complicated technology and survey designs," Oviedo Pérez explains. "We have already been able to provide Pemex with better images of the subsurface, in order to define both the top and base of the salt and, through its interpretation, try to define a better geological model and select the right place to locate the next opportunity over there."

The development of Tsimin-Xux has also been a successful project during 2012; after confirming 239.3 million bbl of 1P reserves during August 2011, it only took one year for Pemex to successfully start early production in the field. This is an additional production source that is already accounted for in the favorable trend that Pemex wants to follow. "With the new type of discoveries that we have made, such as Ayatsil and Tsimin, it is important to define reservoir behavior, and in the end, that is purely the role of exploration. Investment in these fields should be focused on

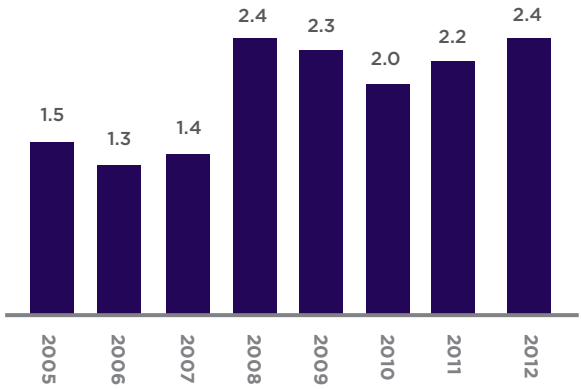
development, appraisal, and on establishing the commercial size of the discovery," Oviedo Pérez says. "On the other side, additional exploration projects also have to be pursued: Tampico Misantla, prospective shale oil and gas resources, and deepwater exploration have to be efficiently taken care of in the interests of propagating commercial exploration success towards the future."

Whilst the NOC has gained expertise in shallow water and onshore operations, it still had to strengthen its abilities in extended water depths before actually committing to drilling in deepwater. At first, Pemex decided to focus its investments on acquiring as much 2D and 3D seismic information as possible for the more than 500,000 km^2 deepwater area. "Through geological surveying, Pemex managed to update its intelligence on prospective areas where commercial hydrocarbons might be found in the mid and long term," Escalera Alcocer stresses.

2012 can probably be regarded as a breakthrough on Pemex's ongoing deepwater endeavor. The final months of the year saw efforts paid off, as two deepwater wells were drilled where light crude oil was discovered: Trion-1 and Supremus-1. "Deepwater represented high-risk, high-profitability projects for Pemex," Carlos Morales Gil, Director General of Pemex E&P, describes. "That makes them long-term projects that require big flexibility ranges."

Morales Gil, Director General of Pemex E&P, says that the plan had not been to drill Trion and Supremus first, but that they ended up being an unmatched learning experience. "We had marked Maximino as our first geological long-term prospect, ever since getting its seismic results back," he explains. "Maximino and PEP were our original bets for deepwater. We switched to Trion and Supremus because they were faster wells to drill and they would give us a better idea of what to expect in the rest of the Perdido projects," adds Gustavo Hernández García, Subdirector of Planning and Evaluation at Pemex E&P. The success at Trion and Supremus has raised the expectations for future deepwater discoveries, despite persisting doubts about Pemex's decision to allocate time and resources to explore the Perdido area a few years before. "Deepwater is an exciting opportunity," Oviedo Pérez says. "With a 55% commercial success rate in deepwater exploration wells,

EXPLORATION INVESTMENT (US$ BILLION)



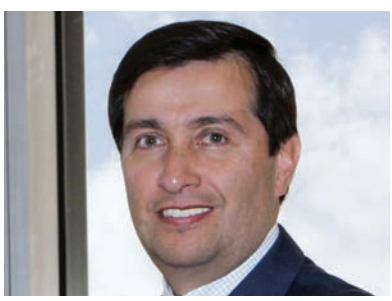
Source: Pemex

Pemex has done an incredible job." By the end of 2012, Pemex had already committed US$1.12 billion out of the US$2.64 billion available for deepwater – which was around 40% of the entire deepwater budget for the year – in three additional drilling operations.

While technology and training have been important factors in Pemex's exploration success during 2012, Escalera Alcocer believes that the flexibility of the NOC's exploration team to acquire those technologies and combine them with their experience has been the tipping point for progress in exploration. "Exploration, as other activities within the value chain, requires great amounts of experience. Its profile consists of a mixture of geoscientists that study the field's characteristics and artists that interpret them into usable knowledge that cannot be acquired through memorizing," Escalera Alcocer explains. "The exploration team uses that knowledge to understand what happened within nature over the past billion years and predict where commercially-extractable hydrocarbons rest in the earth's geology."

"Originally Maximino and PEP were our first bet for deepwater. We switched to Trion and Supremus because they were faster wells to drill and they would give us a better idea of what to expect in the rest of the Perdido project"

Gustavo Hernández García, Subdirector of Planning and Evaluation at Pemex E&P



Pemex has addressed even the harshest criticism, by delivering on challenging projects, exceeding a 100% reserve replacement rate, and constructing a stable production curve for the future. The role of exploration will continue to be critical in the prolongation of this success, and, as Escalera points out, it has all originated from careful planning and continuity. "Today, after all the experience we have amassed in the years, we have greater clarity on where the potential for important resources lies in Mexico," he adds. "This has convinced our authorities and the society to invest in exploration and not rest in their laurels, depending on the country's proved reserves."

RETURN ON EXPLORATION INVESTMENT

The country's prospective hydrocarbon resources can be separated into different segments. Conventional resources are found in onshore, shallow water and deepwater, and unconventional resources include complex fields requiring advanced technology, and shale oil and gas. "Deepwater fields present high financial risks, due to high level of capital expenditure needed for their development that is concentrated in the first few years of a project," says Carlos Morales Gil, Director General of Pemex Exploration and Production. "Non-conventional resources such as mature fields at Chicontepec and shale oil and gas, on the other hand, have low financial risk. The other factor in the analysis is profit, which is inversely correlated with risk. High profitability is usually present in high risk reservoirs and vice versa," Morales Gil adds.

we discriminate investment through a set of factors, but primarily the analysis of risk and profitability."

With the Perdido successes of 2012, the next step is more efficient well completion through the implementation of horizontal drilling and other technologies. "Currently, we have more than 50 prospective wells in Perdido," Escalera Alcocer, Subdirector of Exploration at Pemex E&P details. "We need to continue planning accordingly and decide on the drilling procedures, the amount of wells, the equipment to be used, and the investment required to optimize our resources."

Pemex's exploration and production division will continue to be the biggest beneficiary of the company's budget – accounting for 79% of the $US25.1 billion made available

PEMEX E&P INVESTMENT MATRIX

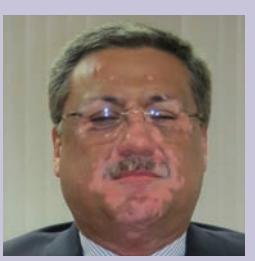
		Investment	Risk	Profit
Conventional	Shallow / Onshore	High	High	High
	Deepwater	High	High	High
	Mature Fields	Low	Low	Mid
Non-Conventional		Low	Low	Low

Companies follow different strategies to tackle the diverse sources. "IOCs tend to concentrate on the high-risk, high-profitability areas, while smaller companies concentrate on the low-risk niche," Morales Gil says. "Exxon, for example, manages non-conventional resources in a separate subsidiary called XTO Energy. Given that Pemex is the only operator working in Mexico, it has to attack both fronts. Mexico currently has a wide array of projects, and

this year by the Federal Government. "We expect an equal share of the budget to be allocated to shallow water, deepwater, and onshore, while keeping conventional gas projects active in Burgos and Veracruz," Escalera Alcocer says. This compels the E&P division to continue to favor projects that offer the most atractive returns on investment potential to reach its goal of achieving a production level of 3 million b/d mid-term.

WHAT DOES THE PIPELINE OF POTENTIAL DISCOVERIES LOOK LIKE FOR 2013?

We still have a lot of hydrocarbon potential in deepwater areas such as Perdido. We started drilling three additional wells in that area between December 2012 and February 2013, Maximino, PEP, and Ahawbil. We have great expectations for these wells, as well as from the other three that we have planned for 2013. If we continue with the same success rate as in 2012, we estimate that two or three of those six wells will end up being commercially productive.



José Antonio Escalera Alcocer, Subdirector of Exploration at Pemex E&P

In shallow waters, we are expecting important discoveries similar to what we found at Tsimin and Xux. We are also delineating Xux, which is looking promising. We believe that President Peña Nieto will get some good news soon in terms of hydrocarbon findings, since we expect to have some interesting results in 2013, continuing the trend of last year. We will continue to add reserves in the same proportion as we have managed to do in the past few years.

DEVELOPMENT OF MEXICO'S HYDROCARBON RESERVES

Fluvio César Ruiz Alarcón, Professional Board Member of Pemex

Reaching an oil reserve replacement rate that exceeds 100% is a key priority in Pemex's current strategy. For the past two years, the NOC has achieved this target while maintaining a stable production figure of between 2.55 and 2.58 million b/d. According to the company's management team the commercial success of this year's exploration projects has given the NOC enough 3P reserves to maintain energy sustainability for at least 30 years.

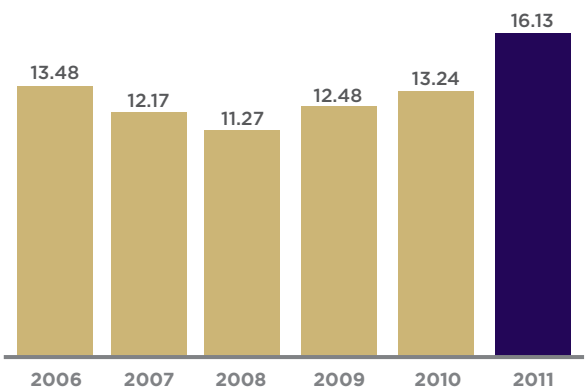
"The key factors that have led to success have to do with a constant and steady investment effort in exploration projects," says Fluvio César Ruiz Alarcón, one of Pemex's Professional Board Members. "When the oil price dropped to US$80, all investment was allocated to production activities to keep a healthy ROI. Slowly, with the increase in prices, the appearance of research funds, and through a strategy focused on exploration projects, Pemex has managed to achieve a 100% reserve replacement rate."

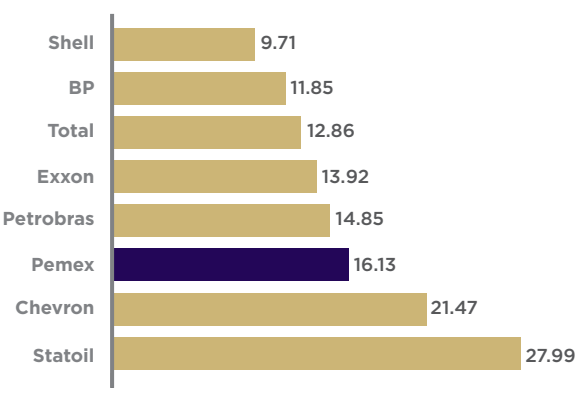
Ruiz Alarcón believes that the most important objective for Pemex is to achieve sustainability in the future. "This can be achieved through continuous exploration investment and the evolution of industrial transformation and maintenance capabilities, which have seen little investment for many years," he says. "We have seen important developments at Ku-Maloob-Zaap, while EOR techniques are being applied to increase production at more complex fields. Chicontepec's production has risen within expected levels due to the results that the field lab strategy has yielded. Exploitation techniques have been enhanced, increasing the production volume per well drilled. Both of these fields have contributed a great deal to maintaining production levels while increasing the reserves through additional discoveries."

The diversification strategy that Pemex E&P has followed in order to succeed at achieving both its reserve replacement and production objectives has altered the NOC's cost profile for exploration and production costs. From finding and development costs (FDC) of US$13.48 per barrel in 2006, the NOC's FDC have gone up to US$16.13 per barrel in 2011. This increase was driven mainly by the addition of deepwater and mature fields to Pemex' portfolio, which bring with them higher costs for hydrocarbon detection, and require more complex and costly development strategies.

Production costs have also increased due to the growing complexity of Pemex's producing fields. However, this increase does not mean that Pemex should stop investing in finding, developing, and producing hydrocarbon resources, no matter how complex the projects might appear, according to Ruiz Alarcón. "The expansion of the geological frontier through technology and the movement towards deepwater are leading the way towards heavier investments in exploration, thus allowing future energy stability for the country. Shale gas is another important piece in the learning puzzle, and its progress should be monitored, since the formations also promise to contain shale oil."

EXPLORATION AND DEVELOPMENT COST





Source: Pemex

WHAT IS THE IMPACT OF THE DIVERSIFICATION STRATEGY ON PEMEX'S PRODUCTION COST?

Our portfolio has changed due to our diversification strategy. Since the costs of exploration and production in areas such as deepwater and Chicontepec are higher than those in our traditional areas of focus. In the end, we still operate with very attractive margins since we sell oil at over US$100 per barrel while our combined exploration and production costs are only US$22.25.

Carlos Morales Gil, Director General of Pemex E&P

CNH REVIEW OF EXPLORATION ACTIVITIES

ALMA AMÉRICA PORRES LUNA
Commissioner of CNH

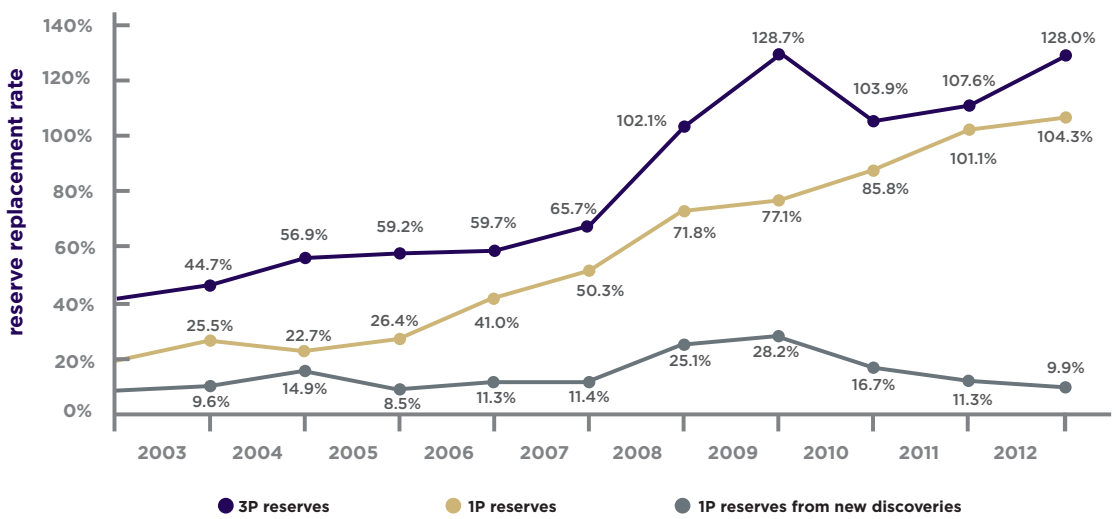
Q: What do you think are the main lessons Pemex has learned in the last years regarding deepwater exploration and drilling, and how has Pemex improved its drilling and exploration programs, plans, and safety measures?

A: The area where we have progressed the most, without a doubt, is deepwater. I can comfortably say this because Pemex has to provide its drilling programs to the CNH, including an overview of the planned security measures, processes, certifications, and qualifications and capacities of Pemex personnel. Based on the programs we have reviewed Maximino, Supremus, Trion, and PEP, and we are satisfied to say that Pemex has been progressing steadily in this area. However, progress has not been easy. In 2010 Pemex's capacity to drill wells was below the current level because the company did not have the necessary security measures in place. For example, companies in the US and the rest of the world hire various insurance companies as a means to back their drilling operations in case of accidents, but Pemex did not have any insurance. Currently, even though it was not easy to acquire, Pemex has a contract in place with Wild Well Control. Some issues like this are making Pemex a good player in the exploration of deepwater resources.

Q: What are the main improvements that you would like to see in the exploration strategy of Pemex?

A: In our case, the CNH is responsible for regulation, and therefore, we are not involved in the creation and execution of Pemex's exploration strategy. Despite the exploration success during 2010-2012, I believe that the country needs a well-defined exploration strategy oriented to deliver new resources and to increase production, creating substantial value to Pemex and the country. In this sense, it is very important to prioritize all the resources to define the best options to maximize the value of the exploration portfolio. Currently, it seems that we are drilling in various locations, without a clear program or logical plan. No one really

RESERVE REPLACEMENT RATE 2000-2012



Source: Pemex

For years, Pemex felt that it had enough hydrocarbon reserves to justify minimizing exploration activity. However, 10 years ago, the company started to prepare for Cantarell's production decline, and decided to change its budget allocation and increase investment in exploration. The results of this investment reinjection have been obvious: in 2000, Pemex had a 14% 3P reserve replacement rate, which has increased over the years, reaching 100% in 2008. The strategy has been carefully continued: 2012 was the fifth consecutive year with a 3P reserves replacement rate exceeding 100%.

knows, or explains to us, if we are drilling in new locations because they are close to existing infrastructure or recent discoveries, or because these locations are cheaper than other places, or whether we are looking for gas or oil. We need a clear and logical national strategic plan to create value to the country. Also, it could be important to develop new options in the strategy in order to create value based on our superior gas position, including shale gas and shale oil developments.

Q: Another important discovery was Navegante, located in a new geological layer in onshore Tabasco. What does this discovery mean for the future of onshore exploration in that region?

A: Navegante has been an important onshore exploration success story. Therefore Pemex will continue exploring and drilling new wells using frontier reservoir exploration, which means exploring and drilling new wells in the vicinity of existing ones to find new potential reserves or reservoirs that are geologically connected to existing fields. I believe that this is a great exploration strategy for onshore areas in Tabasco because most of the fields in the region have similar geological characteristics, allowing Pemex to optimize the use of technology and infrastructure while not having to invest in new equipment, research, and development of these fields. The discovery of Navegante is of great importance because it has taken Pemex into a new era of frontier reservoir exploration in onshore and shallow water regions.

Q. What is your perspective on Pemex's exploration priorities in 2013?

A: Exploration efforts in Mexico are focused on onshore, shallow water, deepwater, shale gas, and shale oil resources, to reduce the risk associated with exploratory activities. I am truly surprised that Pemex has not started to delineate the large reservoirs that have been found in deepwater – such as Maximino, Supremus, Trion, and PEP – and that they are continuing to drill new deepwater exploration wells. Regarding the myth that has been circulating that Pemex is trying to find as much oil and gas in deepwater, before a comprehensive energy reform is passed, as a means to have a portfolio of opportunities to offer to potential partners in future deepwater activities. I believe that it is more related to a general program developed some time ago that needs to be improved in order to create value and to provide production in the short term. Therefore, the most interesting exploration activity is in the Southeastern Basins. These basins have contributed with the largest volumes of new reserves; a good option is to locate new reserves in shallow water, reservoirs of the Mesozoic, because this basin mainly produces light oil, and Pemex has all the experience, technology, and infrastructure to develop this resources.

· Seismic data acquisition: land, transitional and marine, 2D, 3D and 3D3C
· Vertical seismic profile (VSP) 2D, 3D
· Seismic data processing
· Integration and Interpretation of seismic data

· FEL (For exploration and production processes)
· Static and dynamic reservoir characteria tion
· Engineering, operation and maintenance of facilities
· Reliability and Risk Analysis for Exploration and Production Projects

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A CLOSER LOOK AT RESERVES REPLACEMENT

EDGAR RANGEL-GERMÁN
Commissioner of CNH

Q: New discoveries represented a 1P reserves replacement rate of less that 10%, how does Pemex reach a 1P reserves replacement rate exceeding 100% for 2012?

A: Because they have very large volumes of 2P and the 3P reserves, which are moving from possible to probable, and from probable to proved categories through reclassification. Reclassification of the large reserves from fields such as, Cantarell and Ku-Maloob-Zaap gives Pemex the opportunity to replace its 1P reserves. It is an interesting analysis.

Q: Does this mean that the exploration results in recent years have not been true success stories?

A: Not necessarily. You also have to take into consideration that this is the nature of the exploration game. Pemex has a decent success rate for its exploration wells, but the company has a budget similar to major international oil companies, and it allocates a similar amount to exploration. However, I have the feeling that the return on investment could be optimized by better allocating this investment.

1P RESERVES REPLACEMENT RATE (RRR)

Year	Oil	Gas	Total
2009	90.5%	83.1%	71.8%
2010	101.6%	67.5%	77.1%
2011	72.5%	114.6%	85.8%
2012	85.4%	96.2%	101.1%
2013	105.1%	93.6%	104.3%

Q: How would you do that?

A: Last year, Pemex E&P drilled two successful wells, from the exploratory standpoint, in ultra-deepwaters: Trión-1 and Supremus-1. A rough estimate of the cost of these two wells would be US$500-600 million, but Pemex has been able to incorporate no more than 500 million bbl 3P reserves, a small amount of 2P reserves, and zero 1P reserves. On the other hand, the onshore well Navegante-1, in the southern region, which was very expensive as it was drilled to great depth to reach the Jurassic formations, probably cost US$50 million, but might enable Pemex to incorporate around 300 million bbl of 1P reserves in the short term. If you look at the immediate return on investment then, one could argue that there is a significant amount of oil to be discovered in the basins, such as the Southeastern basins and the Tampico-Misantla basin. If you add shale oil, there is a lot more. Even with the same amount of money to invest in exploration, optimizing its allocation could add more value.

Q: The 3P reserves discovered in ultra-deepwaters will eventually be reclassified as 2P and 1P reserves? Does this justify the investment of US$600 million?

I agree with the fact that they could eventually turn into 1P reserves, but I do not believe this is inevitable. I would call the ultra-deepwater discoveries a success from the exploration side: we proved that the petroleum system exists, that the rock is impregnated with oil, and we will see production in several years. I would not stop the deepwater program, because it is focused on long-term production sustainability. Of course we have to continue, but is this the right share of the exploration budget to allocate towards these projects? It is a difficult question because that is part of the discussion in the upcoming energy reform. We must create the optimum mix of investment, risk and reward: combining money from Pemex and other partners in the model that is comparable to deepwater exploration and production contracting models used globally, with joint ventures or some other type of partnerships. Forcing Pemex

1P RRR FROM NEW DISCOVERIES

Year	Oil	Gas	Total
2009	24.0%	23.4%	25.1%
2010	29.1%	22.1%	28.2%
2011	14.5%	17.8%	16.7%
2012	12.5%	6.9%	11.3%
2013	9.6%	8.9%	9.9%

to make all the investment and take all the risks – geological and financial- is not the way the deepwater game is played in the world. When you are onshore or in shallow waters, you can do that: Pemex is one of the world's leaders in shallow waters production, so they can manage these kinds of risks.

Q: To optimize the allocation of the budget, would you not drill for gas in deepwaters, shale gas or Chicontepec?
It depends, because there are different levels of risk analysis and short-term and long-term objectives. If you want to maintain a production plateau, or increase production, then you also have to manage the future risk to invest in projects that hopefully would give you a lot of reserves and more production in the long-term. If you just concentrate on short-term results and net present value, then you would shut down every natural gas project – deepwaters or shales – and Chicontepec, and you would focus all investment on the big fields in the southern or marine regions, but we do have to balance it out. That is one thing, from the economic point of view. But you also have only one operator, and Mexico needs natural gas, so Pemex has to produce it. This means that it has to allocate investment budget to produce that gas, even though it is not the most profitable of its portfolio. However, the investment budget is allocated based on an investment attractiveness ranking of potential targets, which it topped by projects like Ku-Maloob-Zaap and Crudo Ligero Marino, while natural gas opportunities are ranked lower on this list. If this capital investment planning scheme would be applied strictly, then all these gas projects would stay on the bottom of the ranking and would never be developed. This is one of the reasons why Mexico has become a net importer of natural gas. Mexico has substantial natural gas reserves and huge natural gas resources, but we have problems bringing the molecule to the surface and its final destination.

EVOLUTION OF MEXICO'S OIL RESERVES

Region / Asset	Original oil in place (3P)	Accumulated oil production	Remaining oil reserves		
			1P	2P	3P
Northeast Marine Region	76,769	17,464	5,528	8,528	11,595
Cantarell	38,037	13,896	2,025	3,443	4,845
Ku-Maloob-Zaap	38,732	3,568	3,503	5,085	6,750
Southwest Marine Region	28,719	6,245	1,267	2,469	4,027
Abkatún-Pol-Chuc	17,035	5,538	414	984	1,142
Litoral de Tabasco	11,684	707	853	1,485	2,885
North Region	111,169	5,760	813	4,493	11,499
Aceite Terciario del Golfo	81,493	205	569	4,066	10,948
Burgos	419	34	6	9	10
Poza Rica-Altamira	28,502	5,441	229	404	521
Veracruz	756	80	9	14	21
South Region	39,256	10,225	2,417	3,084	3,491
Bellota-Jujo	13,290	3,094	879	1,218	1,319
Cinco Presidentes	7,154	1,815	229	256	327
Macuspana-Muspac	6,077	1,800	159	212	288
Samaria-Luna	12,735	3,516	1,151	1,398	1,558
National Total	255,913	39,695	10,025	18,573	30,612

Source: Pemex

MEXICAN SOLUTIONS FOR SEISMIC STUDIES

In recent years, Pemex has been allocating an increasing proportion of its investment budget to exploration activities in onshore and offshore areas. In order to successfully identify new oil reserves and better exploit existing ones, Javier Núñez, CEO of Grupo Núñez, explains that Pemex must invest more capital in the acquisition of seismic data. "Pemex has seismic data on most of its fields, but in order to increase production, it must acquire more seismic data to better define geologic models and be able to identify the different strategies and technologies needed to exploit the remaining oil reserves at mature and potential fields," says Núñez. "If studies are performed and accurate seismic data is acquired, Pemex also has the potential to achieve early production and get an earlier return on investment."

"The easiest fields to acquire seismic data, develop, and exploit are onshore fields. However, this does not necessarily mean that Pemex should be investing more resources in these fields"

Javier Núñez, CEO of Grupo Nuñez

Capitalizing on these opportunities, Grupo Núñez, a Mexican company specializing in all seismic related matters, offers technical support in the acquisition of seismic data through the use of tools such as geophones and advanced exploration techniques such as gravity gradiometry. The company also offers technical support in all activities related to data acquisition.

The potential for seismic studies in Mexico is huge, due to the fact that there are vast onshore, shallow water, and deepwater opportunities. "The easiest fields to acquire seismic data, develop, and exploit are onshore fields. However, this does not necessarily mean that Pemex should be investing more resources in these fields," explains Núñez. Despite the importance and number of onshore fields, he strongly emphasizes the urgent need to invest in seismic studies for shallow water fields, because past seismic studies and over three decades of production experience have demonstrated that shallow water fields have great potential due to their geology, accessibility, and Pemex's experience in shallow water.

With regard to deepwater, Pemex has acquired vast seismic studies, but there is a need for more detailed data. "One of the ways to acquire this detailed data is through the use of techniques such as VSD massive and 3D studies, which would offer Pemex more detailed information on specific areas where other fields have been discovered and more data on the limits and quantities of oil reserves," says Núñez.

In order to obtain more detailed seismic data, Núñez believes the NOC should acquire more technologies from abroad. "Pemex needs new technologies like data acquisition from digital sensors, technology with the ability to analyze secondary waves (S-waves), and new high density technology for mature fields, which would allow Pemex to have a better understanding of underground geology, reduce the distance between seismic indicators, and allow them to better define the volume of the oil or gas reservoir," explains Núñez. Besides needing all these state-of-the-art technologies to understand geological features of reservoirs, Pemex must invest in acquiring seismic data in a faster and more organized manner. Therefore, it must invest in a wireless transmission system, which is currently being applied globally and gives operators the ability to take real-time decisions and reduce costs.

Understanding the technological needs of Pemex and helping the company to bridge technology gaps, Grupo Núñez – through its alliance with Sercel and Bell Geospace – is making sure it acquires the best and most innovative technology worldwide and implements these in Mexico. Its main objective is to introduce the latest seismic technology available to Mexico through the various services offered to Pemex and Comesa, not only by selling the technology, but also through training, and ensuring that the technology is implemented correctly for the benefit of the country, Pemex, and Grupo Núñez's clients. For example, the company operates a training and support center in Mexico City to ensure that its clients are able to maximize the impact of their technology investments.

Grupo Núñez offers integrated solutions, products, and services through its three branches: Semor, Núñez y Asociados, and Geoaplicaciones. Its portfolio consists of legal, accounting, and management services; geosciences and engineering support; and consulting, geological, geophysical, and engineering products and services for the oil and gas industry.

COMPLEMENTARITIES BETWEEN SEISMIC TECHNOLOGY COMPANIES

In the Gulf of Mexico, a proportion of the hydrocarbon resources lay beneath large salt structures making it more difficult to obtain accurate data with older exploration techniques. In 2012, Pemex stated that it would continue to focus its offshore exploration in both shallow and deepwater, confirming the importance of integrating the newest and best technology in seismic acquisition and data processing.While Pemex is equipped with the human resources and capacity to integrate these technologies and interpret the data, much of its seismic surveying and data processing has been done through contracts with international companies. "Pemex has worked to get the most out of us. They give us each a sector of the marketplace, based on our technologic strengths," David Pring, Country Manager Mexico at Petroleum Geo-Services (PGS) explains. "In one case, you may have a contractor that is seen as an expert in time processing; you may have another that is an expert in depth processing, and the work gets pushed accordingly."

In the case of PGS, a Norway-based company with regional headquarters in Houston, it was its expertise in depth imaging and data processing, in addition to its successful track record and relationship with Pemex that allowed the company to capture a contract with Pemex in 2009. "A handful of contractors, five or six of us, were given an opportunity to demonstrate the technology that we have," explains Pring. "The contracts are awarded directly based on technology patents – normally for a three-year period with a predetermined contract value. From there, a portfolio of projects is assigned to that particular contractor."

The same year it entered into a formal contract with Pemex, PGS divested its onshore operations to focus on strengthening its leadership in marine areas in the Gulf of Mexico. "Our strength has been in depth imaging, specifically with our beam technology," Pring says. "When we started with this beam product, our clients could not believe it. They thought that we were inventing the data, because literally, they could see the subsurface in a way that no one had seen it before."

Seismic technology employed in marine environments continues to rapidly evolve, requiring that companies are continually researching and implementing new technological solutions. "As these technologies evolve, there is a balance between the need to apply the technology in the moment and the need to keep an eye on new technologies that are coming," Pring adds. More than three years ago, it was time-based processing rather than advanced depth imaging that gave Pemex data on fields in the Gulf of Mexico.

The specific technology employed by PGS is known as the 3D Geostreamer, an advanced kind of wide azimuth (WAZ) or broadband seismic survey that completely eliminates "ghosts" on both the receiving and source ends. "We have more experience in broadband than anyone else," Pring details. "We have been shooting it for almost three years, and essentially we have a unique system that allows us to produce extremely high fidelity images."

Yet aside from its strength in broadband seismic and data processing, Pring believes that it is PGS's human resources that have allowed the company to be a successful contractor with Pemex. "The history of data processing is that the importance of people is probably a heavier weight in the equation than technology," he explains. "People that have established a track record over many years with Pemex have really grown to become partners in the business rather than a strict, over-the-fence contractual arrangement."

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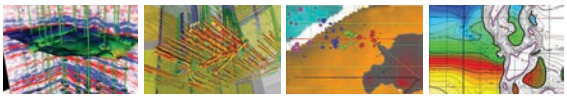

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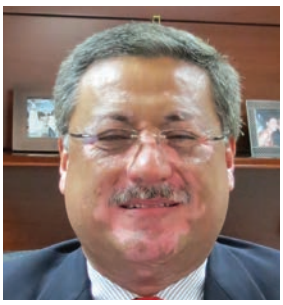
REPLACING KMZ PRODUCTION AFTER ITS MAIN FIELDS DECLINE

In September 2009, Pemex announced that they had awarded their largest-ever 3D seismic campaign to international geophysical service provider CGGVeritas, now known as CGG. The contract specified that CGG acquire 75,000km² of 3D seismic data starting in October 2009 and running until 2013. The high-end vessel Alizé, equipped with 12 Sercel Sentinel solid streamers fitted with Nautilus integrated streamer control devices, is towing one of the largest areal receiver arrays deployed in the industry. The Alizé has already acquired several large surveys in deepwater areas delivering high-quality data.

José Antonio Escalera Alcocer, Subdirector of Exploration at Pemex E&P division, has lobbied for the use of these technologies to increase the prospects of finding hydrocarbons in deepwater. "There are regions in the deepwater area that present saline accumulations in the seabed," he explains. "New technologies have to be applied in order to thoroughly examine the geology of the salt layer on the seabed. Wide azimuth's ability to expose the blurry underwater structures beneath those salt layers proved to be very effective in our discoveries at Perdido."

In the past year, CGG has conducted double-density WAZ surveys in areas outside of deepwater, at Ayatsil, with its dedicated vessel. "The aim is to work in areas where seismic



LEFT: José Antonio Escalera Alcocer, Subdirector of Exploration at Pemex E&P division
RIGHT: Dominique Gehant, CGGVeritas Geomarket Director for Mexico

surveys have already been conducted, in order to intensify the resolution of the images," explains Dominique Gehant, CGG's Geomarket Director for Mexico. The resolution was improved through the use of CGG's BroadSeis technology (see the article below).

"We are conducting a base survey to better characterize recently discovered extra heavy oil fields with the purpose of using the data to optimize production," Gehant explains. "It is an industry first to acquire high-density, high-resolution, wide-azimuth data for field development purposes." Pemex's Exploration division manages this contract, but once the data is acquired, the development team that handles the Ayatsil field will oversee the data processing and reservoir characterization for the project.

| TECHNOLOGY SPOTLIGHT

PEMEX'S APPETITE FOR WORLD-LEADING SEISMIC TECHNOLOGY

When it comes to introducing the latest innovations in the world of marine seismic acquisition, Pemex has been a frontrunner in adopting world-leading technologies. 2009 marked the NOC's first foray into wide-azimuth (WAZ) seismic marine surveys, and over the last few years the solution has been established in Mexico as a proven technology. The NOC has also worked with French geosciences company CGG, which first brought WAZ to Mexico, on a project that incorporates one of their latest seismic solutions, or BroadSeis, for marine seismic acquisition. This technology employs streamers with varying receiver depth from near to far offsets to produce receiver ghost notch diversity, allowing the streamer to be towed deeper to improve the low-frequency signal-to-noise ratio without compromising the high frequencies. BroadSeis provides clear images and details of the reservoir from its exceptionally sharp and clean wavelets without sidelobes. The broad bandwidths of BroadSeis also enhance imaging below difficult to image geology and provides greater accuracy in seismic inversion from improved low frequencies.

Now, CGG is introducing a new technology to the Mexican market, known as StagSeis. Promoted as a "next generation" solution specifically designed for subsalt imaging, StagSeis is designed to reduce risk in exploration and production by providing high quality seismic imaging for areas where previous generation technologies cannot acquire targets due to complex overburdens. The technology was developed to help companies operating

"During the last few months, we have been holding meetings with our internal contracting area to maintain open contracts with the three leading seismic providers and gain the access to their new technologies," Escalera Alcocer details. "The oil market is really dynamic: technologies move as companies change. Having open contracts with all the leaders – CGG, Western Geco, and PGS – allows us to freely request quotes on the different technologies that we deem appropriate for specific tasks." The fact that Pemex now has a dedicated vessel, contracted from CGG through this model, to carry out wide-azimuth surveys helped in the feasibility of the project at Ayatsil. Gehant explains that in order to contract this work from scratch would have taken a lot longer than it took to simply move CGG's surveying vessels into the region. This was key since the survey needed to be completed before production infrastructure was brought to the region, which makes seismic surveying a lot more complex.

This project has the potential to open the door to a brand new set of opportunities for seismic and geoscience companies: the chance to work with the Pemex on marine field development, and better characterize target reservoirs before infrastructure is developed. "Pemex is now much more open to new technologies than it was before, and they want to operate as a technology-driven player," Gehant emphasizes. "Additionally, projects such as the double-density survey being conducted at Ayatsil have the potential to be carried out elsewhere. Pemex already sees the benefit of using the technology, where conventional techniques do not suffice, both in shallow and deepwater."

CGG is also a big believer in 4D surveys: carrying out multiple seismic surveys over a period of time in order to see the changes in the reservoir throughout the course of its producing life in order to analyze the field's evolution. These technologies could enable Pemex to take its current experience at Ayatsil and turn to exploring unconventional fields to obtain a better understanding of the behavior of these reservoirs. "We already have some information on unconventional complexes at Tampico-Misantla, from which we have inferred the presence of shale oil prospects," Escalera Alcocer says. With advanced technologies that enable a progressive look at geologic behavior, these reservoirs might be construed into opportunities for reserve replacement in the long-term, as deepwater is still being groomed to occupy the mid-term driver of production increase.

in the US Gulf of Mexico, where large wide-azimuth acquisition is extremely desirable but difficult to attain due to sub-salt and sub-basalt. The solution can also be adapted to shallow waters, where ultra-long offsets are not required, but wide-azimuth data is desirable.

StagSeis utilizes a multi-vessel acquisition configuration, which produces ultra-long offsets of up to 20km, and full azimuth of up to 10km. The process is also compatible with BroadSeis, which adds extra frequency bandwidth, especially useful for deep imaging. Due to its staggered vessel configuration, it can provide wide-azimuth and ultra-long offsets using a linear tow in two orthogonal passes. The linear tow brings with it many advantages, as it ensures that the fold, offset, and azimuth distribution are consistent from bin to bin, providing a stable stack response. By combining long offsets, full azimuths and broad bandwidths, StagSeis allows for better subsalt imaging by illuminating shadow zones and steep dips, improving noise and multiple attenuation. This leads to more accurate velocity models. It can provide more than six octaves of signal in conjunction with BroadSeis, with lower frequencies to improve deep imaging and to provide more quantitative inversion results. Data is immediately available after acquisition and the results are compatible with wide-azimuth processing technologies.

In Mexico, CGG sees the opportunity to develop existing 3D seismic surveys through time-lapse repeat surveys, also known as 4D surveys, in order to better characterize fields for development, and analyse the evolution of production. The only challenge in conducting further surveys is the infrastructure that has already been put in place: for this reason, in the Mexican case, 4D surveys will be easier to conduct in deepwater areas than in currently producing shallow water zones.

COMESA EXPANDS ITS PORTFOLIO OF ACTIVITIES

ADÁN ERNESTO OVIEDO PÉREZ
Director General of Comesa

Q: You argued that in order to ensure that Pemex continues to fully exploit the new opportunities discovered in 2012, it must double its exploration budget. How should Pemex allocate the additional annual investment?

A: The assets that most demand this investment are the ones where Pemex is already producing around 70% of its crude: Cantarell, Ku-Maloob-Zaap and rest of the Campeche Sound. In the last 4 years, a lot of satellite fields in the Bay of Campeche have been discovered, including new giants Ayatsil-Tekel and Tsimin-Xux. All these new discoveries onshore in shallow waters will require additional investment to appraise and to delineate before development. Onshore southeast Mexico contributes 20% of total production with mostly light crude oil. Onshore north Mexico, including Chicontepec contributes with the final 10% of total production. Chicontepec requires a new fresh approach but golden lane Mesozoic fields offer good opportunities to increase production in short time.

Q: It could be argued that the current contribution to total production of various regions should not be the main factor for the allocation of exploration budget. What would you say to this?

A: I would argue that if such large discoveries have been made in the region, then more work should be done to appraise and define the behavior of the assets, and that has to be done through further exploration.

Q: Access to new technologies has played an important role in Pemex's recent exploration success. What are the most important technologies that you have introduced recently, or plan to introduce in the coming years?

A: We are right now getting ready to sign a large contract with Pemex related to acquiring offshore massive VSD 3D studies in order to reduce cycle time for the appraisal of new discoveries. This is going to be important, because, for example, in deepwater areas 80% of the identified potential reservoirs are composed of clastic rock. When dealing with massive carbonates like Cantarell, it is not hard to get a very good seismic image resolving on the reservoir. But when you change to clastic, you need to use different technologies to deal with thin and heterogeneous reservoirs. Traditionally, after making a discovery you need to obtain new seismic data, which means that the contractor needs to mobilize a vessel, shoot the survey, and process the data. After that, Pemex goes into interpretation, which takes at least 18 months. But the speed can be increased by using new technology such as massive 3D VSP massive, which can lead to a better image of the 4-5km surrounding the discovery within six months. This increases the confidence for the selection of the location for an appraisal well, meaning that these deepwater assets can be put into production much faster than with conventional means. Then, early production can be reached with the use of an FPSOs.

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Q: Does Comesa still have the ambition to become an operator in Mexico?

A: We hope to take this step in 2014, with Pemex's full backing. Right now we are focusing on introducing new technologies like massive, seismic multicomponent VSP 3D and high-density seismic in mature fields. We will also be working on well workovers in order to develop the capabilities and experience required to become an operator. We need to have these skills in-house, and we also need to find the right partner to do this with.

Q: Pemex and the IMP have started to explore and define the potential in Mexico for shale gas. Were you disappointed that this job went to the IMP when Comesa could have done it?

A: We actually formed a consortium with the IMP, who will administrate the budget provided by the Energy Ministry and Conacyt. We will shoot 1,000km^2 of new 3D seismic in northeast of Mexico, with the potential to acquire an additional 1,000km^2 in the Eagle Ford complex that extends into Mexican territory. We intend to be active in acquiring the seismic data that Pemex will use to develop shale gas. Shale gas and oil is a big challenge for Mexico, we are very pleased to collaborate with a highly recognized institution like the IMP.

Q: To obtain more shale gas experience, Comesa also worked on the US side of the border recently. What are the challenges and benefits of enabling your people work outside of Mexico?

A: When you face a new challenge, there are at least two natural human reactions: fear and excitement. We are trying to support our people to make the most of the exciting side of the opportunity. We arranged a special visa for our people to perform their jobs over there, and we are moving step by step. We are also participating in bids in Colombia and Bolivia for the processing and interpretation over more than 50,000km^2 of 2D seismic. Through these contracts for data interpretation, we are trying to internationalize our operation. We have a strong skills set to apply in other countries, and are able to extrapolate quite easily the deep knowledge of our experienced team based on decades of working for Pemex. As a small company, we are not particularly well-known in the US. It has not been easy to convince companies to work with us, but we have been demonstrating our expertise through pilot projects at no cost to our clients, and although it has taken a year, the strategy has proven to be successful.

"We are diversifying both our clients and services in order to assure Comesa's long term sustainability"

Q: What are the main priorities for Comesa in the coming years?

A: We have proposed to our board that at least 10% of our income in the next 5-6 years must come from international operations. It is not a big effort, but we are moving step by step in order to reach this target. As a state-owned company we are restricted in many different ways when it comes to moving fast and operating in this type of situation, but we are changing the culture and spirit of our staff in order to capture new opportunities based on our knowledge and technology.

Seismic operations in Mexico will remain our main business, representing around 70% of income and revenue, but we are diversifying both our clients and services in order to assure Comesa's long term sustainability.

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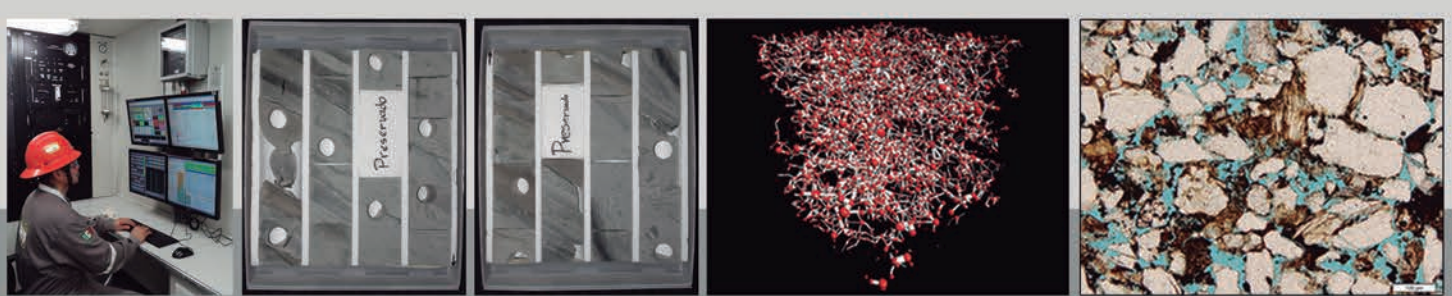

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INTRODUCING GRAVITY GRADIOMETRY TECHNOLOGY

Geological data acquisition is a vital step in determining the presence of subsurface hydrocarbons, and one of the most revolutionary data acquisition technologies is the gravity gradiometry procedure, which Bell Geospace's founder brought from defense contractor Lockheed Martin. Scott Hammond, the company's President and CEO, believes that since the company has successfully introduced full tensor gravity (FTG) gradiometry to the industry, operators such as Pemex will be more open to using it as a complementary technology for complex exploration projects, particularly in the Gulf of Mexico.

"The Gulf of Mexico's seabed is full of salt," Hammond explains. "While seismic technologies do a very good job of imaging flat salt layers, gravity gradiometry-based technologies are better at dealing with complex salt modeling studies, which include steep dips and the vertical faces of the salt." Even though this might suggest that gravity gradiometry is a better fit for acquisition projects in the Gulf of Mexico, Hammond hints that the combined use of both technologies produces a more comprehensive study that minimizes the shortcomings of each individual method.

"While seismic technologies do a very good job of imaging flat salt layers, gravity gradiometry-based technologies are better at dealing with complex salt modeling studies, which include steep dips and the vertical faces of the salt"

Scott Hammond, President and CEO of Bell Geospace

With that in mind, the technology by itself is excellent for modeling complex salt regions. "We all think of gravity as that force that pulls us towards the center of the earth. That is oversimplifying it. What really happens is that we are being pulled by the mass of the objects that are around us, so the force with which it pulls will change according to the mass of the object underneath; a heavier object will pull harder than a lighter one. However, that change in force is minimal," Hammond clarifies. "Gravity is composed of the X-component, the Y-component, and the Z-component. There is change in each of those axes as an object moves in three dimensions. That adds up to nine components that comprise the tensor field that gradiometry is able to measure. Going through the LaPlace equations, we can prove that only five of those components are independent. Our FTG technology measures those five independent gradient components plus one extra component. This helps to get rid of all of the noise that comes from the surroundings."

Bell Geospace can acquire its FTG surveys by both air and sea, using the only gravity gradiometer available in the market. "Air surveys are usually more efficient, since the speed at which the aircraft moves allows us to cover bigger areas in a shorter amount of time. But the amplitude of the signal will drop off due to the lower sampling rate (speed) and as the airplane gets further away from the source," Hammond elaborates. "In these cases, we sometimes recommend carrying out a marine survey, which has proved to be very successful at modeling targets that are well below 10,000m, even in the Gulf of Mexico."

Considering the complexity of the Gulf of Mexico's geology, gravity gradiometry presents itself as a solution to measure its changing patterns. However, that is not all the technique can achieve. Another interesting potential application for the Mexican market consists of surveys in regions where access to the survey area is not easy. "The aerial version of FTG can be used to produce data from areas where you cannot get to the ground," Hammond explains. "Bell Geospace provides airborne surveys, flying over rough terrain and acquiring the geological data. Once the data has been obtained, Bell Geospace processes it almost in real-time which removes the noise and enhances the separate tensor components. This helps clients to see results almost immediately and expand the survey or concentrate on specific zones within the region being studied."

Overall, the use of complementary data acquisition technologies provides companies with a better picture of the subsurface geology that they are studying. "Some objects have density contrast, others are magnetic, and some share both characteristics. If several technologies are used to measure these properties within the same area, it will be easier to determine what is out there," Hammond concludes. "Gravity, magnetic, and electromagnetic signatures will each describe some characteristics of the objects under study but are based on different physical characteristics. Therefore, if you combine all those scans, it will be easier to paint a picture of the underground features that are being studied."

NAVEGANTE: JEWEL IN THE EXPLORATION CROWN

"With the oil discovery at Bricol two years ago and the recent success at Navegante-1, we proved that we have not stopped attempting to incorporate more substantial onshore resources," states José Antonio Escalera Alcocer, Subdirector of Exploration at Pemex E&P. While deepwater resources represent an important part of Pemex's future, its diversification strategy allowed the E&P division to confirm an immediately exploitable reservoir 20km away from its headquarters in Villahermosa, Tabasco. According to Pemex officials, Navegante is expected to hold 3P reserves of around 500 million bbl of light oil, a volume that is expected to increase following the drilling of appraisal and delineation wells and through the search for field extensions.

The importance of the Navegante discovery is enhanced by the fact that pipelines for fast production and refineries plants in the region are already in place, but additionally, the oil in the reservoir is light crude. "Navegante gave us almost immediate production, with the first barrels being extracted in the beginning of 2013," Escalera Alcocer confirms.

"Navegante has been the jewel in the crown this year: explorers have been pursuing this model for the last fifteen years, and this year it finally paid off," states Adán Oviedo Pérez Director General of Comesa. His company has been working with Pemex to acquire new seismic surveys of the region where Navegante was discovered in order to facilitate the development of a better geological model definition in this very complex thrust belt.

The Navegante project was challenging for Pemex. The well is deep, with high temperatures and high pressures, and presented substantial technological challenges while also environmental and social issues had to be considered given the well's onshore location.

"It was a high-risk, high-volume project. The well is so complex that we could not fully evaluate the hydrocarbon column at first," Escalera Alcocer explains. "We could just see the top 320m, while another 300m of the column were left unseen." However, through the application of new 3D seismic technologies, Pemex was able to develop a model of the geological structure that provided the qualitative and quantitative information that encouraged the company to invest in the validation of the conceptual reserves.

Nagevante's light crude oil reserves are located in the autochthonous block in the upper Jurassic kimmeridgian formations. "This represents an important upgrade from the four or five wells we drilled in the allochthonous block, which moved and displaced itself through inverse faults for 15km, below the inferior structure where we have been finding reservoirs," Escalera Alcocer says. "The model we built indicates that the oil pocket moved south under the Antonio J. Bermúdez complex, a big onshore field. The confirmation of this theory could lead to finding more resources there, which is why we continue to do 2D seismic in the region." Escalera Alcocer explains that as soon as 2D seismic acquisition is completed, Pemex will start structural geologic modeling through 3D seismic.

"Working in exploration usually means that we are more often wrong than we are right. The probability of discovering a commercial success averages at around 30%," says Escalera Alcocer. "But we have learned how to take advantage of every single opportunity and learn from the information and knowledge that each well provides, while is allowing us to experiment with new concepts and designs that can be applied in other reservoirs. This has enabled us to reach a commercial success rate of around 40%."

The current expectations for Navegante, according to Carlos Morales Gil, Director General of Pemex Exploration and Production, are to produce a volume of between 30,000 and 40,000 b/d. This number is anticipated as the initial production for the field as soon as the production wells are drilled. Escalera Alcocer, on the other hand, is more cautious when giving an outlook due to the complexity of the development wells that have to be drilled. "These are wells that take a long time to be drilled," he says. "The original Navegante deposit was drilled in almost 450 days due to its complexity. We expect to lower the drilling time for the next wells to 280-360 days."

Pemex E&P is determined to build on the Navegante discovery in the onshore Tabasco area. "We still believe there are several opportunities in this area, especially if we look for field extensions. Reserves related to these opportunities may not be as big as Navegante, and could be found at more profound depths, but we will continue to work by acquiring additional seismic information, model the reservoirs in their geological, geochemical, and structural characteristics to define which type of hydrocarbons we might be able to obtain," Escalera Alcocer concludes. "The correct understanding of the imaging obtained with 3D seismic depth migration technologies and the implementation of 2D and 3D geological and geochemical modeling will help to define the areas where liquid hydrocarbons have bigger probabilities to be found in the future."

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REMOTE SENSING EXPLORATION TECHNOLOGY

MICHAEL MUMELTER
CEO of Geosat Technology

Q: How does Geosat's advanced remote sensing, non-seismic geophysical and geochemical methods improve the success rate for the detection of oil and gas fields?
A: Our InnoEx method delimits a trapping mechanism and defines if there is a hydrocarbon system below the trapping mechanism. Before performing any costly 2D or 3D seismic acquisition survey, Geosat can define the most prospective hydrocarbon areas of a block. This first step reduces the original area to a tenth; therefore, unnecessary geophysical or geochemical groundwork can be avoided. In other words, we create evidence of the existence of hydrocarbons. Meanwhile, seismic only defines a structure, which may be a trap, but it does not clarify if that trap is also filled with hydrocarbons.

Q: How do Geosat's technologies complement existing exploration technologies used in the oil and gas industry?
A: The dominating technology in oil and gas exploration is seismic surveys. According to the AAPG (American Association for Petroleum Geologists), in a study of over 1100 wells worldwide, the average success rate of 2D seismic is 13%. This is where our InnoEx process comes in; it reduces time and cost, and at the same time, increases the probability of success from 13% to over 80%. In addition, 55% of the assumed oil and gas reserves in the world still have not been found, and seismic alone will not be able to find these remaining resources. InnoEx defines the so-called positive anomalies, the potential areas that have a trapping mechanism and an active hydrocarbon system. With the exploration approach of using first a Geosat study like InnoEx, we are reducing both cost and time.

InnoEx is also ideal for sensitive areas; it is non-invasive, environmental friendly, and even the groundwork needed to define the optimum drilling locations does not require huge machines; as a result, there is no ground destruction on the terrain.

Q: What have been the highlights of Geosat's first projects, and what has been the feedback from your clients? Which achievements are you the most proud of so far?
A: Salis S. Aprilian, President Director of Pertamina EP, confirmed that the Geosat exploration concept is superior to 3D seismic, because it produced eight independent levels of information, in comparison to one level of 3D seismic data acquisition. Frankly speaking, such a statement from a NOC's President Director – and geostatistical expert – is a confirmation to me that our exploration concept is the solution to the industry's problem.

Q: How do you integrate the great variety of data you collect – thermal, geological and magnetic data, among other types of data – in order to more accurately quantify the exploration potential of a given area?
A: Our technology is based on the evaluation of satellite image processing (remote sensing), and geo-data interpretation, for which we have developed very precise software for the integration of multiple data in order to define various information levels and optimum drilling locations. The use of satellite data is nowadays accessible all over the world; there are more than 80 commercial satellites circling the world, hence the available data is vast. In addition, Geosat Technology became a showcase project of the European Space Agency (ESA) and has access to satellite data resources.

Q: How would your services apply to Pemex's exploration activities?
A: InnoEx is mainly an onshore technology. Mexico has large unexplored potential on onshore areas which could be cost and time effectively surveyed with this technology, resulting in increasing the probability of successful wells being drilled by 80% or higher. Geosat could contribute a tremendous input to stop the fast declining oil production by finding new resources. Additionally, the application of our technology will help Pemex reduce the exploration costs and will increase oil and gas production much faster than through traditional exploration concepts.

For these reasons, we have recently opened our representative office in Monterrey. I am confident that we can achieve our ambitious plan to contribute substantially to the development of Mexico's quest for oil and gas reserves in a faster and eco-friendly manner. We are already talking to Pemex for innovative research studies on Mexican ground and will develop this further this year.

THINK
SAFETY

5

Drilling safely and efficiently is the key to unlocking Mexico's oil and gas potential. Pemex has a lot of experience drilling in shallow water zones, as these areas have been the staple of production for the company since the late 1970s. However, today Pemex must take this expertise and translate it not only to new drilling challenges in shallow water, but also onshore and deepwater zones.

In this chapter, we explore Pemex's drilling strategy, both in established production regions and new areas; the requirements that Pemex has for companies that want to bring rigs into the country, and how this affects supply and demand; we compare the advantages and disadvantages of different types of rigs and technologies, and investigate the innovations that make drilling safer and more efficient.

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CHAPTER 5: DRILLING

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PEMEX DRILLING CHALLENGES

"Pemex has experienced a huge increase in drilling efficiency in the past 24 years," says Carlos Morales Gil, Director General of Pemex Exploration and Production. "In 1989, the company was barely able to drill a 4,000m well offshore in 280 days. By 1994, the time to drill the same well had been reduced to 70 days. Since then, we have become one of the most competitive forces in shallow water offshore drilling." This efficiency reflects Pemex's historical expertise, which for many years was focused on Cantarell, and later on Ku-Maloob-Zaap: these shallow water assets provided the basis for Pemex's annual production, and so naturally the NOC focused on improving its efficiency in this type of environment.

In areas that were not historically important for Pemex, the company is making significant efforts to strengthen its drilling capabilities. "Onshore, the story is different and we are still not competitive enough," Morales Gil admits. "We need to increase our efficiency level there over the next few years." To do so, Pemex will continue to focus on the areas where it can leverage its world-class technology and expertise: high pressure, high temperature wells. In areas where the company is less competitive, such as Chicontepec, drilling activities have been contracted to specialized drilling companies in their entirety. "We will continue to rely on the help of service providers in the areas where we feel we need them," Morales Gil says.

"We are doing anything we can in order to gain access to the rigs we are missing. Today, we are short by about 15 rigs; one year ago, we were about 30 rigs short"

Carlos Morales Gil, Director General of Pemex Exploration and Production

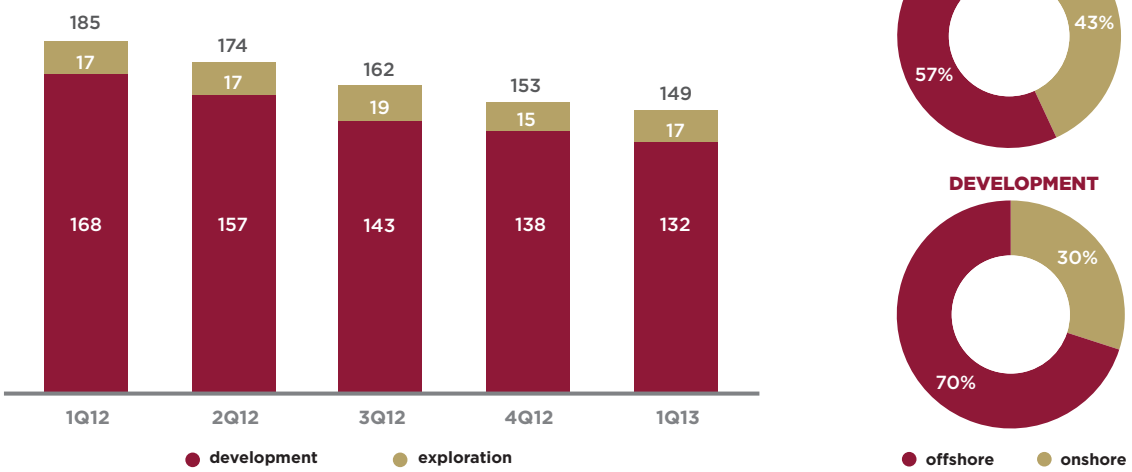
Success in drilling comes not only from expertise and improved efficiency, but also from having the equipment in place to make sure that the wells that need to be drilled, can be drilled. Morales Gil explains how a shortage of rigs available for hire, given the conditions and maximum day rates that Pemex is offering, has impacted Pemex's drilling operations, and therefore its production rates, in recent years. "We are doing anything we can in order to gain access to the rigs we are missing," he says. "We are basically contracting every rig that comes out of the yards, up to the point that we have managed to contract 15 additional rigs this year, but we are still 15 rigs short of the target. We expect to continue contracting with the same intensity throughout 2013 to catch up with our target. Right now, we are already in the process of securing contracts for eight, which will close half the gap." According to Cantarell Administrator Miguel Ángel Lozada Aguilar, Pemex has set a production target of 472,000 b/d at Cantarell. "If we are not able to hire the necessary drilling equipment, since there are a limited amount of jack-up rigs in the market, we will not be able to reach our production targets." Lozada Aguilar is skeptical about whether Pemex will manage to acquire the necessary rigs because in the past, drilling rigs have not come to Mexico because of the company's pricing and contracting policies, as well as international market forces.

Morales Gil is more positive about the possibility of reaching the company's targets. "Historically, the mandate of Pemex has been to produce as much as possible as quickly as possible to increase profit for the federal government," he explains. "However, due to the fact Pemex E&P is the pioneer within Pemex, it is not surprising they are planning five to 10 years in advance and their strategy is starting to align with the budget needed to purchase and hire drilling rigs."

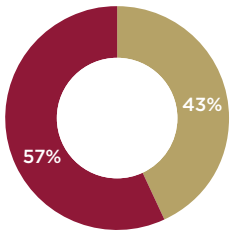
The balance in shallow water between jack-up rigs and platform rigs will increasingly favor jack-ups: Morales Gil says that out of the 90 rigs that Pemex hopes to have in shallow water in the coming years, around 60 will be jack-ups, and 30 will be platform rigs. Currently, Pemex only has 22 jack-up rigs in operation out of 53 rigs. Most of these will be contracted from other companies, rather than bought directly by Pemex: "Out of the 90 rigs that we expect to have in the following years, Pemex is planning to operate around 10 jack-up rigs and 20 platform rigs. We do not want to invest all of our capital in rigs and own the entire fleet ourselves," he explains. "The strategy we are following is to separate drilling activities into a newly created subsidiary or affiliated company. This strategy will start to be implemented in the following months, and will help in terms of the balance sheet and the budget expenses." This new drilling division will allow Pemex E&P to concentrate on activities other than drilling. Morales Gil hopes that eventually, the new Pemex Drilling division will compete for contracts from Pemex E&P alongside private sector companies.

In 2009, Pemex had an average of eight exploration drilling units operating offshore throughout the year. This

DRILLING EQUIPMENT IN MEXICO



EXPLORATION



DEVELOPMENT

Source: Pemex

number dropped to an average of six in 2010, and five in 2011. The number of rigs stationed at Pemex's main shallow water regions (Cantarell, KMZ and the southeast marine region) for development work went from 21 in 2009, with the figure remaining stable during 2010, the year of the Deepwater Horizon incident, and then dropping to 20 in 2011.

Pemex has also faced challenges contracting rigs in deepwater. Since 1999, when Pemex began exploring and drilling operations in the deepwater zones of the Gulf of Mexico, the NOC has drilled 25 wells with a geological success rate of 60% and a commercial success rate of 48%. However, even though the success rate exceeds the industry standard of 30%-35%, Pemex has had various complications in acquiring the necessary rigs. When the first tender for a deepwater drilling rig was launched in 2004, the only rig that Pemex was able to find had a water depth capacity of just 1,000m. When the company decided to ramp up deepwater exploration in 2006, it could not find a single rig to contract: it was only in 2007 that Pemex managed to contract three deepwater drilling rigs, which finally began to arrive in Mexican waters three years later.

PEMEX DRILLING RIG REQUIREMENTS

Pemex has very strict requirements regarding design, age, and capacity of all Pemex and privately owned drilling rigs operating in Mexico. These requirements clearly specify the different technical, safety, and quality standards and regulations that every jack-up rig and semisubmersible platform operating in Mexican waters must comply with.

Semisubmersible platforms, which are floating platforms that remain permanently positioned with anchors or Dynamic Positioning Systems (DPS), must have the capacity to drill and finish wells of at least 7,620m, withstand winds of up to 161km/hr, waves of up to 12m, and ocean currents of 1.5 knots. Furthermore, they must have a drilling tower with a minimum height of 48.77m, a minimum capacity to support 604.64 tonnes, a universal crown of 500 tonnes, six pulleys with a diameter of 152cm each, wire slots of 3.49cm or 3.81cm, and a rotating table of 120.65cm.

Jack-ups are drilling platforms positioned on the seabed on three or four legs, and are used for the drilling of wells in water depths of up to 100m. Due to the limited water depth and reduced risk profile of drilling in shallow waters versus deepwaters, Pemex's technical specifications for jack-up platforms are less demanding than those for semi-submergibles, requiring a drilling tower with a minimum height of 44.8m, a minimum capacity to support 498.95 tonnes, a universal crown of 500 tonnes, seven pulleys with a diameter of 127cm each, wire slots of 3.49cm or 3.81cm and a rotating table of 95.25cm.

Both types of drilling rigs must comply with several specific safety requirements, which include evacuation, rescue, and escape systems, gas and fire detection systems, and environmental protection requirements, including considerations for the proper disposal of toxic waste. Also, for both types of rigs, drilling towers or masts must undergo a complete visual inspection every six months by specialized staff members, and go through full maintenance service every five years. In 2010, following the moratorium on offshore drilling in the US, Pemex took the opportunity to increase the standards it set for rigs as specified in its tenders, stipulating that any rigs used on its projects must be less than 10 years old. However, after failing to contract the rigs it needed for its drilling program, these new standards were relaxed in 2011.

DIFFERENCE BETWEEN DRILLING PROGRAM AND REALITY

Pemex's diversification strategy and attempts to increase production hinge on the success of its drilling program. Each new well drilled has the potential to increase the amount produced per day, whether it be an exploration well to confirm the production potential of reserves, or development wells to best exploit the potential of a particular region. Onshore projects will play a major role in this strategy. In 2012, Pemex drilled a total of 1,296 wells, and completed 1,238 wells, the majority of which were development wells, and located onshore.

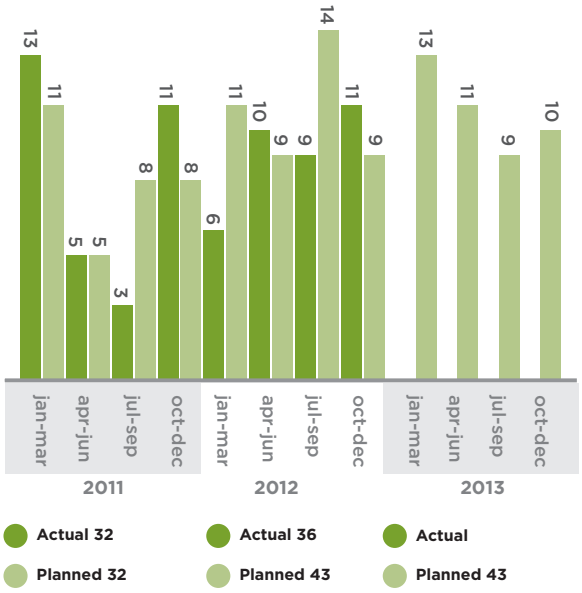
This represents an increase in the number of wells drilled year-on-year. In 2011, Pemex drilled 1,005 wells in total: 32 exploration wells and 973 development wells, in comparison to 2012, when Pemex drilled 36 exploration wells and 1,260 development wells. The difference between planned and actual wells drilled also looks similar. In 2011, Pemex planned to drill 32 exploration wells, and managed to stay on target during the year, drilling exactly the number of exploration wells planned; however, in 2012, while the company planned to drill 43 exploration wells, only 36 were drilled. In both years, Pemex drilled many more development wells than it had originally planned. In 2011, the actual number of development wells drilled was 973, compared to the 548 planned; in 2012, Pemex almost doubled the number of wells drilled when compared to its plan, from 677 to 1260.

The number of wells completed during this time also correlates with the number of wells drilled, and shows a level of consistency year-on-year. In 2011, Pemex completed 33 exploration wells, having planned to complete 34, and in 2012, it completed 37 wells, compared to the planned 44. In 2011, 1001 development wells were completed, once again higher than the planned number of 713, and in 2012, 1201 development wells were completed, again higher than the planned number of 789.

It is important to remember that the number of wells drilled is not on its own an indicator of success for an oil and gas company: those wells have to be productive and drilled with purpose. Indeed, Pemex has been criticized in the past for rushing into drilling wells without a sustainable plan in place for exploitation. This happened in 2010 with Chicontepec. Mexico's upstream regulator, the CNH, published a report which criticized Pemex for drilling too quickly at Chicontepec, instead of trying to optimize production at its already-drilled wells at the project. Pemex says that it has now learned from past mistakes, and indeed, drilling at Chicontepec did decline following the publication of the report. From drilling 794 wells in 2009, by 2012 this number had dropped to 642 wells drilled. The increase in the number of unconventional wells, predominantly horizontal wells, and the growing use of casing drilling technology has increased the complexity of drilling activity and thereby resulted in a reduction of the number of wells drilled per rig at Chicontepec, which has gone from 19.9 in 2011 to 18 in 2012, despite increases in drilling efficiency.

Pemex officials often discuss the impact of rig availability on reaching drilling targets, but when comparing the 2012 plan with the results for the year, the company managed to reach and surpass its targets with the equipment available.

EXPLORATION WELLS DRILLED ACTUAL VS PLANNED



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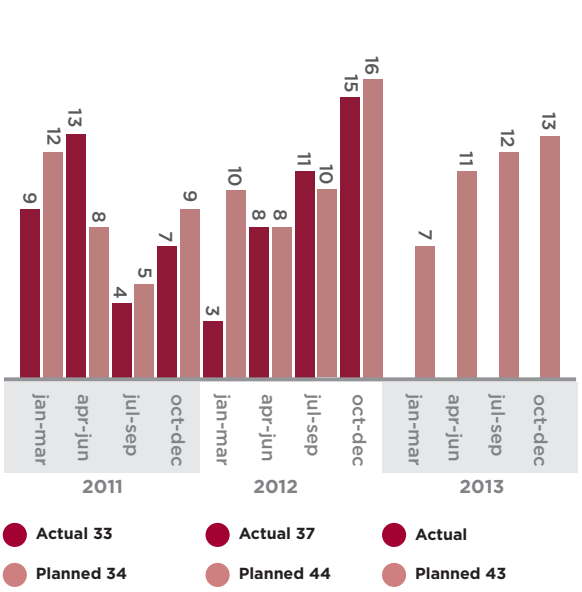


Source: CNH

EVOLUTION OF MEXICO'S DRILLING EFFICIENCY

In 2012, Pemex improved its drilling efficiency. At the national level, taking into account both exploration and development wells, Pemex drilled a total of 1,296 wells with an average of 136 drilling units in 2012, which means that on average, each drilling unit drilled 9.5 wells during the course of the year. This represents an increase of eight units and 291 wells in comparison to 2011, a year in which the ratio was of only 7.9 wells drilled per unit.

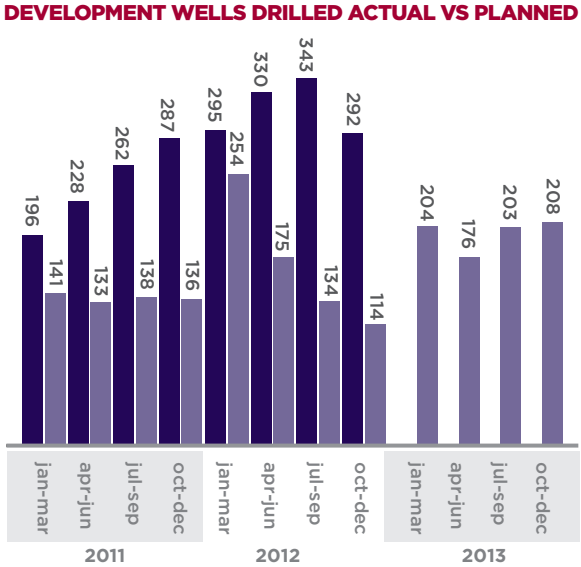
When broken down into exploration drilling and development drilling, Pemex's units drilled an average of 2.1 exploration wells during 2012, while units dedicated to development drilled 10.6 wells on average. Certainly, drilling was overwhelmingly focused on development during the past year. Whereas an average of 17 drilling units were dedicated to exploration throughout 2012 - with five operating offshore and 12 onshore - 119 units were dedicated to drilling development wells. In sum, Pemex devoted 87.5% of its drilling units to development projects in 2012, and 97.2% of the wells drilled by the company were development wells.

Pemex's development division's results were broken down by the CNH to compare drilling times at each of the company's main development projects. Drilling units at Chicontepec were the most efficient, with each unit drilling an average of 18 wells per year. Burgos saw the second largest number of wells drilled per drilling unit: an average of 16.9 wells. At Cantarell, 16 development wells were drilled by an average of eight drilling units over the year, although the variation in the number of drilling units throughout the year means that the average wells drilled per unit stands at 1.9. Ku-Maloob-Zaap saw a slightly higher efficiency, with an annual average of six units drilling 14 wells throughout the year, leading to an average of 2.4 wells per unit.

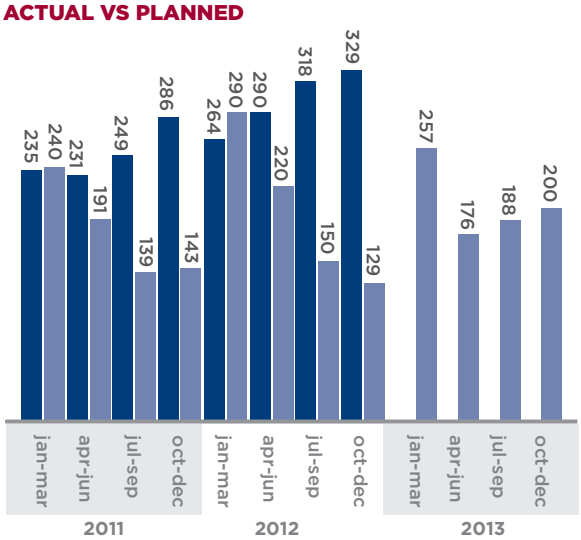
In Pemex's southeastern marine region, drilling took place at 1.6 wells per unit on average: a mean number of nine drilling units throughout the year drilled a total of 14 wells. In Pemex's southern region, an average of 33 drilling units were in operation during the year. In total, they drilled 229 development wells, leading to an average number of wells per unit of 6.9. The remaining wells drilled for the year are grouped together by the CNH, adding up to a total of 149 wells drilled by an average of 15 drilling units. This led to an average of 9.8 wells drilled per unit.

Another factor for measuring drilling performance is the number of days taken to complete each well. On average, exploration wells were completed in 155 days in 2012, while development wells took an average of 34 days to be completed. Each well drilled at both Chicontepec and Burgos during the year took only 23 days to drill. However, at Cantarell, this number increases to 117 days per well, and at Ku-Maloob-Zaap, it took an average of 125 days. In the Southeastern Marine region, the average well took 222 days to drill, while in Pemex's southern region, the average development well took 51 days to drill. Nevertheless, completed offshore wells generated a larger initial oil output, thus compensating for the added drilling time and cost entailed. Whereas onshore wells produced an initial output of 307 b/d during 2012, offshore wells generated an initial production of 4,917 b/d.

DEVELOPMENT WELLS DRILLED ACTUAL VS PLANNED



DEVELOPMENT WELLS COMPLETED ACTUAL VS PLANNED



Source: CNH

JACK-UP RIGS

Jack-up rigs are one of two types of bottom-supported Mobile Offshore Drilling Units (MODUs) currently available for exploration and development of offshore oil and gas reservoirs. There are two types of jack-up rig: the independent-leg rig, which usually has three legs with a lattice construction, and the mat type, which usually has its legs attached to a large mat resting on the seabed. Jack-up rigs started being used in 1954 and are relatively motion-free because their legs are anchored to the seabed. At the same time, they offer mobility because they can easily be towed by tugboats or barges, although some have self-propulsion capabilities. Besides stability and mobility, modern jack-up rigs offer various advantages over platform rigs; they are easily upgraded by converting slot to cantilever units, their legs can be smoothly strengthened with more preload tanks, they have the ability to adapt to current environmental standards, they are relatively inexpensive to move, and due to their numbers, they are readily available worldwide.

Even though jack-up rigs were originally invented for shallow water, with a maximum water depth of 107m, modern technology has allowed companies to modernize and create jack-ups with the ability to drill and develop wells of up to 168m. However, as water depth increases beyond this level, semisubmersibles and drillships become a better option. After the catastrophic events of the Usumacinta Jack-Up in the Bay of Campeche in 2007, where a mat-supported jack-up up rig broke well valves that led to 21 reported deaths, Pemex only operates independent-leg rigs. Currently, the NOC operates 46 offshore drilling rigs; five semi-submersibles, five platform rigs, and 36 independent-leg jack-up rigs.

PLATFORM RIGS

Platform rigs, unlike semisubmersibles, jack-up rigs, and drillships, are fixed atop offshore wells. This is usually achieved through a jacketed spar, tension leg platform (TLP), or gravity structure. Furthermore, unlike other exploration, development, and production infrastructure, most platform rigs are completely self-sufficient, with self-contained units that include power plants, crew accommodation, drilling equipment, life-saving equipment, and auxiliary services. However, there are various issues that need to be taken into consideration before deciding to use or build a fixed platform rig. The first and most important aspect is what specific type of fixed platform will be required: a modular fixed platform, a conventional standard platform, or a self-erecting, self-loading, and highly modularized platform.

Beside this decision, operators should always acknowledge whether the platform includes all the necessary items such as drilling mud, operator fixed items, liquids, portable tools, live loads, hook, setback, rotary table, storage, and expendable items like bulk casing and operator supplies. Additionally, since fixed platform rigs are static structures, operators should consider the cost of mobilization and construction, since once they are built they need to be broken down for shipment and mobilization. However, fixed platform rigs are cheaper to operate than jack-up rigs; therefore, operators usually opt for fixed platform rigs when there are multiple wells to drill, even though water depth, global jack-up availability and rates, and the mobilization cost and time are vital factors in the decision between using jack-up rigs and fixed platform rigs.

THE BUSINESS CASE FOR THE SELF ERECTING MODULAR RIG

There are only a handful of Mexican companies operating rigs in the Gulf of Mexico. This is mainly due to the lack of experience they have had in performing operating roles in their drilling contracts with Pemex. Grupo Goimar – a Mexican drilling company based in Monterrey with an operating office in Ciudad del Carmen – has acquired the necessary understanding through international partnerships in order to provide Pemex with operating skills and the latest technology for the NOC's drilling demands.

"Our first operational experience was alongside Maersk Contractors with the semisubmersible rig KanTan IV, owned by Sinopec," recalls Yann Kirsch, VP of Business Development & Strategic Planning of Goimar. With this knowledge in hand, Goimar was able to perform as operator for several drilling projects in the Mexican market for Pemex. These included a contract to operate four 2,000 hp platform rigs owned by China Oilfield Services Ltd. (COSL), and another to operate the semisubmersible rig Zagreb I, owned by Croatian company Crosco. "Due to these experiences, Goimar has been able to develop a team of highly qualified and certified personnel operating our fleet. We also provide privately-owned drilling companies with human resources for their drilling, and maintenance operations," Kirsch proudly states.

By developing the experience and skills needed to become one of the Mexican operators in the drilling market and having proved its operating capabilities with the 114m COSL Confidence, COSL 936, and 106m Sandunga, Goimar is now looking to build a preeminent national fleet to address Pemex's drilling demands. "We anticipated the need of Pemex for modular rigs since 2009," Kirsch explains. "Pemex is still drilling in shallow waters, but its drilling activities have become more complex, therefore better drilling proficiency is needed." To accomplish this, Goimar pioneered the idea of a brand-new, self-erecting, state-of-the-art, 3,000hp modular rig, with capacity to drill up to 10,600m, called GX-10. "We hired Houston-based Zentech, Inc. and invested to create the design, which was not only well received by Pemex, but also got the Inovatec award – handed out by Conacyt for technological innovations that boost business competitiveness – and with it a representative funding amount," Kirsch points out.

The GX-10 will be competing with several other modular rigs in the coming Pemex tenders for drilling contract. "The advantages that the GX-10 brings are related to its self-erecting design," Kirsch explains. "Normally, in order to put the rig on top of the jacket, you need a crane vessel large enough to transport or move the heavy modules. Our rig is 50tonnes per module, but since it erects itself, no crane barges are needed and this expense is avoided." Goimar's self-erecting GX-10 rig can offer both a speed and cost advantage over heavier rigs during installation. "The GX-10 can self-erect in 35 days. Although heavier rigs can be raised in a similar amount of time, the difference is that Pemex then also needs to spend on a crane barge to lift the rig into place," Kirsch explains. "If we use the same crane barge to install the GX-10, it would only take us 15 days to do so."

Goimar has been able to internalize its operating experience to provide Pemex with cutting-edge drilling rigs to satisfy its drilling demands. The ability of Goimar to use operating experience in combination with knowledge garnered of the Mexican oil and gas business to facilitate the creation of the first of many drilling rigs to satisfy the NOC's demands is good news for Pemex as it tries to catch up on its delayed drilling program due to limited rig availability.

ORO NEGRO BUYS DRILLING COMPANY AS FIRST ACQUISITION

GONZALO GIL WHITE
CEO of Oro Negro

Q: How has Oro Negro evolved from an investing outfit to an established operating company over the past year?

A: We have been primarily building up our management team with the best and most talented people specializing in different fields, and have been executing our business plan to become an integrated and diverse oil and gas company through acquisitions. We began this process by acquiring TODCO (The Offshore Drilling Company), a wholly owned subsidiary of Hercules Offshore, a company based in Houston, Texas. TODCO, at the time of the acquisition, had one platform rig under contract with Pemex. Subsequently, we acquired two premium jack-ups under construction at Keppel FELS Shipyard from a company called Jasper Investments. The first rig was delivered in November and the second one will be delivered in May, 2013. Thereafter, we acquired two additional premium jack-ups from PPL Shipyard, with delivery dates scheduled for December 2013 and March 2014.

Q: For what specific reasons did you acquire TODCO?

A: We bought the company for a variety of reasons, the first being its outstanding management team and its record for operating the rig with the best utilization rate in Mexico. We were able to retain 100% of the personnel upon the acquisition, thus absorbing a cohesive operational setup with an excellent track record and great scalability. The second strategic reason behind the TODCO acquisition is the prequalification status with Pemex that Oro Negro achieved as a result of the acquisition, enabling the company to market and operate drilling assets to Pemex going forward.

Q: What do you see as the main challenges in introducing state-of-the-art ultra-deepwater units such as drillships in the Mexican market?

A: The key challenge, in my opinion, is the timing of the decision from Pemex to contract the asset(s) in the marketplace. It is inevitable that the Mexican deepwater reservoirs, which today account for over 40% of 2P reserves, will be developed in the future; however, the prioritization of the investment budget will determine the pace of development given the significant higher costs when compared to shallow waters and onshore reservoirs. With respect to the contract assignment process, I would expect Pemex to look for the highest standards of safety and efficiency in selecting the asset and having a proven operator. The timeframe in which Pemex will award such contracts depends on the format that Pemex utilizes tender process or direct assignment. We are convinced about the long-term demand for the asset class and, in the same spirit that drove the acquisition of our jack-up fleet, we are prepared to invest in securing availability for Pemex of state-of-the-art ultra-deepwater units. The characteristics of our deepwater reservoirs demand assets that can operate at significant water depths and being in a hurricane-prone environment, the mobility of drillships will, in our view, make them the preferred asset class for exploration and development.

Q: What are Oro Negro's ambitions for the future in terms of deepwater drilling and offshore logistics services for deepwater?

A: We have been analyzing investments in assets that are tailored to Mexican requirements and that have certain differentiating aspects that could prove critical in accelerating the development of Mexico's deepwater potential. In addition, we are in advanced conversations with an established operator to jointly pursue the offshore logistics requirements for deepwater exploration and development. The combined asset base and expertise will allow us to offer our client an integrated solution that minimizes development time and increases the net present value of the reservoir. Our approach to offshore logistics is no different than our approach to drilling in the sense that we see opportunities in both shallow water as well as deepwater solutions. There is a significant potential in the development of our shallow water new discoveries that will require multipurpose construction and supply vessels, among others.

Q: In addition to shallow water drilling with TODCO, deepwater drilling with a partner to be defined, and shallow water and deepwater logistics, are there other areas you would like to add to this portfolio of priorities?

A: Yes, we participated in one of the rounds for the incentive-based contracts, in particular an offshore field. It is certainly one of the areas that interest us and to that end we are engaging in discussions with a company that has proprietary technology and processes for enhanced recovery to form a

joint venture to pursue opportunities in the Mexican market. In addition to the attractiveness of the business model inherent in incentive based contracts for mature and marginal fields, we see potential for vertical integration.

Q: What are the main differences between Oro Negro and established drilling companies such as Grupo R?

A: Grupo R is a well-established company that has been in the business for a long time. They have been very successful and are a very well-run company, so I think there are a lot of things that we could and should emulate from their operations. They understand Pemex and have the capacity of investing in the assets that Pemex requires to meet its production objectives. I would say that Oro Negro is different in the sense that it is a much younger company; that it has developed its expertise through acquisitions rather than through an organic approach; and that it is structured as an institutional platform rather than as a family-run business.

Q: How does the relationship between Oro Negro and Navix function?

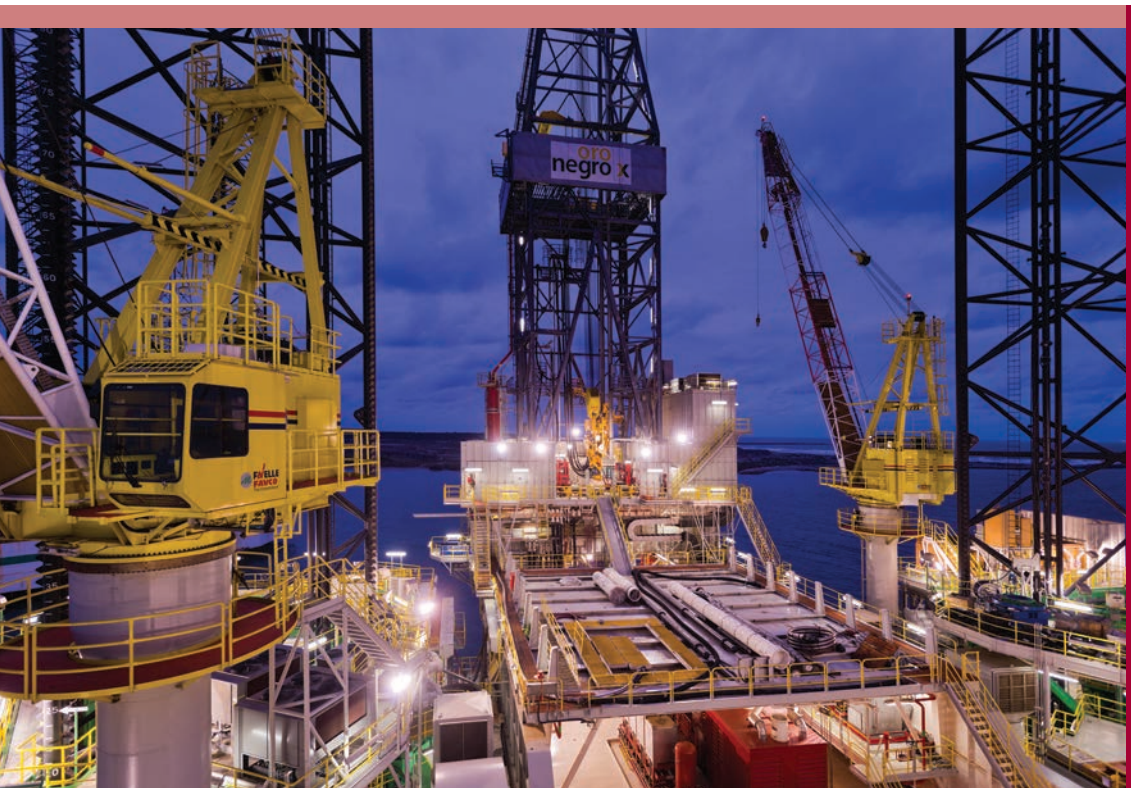
A: We are very fortunate that we have fantastic management teams in both companies. In the case of Navix, my involvement is less on day-to-day operations and more on a strategic function. We created an Executive Committee – which I preside over – that is tasked with managing the relationship with our funding sources, charting the growth of the company, and overseeing the management. In addition, I continue to participate in the board of directors and the key operating committees, including, among others, the credit committee. In Oro Negro we are in constant flux as the company evolves from an investing outfit to an established operating company. The most important aspect of my role is to incorporate the management skill-set that is consistent with the quality of the assets that we acquire. The TODCO acquisition has made this transition easier and we continue to add talent with operating track record on par with the acquisition of assets.

Q: How do you avoid conflicts of interest between Oro Negro and other companies financed by Navix that are also competing for contracts with Pemex?

A: Even though there might be some overlap that could potentially create a conflict, the universe of service companies that we finance in Navix is very vast and Oro Negro only focuses on very select areas of a much higher profile, so it would be very rare to see a potential competitor of Oro Negro being financed by Navix. Secondly, we manage these companies independently, so it helps that people are very clear with respects to their fiduciary duties to make sure that not even the appearance of conflict is present.

Q: What are the possible changes that the new federal government may bring to the energy sector?

A: We do not do political speculation, but what we do see is an investment trend in Pemex that is really inelastic due to its high correlation with the fiscal health of the country. It is a very exciting time in the industry because there are a lot of prospective resources, not only in terms of deepwater, shallow water, and conventional resources, but we also have unconventional resources such as liquid gas, shale gas, and shale oil. We are pleasantly surprised with the new administration and their campaign promises, being very vocal about the importance of the energy sector and trying to find mechanisms to attract more investment, but I cannot predict what specific policies will come out of it.



ABOUT ORO NEGRO

Oro Negro started operations in February 2012 to become an integrating and diversified Mexican oil service company. Its strategy is based on acquiring controlling interests in operating companies and strategic standalone assets and contracts in the oil and gas services sector. Oro Negro's first acquisition was Todco Mexico, an operator of drilling rigs that currently has rigs under contract with Pemex, which was acquired for approximately US$36 million.

IAMSA

ACTIVEPOWER

GREEN economically

RELIABLE inherently

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En Ingeniería Autoeléctrica Martínez, S.A. de C.V. (IAMSA), somos un equipo de Ingenieros, Técnicos y Expertos en materia de calidad de energía y sistemas cero cortes.

Nuestro Sistema Cero Cortes y de Calidad de Energía alimentará su industria con energía de calidad, evitando interrupciones para garantizar que su proceso de producción esté libre de problemas y variaciones que se reciben de la red eléctrica, proporcionando energía confiable y de calidad.

Nuestros sistemas cero cortes y de calidad de energía además:

- No contribuyen al contenido armónico a la línea de suministro de energía
- Eliminan la distorsión armónica de las cargas a <3% THD y <8% THD
- Corrigen el factor de potencia a valor unitario (0.99) en el lado de entrada de la línea de suministro de energía
- Menos emisión térmica (25,300 BTU, 7.5kW), la mitad de un UPS de doble conversión
- Soporte de temperatura ambiental entre –10°C y 40°C
- Tienen un tiempo máximo de recarga del acumulador de energía de 2.5 minutos
- No producen emisión de gases tóxicos, contaminantes, corrosivos y explosivos
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PERFORMANCE-DRIVEN ONSHORE DRILLING

With the decline of Cantarell, the role of drilling companies in Mexico has started to shift onshore, with one of Pemex's main drilling priorities today being gaining access to heavy oil at mature onshore fields. César Vera Méndez, Country Director of Nabors México, believes the way of getting that production back is through performance-driven contracts for drilling companies at these projects.

"For Nabors, Mexico is the second largest market outside the US, after Saudi Arabia," Vera Méndez explains. "This stems not only from a turnover perspective, or because of the number of rigs that we currently have in Mexico, but also because of the stability provided to the company from having a secure investment in the country with the high level of commitment that comes with it."

"Drilling companies need to be measured on performance, and really provide additional value in terms of optimized drilling times and, thus, earlier production"

César Vera Méndez, Area Manager at Nabors Industries

Nabors is mostly known for its onshore capabilities, and Vera Méndez still believes in the growth potential for this sector, especially now that Pemex has had to look elsewhere to replace the production missing from Cantarell's decline. "Onshore areas in Mexico have potential both now and for the future. They just need different technical approaches for development." The approach that he suggests as the most adequate includes an incentive-based component to measure the real added value that drilling companies bring to the operation. "Drilling companies need to be measured on performance, and really provide additional value in terms of optimized drilling times and, thus, earlier production," Vera Méndez explains. "Nabors can participate in providing true performance that raises the effectiveness of Pemex's drilling plans. Whenever the opportunity exists to be measured on performance, and provide additional value in terms of shorter drilling times, we are willing to participate with solid technological and operational advantages under high safety standards and performance guidelines."

For these performance-driven operations, Vera Méndez believes that automated drilling will be of assistance. "It doesn't mean that drill operators are becoming redundant. The difference lies in that, instead of concentrating on handling the machinery, they will be able to focus on the way the operation takes place and when to intervene." The technology that Nabors is offering could provide up to 30% savings in drilling time, and also cause less damage to the drill bits. "This would extend the life of the drill bits, and, increase the ROP (rate of penetration), while minimizing the error and maximizing the utilization of the torque drive and the power on the engines," he explains.

Vera Méndez emphasizes that his company's rigs have this technology already built in, and it is up to their clients to properly recognize it and utilize it. "Nabors' precision service can be brought to Mexico immediately. The equipment already has the performance-based tools needed for it. It has certified quality, proper performance, and it is going to get the job done, for a specific market segment that does not necessarily compete head-to-head with the existing service companies." Nevertheless, he understands that Pemex is a large corporation that has specific processes to follow. "They are going to work as the requirements come up, with a slow-paced progression towards a real cost-benefit scheme based on performance."

At the same time, the introduction of the integrated service contracts offers new opportunities for drilling companies. Vera Méndez believes that Nabors should be working together with the private sector companies that are now operating in Mexico, in order to develop fields in the most effective way possible. "When I talk about performance, I do not ascribe to trying to compete with other companies to prove what each of us can do – which eventually are variants of the same. Performance refers to working with them, and alongside them, to meet the common objective of developing the fields in question. That way, we can not only provide rigs, but also services such as fracking, cementing, directional drilling, or coiled tubing. We can therefore provide earlier production in a shorter time." In Vera Méndez's opinion, this would account for greater benefits for all of the companies, obtaining incentives for doing their work correctly, and better oil production for both Pemex and its new private sector partners.

DATA TRANSMISSION FOR HIGH TEMPERATURE WELLS

For decades, oil companies used the knowledge of geologists to try and understand the conditions surrounding the drill bit, but today, IOC's are using a state-of-the-art technology known as measurement while drilling (MWD). This innovative technology gives drilling companies and engineers the ability to measure, the density, porosity, resistivity, acoustic-caliper, magnetic resonance, and formation pressure of a well while drilling, as well as the inclination of the drill bit. These measurements, which were usually acquired at different phases of the drilling process with logging while drilling (LWD) technology, have allowed drilling companies to drill more accurate, faster, and safer wells by delivering the real-time data at transmission rates quadruple the industry standard.

The main challenge for drilling companies is not the invention of measuring technologies, but rather creating devices with the ability to withstand immense pressures and extremely high temperatures. Over the last decade, the oil and gas industry has begun to focus on deepwater drilling, and with new oil discoveries in deepwater wells, oilfield service providers and drilling companies have created different instruments that can withstand these severe conditions. For example, Schlumberger has created two plastic board-mounted electronic components that are capable of withstanding high temperatures: a plastic-encapsulated and a ceramic-encapsulated electronic component. The plastic-encapsulated electronic component has a life expectancy of 1,000 hours at 150°C and 100 hours at 175°C, while the ceramic-encapsulated electronic component, which was designed for the US military, lasts longer at 175°C, but is larger and heavier; therefore, since space is limited in the drill bit, the ideal solution is to have a MWD encapsulated component made of a mixture of ceramic and plastic.

Schlumberger has made a large investment in the last eight years to develop electronic components that could potentially withstand high downhole temperatures of up to 200°C, but field testing is ongoing in order to meet the high expectations of customers in the deepwater drilling sector. Besides Schlumberger's data transmission technology for high temperature wells, Baker Hughes also offers such solutions with its SMART Intervention technology. This innovative solution for data transmission, claims Baker Hughes, combines drilling optimization, real-time downhole measurements, and closed-loop process control, delivering a better understanding of what is happening at the business end of an intervention bottom-hole activity (BHA). Furthermore, this technology allows clients to make informed and on-time decisions that lead to the optimization of well intervention operations, not only reducing non-productive time (NPT), but also risk exposure.

Baker Hughes SMART Intervention service functions with a downhole data acquisition tool called SENTIO. The tool has sensors that acquire static measurements, digitalizes and analyzes the data acquired through the sensors, and then sends the data to a rig-floor display screen at the surface or to a remote real-time operations center. Despite being able to send information directly to the surface, the SENTIO tool has the ability to store and record data in the on-board memory, giving operators the ability to retrieve it at the surface for further evaluation.

Halliburton also offers data transmission for high temperature wells; however, their product, the Electromagnetic Telemetry Technology (EMT), works without fluids. Halliburton explains it created this product because "the downhole rocks are so brittle that their natural fractures alone cause significant fluid loss that could potentially affect mud pulse technology, and if telemetry signals disappear because of a fluid loss, the operator is suddenly working blind." Therefore, Halliburton's EMT MWD/LWD technology allows operators to have a two-way communication link between the surface and the tool downhole and by using low-frequency electromagnetic wave propagation, the EMT facilitates high-speed data transmission to and from the surface through any rock formation. Furthermore, the EMT provides a cost-effective alternative to pulse systems and makes drilling operations more cost-effective, which, according to Halliburton, "is another key differentiator from other data transmission services on the market."

Baker Hughes, Schlumberger, and Halliburton's data transmission solutions for high temperature wells allow operators to better understand well environment, offers them solutions for well intervention situations, and help optimize drilling operations and ultimately reduce risk while drilling. Their value proposition could be a good match with Pemex's drilling ambitions. According to Carlos Morales Gil, Director General of Pemex Exploration and Production, his division will keep focusing on the niche of high-pressure, high-temperature wells, with the continuing help of service providers, while wells that require a different type of expertise will be handled by specialized drilling companies.

DRILLING DATA MANAGEMENT

As the age of easy oil in Mexico is coming to an end, exploration and production activity is gradually moving to new frontiers. This not only requires the introduction of innovative technologies, but Mexico's production decline also created a sense of urgency to discover new reserves and reduce time to first oil. In response to these challenges, Petrolink has created the Mexico Software Development Program that decreases the time between exploration and production by tailoring IT applications to enhance information availability in the drilling process.

"At the end of the day, we save time and money for everyone involved in drilling operations, not only operators"

Pablo Pérez, Executive VP of Business Development at Petrolink

"The drilling process presents a series of important challenges for the oil industry, since it is the core operation behind oil production," says Adrehny León, Engineering Supervisor of Petrolink. "Drilling locations and objectives have become more complex with time. This has forced companies in the drilling market to gather different methods and technologies through new practices and software applications to optimize the entire process." All this is enabled by the analysis information, which companies such as Petrolink provide.

"As a neutral and independent player, our objective in the Mexican oil and gas industry is to collect, display, and maximize the benefits of the data acquired," explains Pablo Pérez, Executive VP for Business Development and former Country Manager Mexico of Petrolink. "Our company provides data and engineering technical support in a way that every decision made can be taken with the sights set on attaining planned geological objectives, keeping the well's integrity in its mechanical state, and reaching the volumetric success that the well is committed to," adds León.

In order to provide companies with the basics needed to optimize their decision-making process, data needs to fulfill two different qualities: it needs to be well integrated, and has to be expedited into relevant information sets that can be interpreted by any company. "Integration plays a vital role, since an emphasized set of data serves as the foundation for the decision-making process," Armando Almeida, Chief District of Reforma-Comalcalco-Cárdenas of Petrolink describes. "At Petrolink, we collect the data, process it, and integrate it into data sets that are sent to the engineering division. Our team of engineers then analyzes it and turns it into focused information related to clients' objectives of reducing drilling time."

The ability to convey the meaning of that information constitutes the second step in Petrolink's purpose. "The quality of interpretability in information plays a crucial role in the ability of our clients to analyze data in a timely manner and use it for predictions and geomodeling," Pablo Pérez explains. "We are very committed to XML language – which is an industry data standard coordinated by Energistics – and this allows us to share information in an easy way for our clients to understand it, since the standard is free and is the dominating meta-language in business data management. Sharing might be challenging, since we are in a very competitive market, but we believe that most companies are open to data exchange and cooperation. This leads us to believe that cooperation is beneficial for everyone in the business," he says.

Enhanced access to drilling data through easily interpretable information sets also has implications for how Pemex can best face the current and upcoming challenges in deepwater. "We have experience in deepwater in the Gulf of Mexico and other locations in Europe, which is why we have deployed the Mexico Software Development Program," Pérez describes. "We have identified the cost savings that the implementation of our integrated services for running real-time operation centers could have on deepwater. We could help clients save somewhere around 1% of their budget in deepwater operations. The savings opportunity is massive if you consider that a couple of days of operations offshore could end up costing US$1 million."

"The future for Petrolink is related to innovating and applying knowledge and technology in an efficient and profitable way, so clients can get added-value in the way they face new extraction challenges." Samuel Pérez, Operations Manager Mexico of Petrolink concludes. "We want to collaborate more with Pemex and other Mexican companies to help develop knowledge and facilitate training and education, because at the end of the day our core business is technology as a means to foster the growth of the Mexican oil and gas market and find new opportunities," adds Pablo Pérez.

TELECOIL DOWNHOLE COMMUNICATION SYSTEM

TeleCoil Downhole Communication System is a technology patented and developed by Baker Hughes that focuses on maximizing coiled tubing operational efficiency. Coiled tubing, which is commonly used in drilling and well intervention operations, is a continuous tube, composed of steel or composite, with enough flexibility to be carried on a reel and inserted into a producing well. Usually, coiled tubing is composed of an injector, a control console, a power supply, and a well control stack, and is regarded as the most cost and time-effective mechanism for well intervention since it allows for successful well operations without removing the tubing. Additionally, coiled tubing has three main advantages over conventional straight tubing. First and foremost, it does not need to be screwed together; second, it does not require a workover rig; and third, since coiled tubing is inserted directly into the well while production is ongoing, it has the ability to withstand drastic changes in temperature and pressure. Baker Hughes' TeleCoil Downhole Communication System not only improves the efficiency, accuracy, and safety of conventional operations, but also enables downhole operations that were previously impossible.

The TeleCoil Downhole Communication System, which took Baker Hughes about five years to develop, consists of a bottom hole assembly (BHA) mechanism with a non-intrusive wire installed inside the coiled tubing, which allows operators to have real-time data on changes in temperature and pressure inside the well. It also maximizes the efficiency of coiled tubing operations by transmitting the depth accuracy needed for precision applications such as perforation and zonal isolation, using its real-time collar location. Furthermore, using the transmitted temperature, pressure, and depth information, this innovative technology allows operators to optimize milling, stimulation, cleanouts, sand removal, debris removal, and gas lifting operations in a well.

The TeleCoil system functions with the use of a conductor that is preinstalled inside the coil tubing and can withstand any type of aggressive or destructive liquids such as acids, cement, and sand slurries. Besides the normal conductor, the TeleCoil Downhole Communication System has a small diameter conductor with the ability to endure heavy drops in pumping pressure along the coil and reel weight. Baker Hughes claims the conductor is well protected, since the TeleCoil conductor's protective jacket is sized for the necessary strength and stiffness to withstand dynamic

TeleCoil Downhole Communication System applied at an onshore well in Taranaki, New Zealand, saved the operator more than 15 hours of operating time by modifying logging parameters and avoiding miss-runs due to inoperable tools.

tension and compression forces encountered during spooling and pumping operations. Moreover, another advantage of the TeleCoil Downhole Communication System is that it can be installed in the field in a matter of minutes. This is the case because the standard end fittings and attaches connected to the BHA are mechanical and electrical quick connectors.

The TeleCoil Downhole Communication System was such an innovative and groundbreaking technological development that the Offshore Technology Conference (OTC) awarded Baker Hughes with the 2012 Spotlight on New Technology Award. According to OTC (which gives awards to offshore exploration and production companies in the oil and gas industry), Baker Hughes was recognized because the technology was original, groundbreaking and capable of revolutionizing the offshore E&P industry: "It was proven through full-scale application or successful prototype testing, it had appeal from broad sections of the industry, and because it provided significant benefits beyond existing technologies."

"The TeleCoil Downhole Communication System is such a neat technology because it can be left up to the imaginations of the tool-builders to design tools that can be used with the technology. It's like having a power source downhole," says Luis Moncada, Vice President of Baker Hughes' Mexico Geomarket. The technology has been already used in the North Sea, the Middle East, the Far East, and Russia's Caspian Sea. Baker Hughes is currently attempting to implement it at projects in the Gulf of Mexico.

STANDARDIZING DATA EXCHANGE

"Open data exchange standards are the methodology through which operators and vendors in the oil and gas industry exchange information from a drilling rig to the beach or from a production platform to the back end system," explains Jerry Hubbard, President & CEO of global nonprofit Energistics. Open data exchange standards have become a vital tool for the oil and gas industry because they standardize the structure of information allowing operators to avoid any additional labor to reconfigure the data needed to make real-time decisions.

"Pemex has employed it in offshore and onshore fields, and they have downloaded some contractual language that allows operators working in the country to apply WITSML"

Jerry Hubbard, President & CEO of Energistics

"Energistics has grown to encompass 116 corporate members that collaborate to develop open standards for the oil and gas industry. Our members volunteer on specific tasks to develop the business process for standardization and then pilot the new standards. After they have come up with a solution, we do the coding and – if the industry accepts it – we then provide it for free at our website and anyone can download and embed it into their products," explains Hubbard.

In essence, Energistics provides a facilitated, anti-trust mechanism to ensure data is exchanged in a structured and standardized manner. In order to achieve this, the Energistics community created standards with the ability to accept data from WITS 0 - which is an older standard - by WITSML, and make the exchange within WITSML back to their real time operation centers (RTOCs). However, WITSML has been so successful that, "currently there are a number of companies who are starting to collect the data in WITSML – which eliminates the initial conversion – and makes it much more efficient by allowing the use of the data on the rig without any transfer back and forth," Hubbard says.

Open data exchange standards not only allows vendors and operators to exchange and acquire standardized data, it also facilitates the interaction between operators and regulatory agencies. "These standards, once they are adopted, allow the sliding of information between both parties not just for drilling or technical information, but also for platform production information," argues Hubbard. Additionally, on the regulatory side, the use of open data exchange standards offered by Energistics give an opportunity to provide daily reports in an XML format – meaning it can be sent from machine to machine – as opposed to having human intervention, where quality could be potentially lost.

Mexico offers a great opportunity for Energistics because Pemex has already adopted the use of WITSML in drilling standards. "They have utilized it in offshore and onshore fields, and they have downloaded some contractual language that allows operators working in Mexico to utilize WITSML," says Hubbard. With such a huge influence over the country's oil and gas sector, Pemex's adoption of the WITSML standard is an extremely positive step for Energistics in terms of the more widespread adoption of the standard in Mexico.

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BUILDING THE REPUTATION OF CHINESE DRILLING EQUIPMENT

Tony Solis, Vice President of International Sales & Operations for TSC Offshore

TSC Offshore started operating in Mexico in the beginning of 2013, bringing its products and services to the oil and gas industry. With a very confident entry strategy, the company expects to turn a profit in the next six to eight months and open three offices in the country. Nevertheless, the lack of a brand name and reputation are challenges TSC Offshore has to overcome in order to be successful in the Mexican market.

TSC, which stands for Total Solutions Company, is listed on the Hong Kong stock exchange and has been known as Emer International Group since 1995. The name was changed in 2008 with the purpose of better reflecting its core philosophy. Since then, TSC Offshore has become a global product and service provider to both the onshore and offshore drilling industries worldwide. While maintaining manufacturing capabilities in China at Qingdao and developing a new plant at Xi'an, TSC has become a global company with corporate offices in Houston and manufacturing facilities in China, UK and Brazil.

Identifying itself as an American company is crucial for TSC's entry in every new market. Back in 1995, the company started as a representative selling Chinese equipment in Houston. Solis acknowledges that this strategy was not very effective since it led to the purchase and reselling of poor quality equipment, which hurt the company's reputation in the US market. This called for a change of plan to focus on quality. The partners reinvested their profits into the company to acquire their own manufacturing facilities in China, hire engineers, and start making their own designs. "Our CEO always reinforces that we are an American company, we do manufacture in China, but our quality control processes are as good, if not better, than other American or international manufacturers," stresses Tony Solis, Vice President of International Sales & Operations for TSC Offshore.

With its eyes set on Latin America, among other emerging markets, TSC decided to bring Tony Solis on board. He has over 30 years of experience in NOV and is convinced TSC is ready to enter the Mexican market, because many potential customers in Mexico already are clients of the company in other regions, which makes it easier to start selling to them. Before starting operations in Mexico, TSC already had customers in the country that were managed from Houston. "Now we will be able to provide a local service," Solis explains. "Companies prefer to buy local. It does not matter if we offer them the best price from Houston; they do not have the time to wait for the product to get here and they are ready to pay the difference." Moreover, the company also has contact with distributors that have direct access to Pemex, such as Comincal and BZN. We are already selling our products to these companies, which also have strong ties with other contractors such as Weatherford and Halliburton," specifies Solis.

The company opened its first office in Ciudad del Carmen, which will be dedicated exclusively to offshore drilling, TSC plans to open another office in Villahermosa during the third quarter of this year, with the purpose of servicing onshore drilling projects in Tabasco, Chiapas and part of Veracruz. 2014 will see the opening of a third office in Poza Rica, focused 99% on onshore operations in Veracruz and parts of Tamaulipas while Tuxpan will serve to support offshore operations.

The company's incursion in Mexico looks like an easy market entry, but Solis is not overconfident. In his view, entering the Mexican oil and gas industry is not as simple as it sounds. On one side stand the US companies that import low quality Chinese products; on the other, supergiants like NOV that offer premium products. Solis sees TCS as a company that now leans towards the latter group, even if it is still small in comparison to its competitors. Even if the challenge of not having an established brand name still stands for TSC, the company has been gradually gaining a place in the industry in the past 24 months, thanks to collaborations with companies such as Seadrill, Noble, Transocean, and Nabors. These relationships have now become essential: they are a reference and a tool to make TSC's name known in the global oil and gas market.

Mexico is not only viewed as a potential market. With cost of manufacturing labor in China increasing each year, the possibility of opening a manufacturing facility in the country increases. "I was told when I came on board, that our cost of manufacturing is going to go up because, in a 2-3 year period, the wage increase is going to be something like 85% over what it was in 2012. All of a sudden, the advantages that Chinese manufacturing offered are not going to be there anymore. This will bring a more equal balance to the competition in this market." Solis also points out that Mexico fares very well in comparison to the US and China on labor costs, engineering, and construction in general: "As China's advantage slips away, Mexico has a great opportunity to stand out in the market."

SERVICING ONSHORE DRILLING CONTRACTORS

HUGO MORÁN
VP and General Manager, Latin America Business Unit, TESCO Corporation

Q: What drives Tesco's innovation process, how does the company select winning technologies, and to which extent do your clients participate in the process?

A: TESCO Corporation is offering technology and services to optimize drilling processes, always attempting to create increasing value for our clients. We use global field studies to develop technology, in which we identify opportunities for improvement from the point of view of operation and maintenance of drilling equipment. Afterwards, our research and development (R&D) department begins developing technologies at our fabrication center in Calgary, Canada, and our operational base in Houston, Texas. Essentially, the end product created by our R&D centers always strives to reduce drilling risk and damage to equipment and human capital, while at the same time reduce non-productive drilling times and costs.

Q: Which opportunities has the introduction of the integrated service contracts (ISCs) created for TESCO, and how do you expect this to develop in the future?

A: Pemex is our number one client, and we are extremely positive about the policies being implemented and the upcoming energy reform. Currently, we work with Pemex on developing and implementing new technologies to optimize onshore and offshore drilling operations. We have been able to offer an increasing range of services to Pemex in recent years as a result of the company's shift towards the application of state-of-the-art technologies.

In my opinion, the fact that Pemex is convinced of the need to strengthen its technological capabilities has increased the company's overall drilling performance. TESCO has been present along the way, offering state-of-the-art technology to improve drilling efficiency and reduce costs and risk. I have no doubt that due to these technologies Pemex has been able to optimize its drilling processes, reduce non-productive drilling times, and, most importantly, improve the safety of drilling operations. Demonstrating our commitment to working with Pemex, TESCO Corporation has its largest top drive fleet in Mexico, and we are also working on the automation, optimization, and mechanization of Pemex's drilling equipment in the Southern region. The new ISCs have allowed us to penetrate another market, tackle new challenges and opportunities, and find new clients. However, the benefit is mutual, since the ISCs have allowed Pemex to optimize its operations with the introduction of new technologies, which have been crucial in obtaining better drilling results.

Q: What are the main drilling challenges that Pemex is currently facing?

A: Pemex's main drilling challenges are reducing risk and becoming more efficient and flexible in drilling operations. In order to become more efficient, you must eliminate accidents, which in turn reduces drilling times and costs, adding value to your company. TESCO is completely focused in this area, which is our main competitive advantage in the drilling industry.

Q: What is your perspective on the success of the introduction of new drilling technology in Chicontepec, and which role is TESCO playing in the process?

A: Chicontepec will play an important part in Mexico's energy future. However, a lot of exploration, development, and production challenges will have to be overcome for the field to meet these high expectations. I personally believe Pemex is advancing in the right manner and taking the necessary steps to develop Chicontepec efficiently and turning it into the Pemex jewel it should be. TESCO Corporation made an important contribution to the progress made, in which horizontal wells and top drive technology played an important role.

DRILLING MARKET DYNAMICS

Frank Bernard, VP Latin America North for Calmena

Having worked in Mexico since 2003, Calmena, a Canadian drilling services company, has had a decade to adjust to the differences between the Canadian and the Mexican market. As Frank Bernard, Vice President Latin America North for Calmena, explains: "The business dynamics of North America and Latin America are completely different in many respects. First, the contracting models in the two regions are very diverse, and secondly, the community relationship challenges that you face as a drilling company are completely different between North America and Mexico. Dealing with personnel issues in Mexico has also been challenging for us. But after ten years we have evolved and adjusted and we now have workforces that are tuned to meet the demands of local operating conditions. Our recruitment, retention, and training programs have played a big role in shaping our fit-for-purpose, efficiency-based services across the board. We are all proud to work as part of one big team with a focus on keeping the customer ahead of the drilling curve whenever possible."

With two drilling rigs currently working in the Poza Rica area, and one in the Villahermosa region, Bernard explains that for Calmena, some of the biggest opportunities in Mexico will come from directional and horizontal drilling at Pemex's onshore fields, and the company has already been drilling horizontal and directional wells at the Ébano field in the Tampico-Misantla basin. Bernard believes that Calmena's opportunities to grow in Mexico will be greatly helped by the latest round of integrated service contracts (ISCs), which will be awarded in the Chicontepec basin later in 2013. "We see tremendous opportunities for two reasons: the number of wells that are due to be drilled at Chicontepec mean that efficient, effective drilling will be required. Also, these wells are within our optimal depth range means that we have the experience and track record to demonstrate performance for these types of wells, as Calmena is predominantly a medium-depth drilling company. Our efficiency bias, coupled with our international footprint means that we can take best practices learned in the volume based plays of North America, and apply the efficiencies to onshore field development programs in Mexico. We expect that many of the international oilfield service companies currently operating field labs in the region will be bidding in this year's third round of ISCs, which will bring a lot of possibilities for Calmena. We also see an opportunity to introduce our directional and horizontal drilling services to smaller companies like MPG, Pico and Grupo Diavaz."

The opportunities for the further development of the directional and horizontal drilling market is being driven by a new openness to alternative drilling technologies on the part of Pemex, according to Bernard. "In recent years, I have seen the Mexican market open to new drilling technologies, such as advancements in rotary steerable, logging while drilling, electromagnetic MWD, faster transmission rates, and underbalanced drilling. Calmena is very competitive with both our technology and our people. In any market, doing a good job with good people is half the battle."

| TECHNOLOGY SPOTLIGHT

HORIZONTAL DRILLING TECHNOLOGY

The first horizontal well was drilled in 1929 in Texon, Texas at a depth of around 500 feet (152.4m), when horizontal drilling did not really have any true practical applications. Nonetheless, due to the fact that most oil and gas reservoirs are more extensive in their horizontal dimensions than in their vertical thickness, horizontal drilling exposes more reservoir rock to the well bore and thus brings more financial and production benefits to oil and gas operators.

However, even though horizontal wells generally offer more benefits and a higher production rate than vertical wells, they come at a cost of around 300% more than vertical wells. For this reason, even though they offer more benefits, they are only used in places where vertical wells would not offer the production needed to make the well profitable. For example, in a reservoir with a high matrix permeability, no gas cap, and no water intrusion, drilling a horizontal well would not be recommended, because a vertical well would offer similar productivity at a lower cost. But if an oil reservoir has low matrix permeability and there is no potential gas and/or water interference, then a horizontal well could offer more profitability because it could increase well productivity by 2.5 to 7 times the rate of a vertical well.

In essence, horizontal drilling is the process of drilling a vertical well from the surface to a target just above the oil and/or gas reservoir – called the kickoff-point – and then

TOOL JOINTS AS A FOOTHOLD IN THE DRILLPIPE MARKET

Entering the market for drillpipe in Mexico has not been easy for Command Energy Services, a Canadian company specialized in drillpipe and drill stem accessories. Emilio Lanzagorta, Director General of Command Energy Services Mexico, explains that Tenaris Tamsa currently has the contract for supplying Pemex with all of its drillpipe. As a result, the company has had to think creatively about how to develop its business in the country. "As the market for drillpipe in Mexico is covered," Lanzagorta points out, "we had to look at different ways to gain a foothold in the market. The way that we have found to do this is through tool joints."

"The connection is also a lot easier and faster to make and break than the double shouldered connections already in the market"

Emilio Lanzagorta, Director General of Command Energy Services Mexico

Tool joints are drillpipe components, used to connect two pieces of pipe together. They are normally manufactured separately from the drillpipe, and later welded on. The standard for tool joints in the oil and gas industry is the API standard. "Command Energy developed Command Enhanced Torque (CET), a premium connection, successfully introduced into the Mexican market, double-shouldered to increase torque, and therefore ideal for directional drilling, or any situation where there is over-torque in the drillstring. The connection is also a lot easier and faster to make and break than the double shouldered connections already in the market," Lanzagorta says. Double-shouldered joints make for a solid fit into the female section of a drillpipe, with the nose of the pin touching the bottom of the box, or female part of the joint, creating a firm structure that is not found with API joints.

In order to get the tool joints introduced in Mexico, Lanzagorta is working with Tenaris Tamsa in an effort to get the product introduced into the company's catalogue.

Although Tenaris Tamsa has its own tool joints after the acquisition of Hydrill, Lanzagorta hopes that the similarities between the API tool joint and the Command Energy tool joint, as well as the advantages his companies joint offers, will make it tempting for Tenaris Tamsa to add it to the list of products they sell. "If we can make it into the market with our connection, we have the potential to grow very fast in Mexico: as well as just selling the product, we have the opportunity to develop a service business too," he says.

changing direction to penetrate the reservoir horizontally – called the entry-point – until the bottom-hole location is reached. The first section of the well is usually drilled using the same technique as a vertical well, where the drill string is rotated at the surface and consists of multiple joints of steel alloy drill pipe, drill collars, and the drill bit itself. However, in order to begin drilling the horizontal well the drill bit is rotated using a hydraulic motor and through a steerable downhole motor the steering of the hole is accomplished.

In order to make sure the well is being drilled in the right direction, depth, and at the right speed, downhole instrument packages that have azimuth sensors provide inclination and directional information and transmit the information wirelessly to the operator at the surface. These state-of-the-art sensors and mechanisms allow operators to calculate the exact position of the drill bit at all times, and depending on the types of sensors, they could also include information on the downhole environment, such as temperature, pressure, and weight, rotational speed, and torque of the drill bit.

Besides the financial and technological benefits of horizontal drilling, this technique also allows operators to develop oil and gas reservoirs with a significantly smaller number of wells, due to the fact that each horizontal well has the capability to drain a larger rock volume than a vertical well. Additionally, horizontal drilling also offers the benefit of reducing the footprint of oil and gas operations and they reduce production obstacles and challenges that may cause low production rates, low recovery efficiencies, and premature well abandonment.

BARITE PRODUCTION IN MEXICO

José Antonio Valdés Rodríguez, CEO of Petrovita

Drilling fluids are a vital part of any drilling operation. Normally containing suspended solids and emulsified water or oil, drilling fluids or drilling mud are primarily used to provide hydrostatic pressure to prevent naturally occurring liquids and gases (formation fluids) from entering the borehole, to keep the drill bit cool as it drills the well, and to carry out drill cuttings as they are created. In order to increase the overall density of drilling fluid, which ensures that formation fluids are kept out of the well by maintaining sufficient bottom hole pressure, a weighting agent is added to the fluid. Barite is commonly used in drilling fluid as this weighting agent. As a non-abrasive, heavy non-metallic mineral, barite is ideal for this application in powder form.

"There is no substitute for barite, and there is no substitute, technologically speaking, for drilling fluid," explains José Antonio Valdés Rodríguez, CEO of Petrovita. "The logistics involved in the production of barite and other raw materials, and the logistics involved in drilling fluids, are essential to the industry. Depending on the location of the well and other factors, drilling fluids account for between 10 to 15% of the total cost of drilling a well." Consumption of barite around the world has risen from 7 million tonnes per year in 2010 to 9 million tonnes per year today, which means that there is a need to develop production, according to Valdés Rodríguez, who also points out that particularities in the markets of China and India, two of the world's largest barite producers, have led costs to double, making domestic production increasingly attractive. By developing barite mines in Mexico, Petrovita hopes to be able to not only supply the demand for the non-metallic mineral in the domestic market, but also produce enough raw material for eventual export. Mexico is currently a net importer of barite, but Valdés Rodríguez believes that in the years to come, it will become a net exporter. "Many raw materials, for many years, have come from China to Mexico, because it was cheaper to get a line of credit and bring a container of barite from there, than to produce it here. Our group was the first to import barite from China, and now we are working to develop barite mining in Mexico."

As a one-time owner of a drilling fluids company, Valdés Rodríguez explains that the market today is simply too dominated by the global oilfield service companies for a mid-sized, nationally focused business to compete. "These companies have many other services, such as cementing, directional drilling and wireline services, which they can provide alongside supplying drilling fluids to operators. Given this, and the difficulty of doing business with Pemex, we decided to sell our drilling fluids supply business and focus on providing barite to our former competitors."

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OPTIMIZING PRODUCTION AT CHICONTEPEC

LUIS MONCADA
Vice President of Baker Hughes' Mexico Geomarket

Q: What have been Baker Hughes' main contributions to the improved drilling performance in Chicontepec?

A: We have been working in one of the five field labs that Pemex assigned to different companies in Chicontepec – the Corralillo Lab – and if you look at the statistics, our lab has been the most successful. The main contribution Baker Hughes made to this success is the great relationship we have with Pemex that enabled us to cooperate as an effective team. However, our real contribution is shifting the focus to production optimization based on obtaining a better understanding of the geology and geomechanics of the reservoirs in our field lab and identifying better drilling targets to increase productivity. In the end, we are breaking paradigms, since we now have wells that are producing over 1,000 b/d, which was unheard of a couple of years ago.

Q: What are the most successful technologies you have applied to optimize production at Chicontepec?

A: It was the combination of understanding the geology and geomechanics of the field and utilizing directional drilling, well completion technologies, multistage fracking, and other fracturing techniques. In essence, through fracking we open up the formation to obtain the highest production from the fractures. The effectiveness depends on the location; fracturing does not guarantee increased production, and making 20 fractures does not mean that you are going to get 20 times more production. The fracture has to be strategically located to be successful.

Q: How are you mitigating the water related problems associated with fracking in Corralillo?

A: We are currently working on a design to minimize the amount of water that is used, and recycling the water that flows back from the well. Once we have reduced the amount of water that is needed to fracture and are able to recycle or reuse this water, we will be able to completely mitigate this problem. In the past, we have used reinjection for disposal in the US, but we have not done so yet in Mexico. Our priority is recycling so we can use the fracture water in other wells. In the US, a lot of arguments are made against fracking, based on concerns about contamination of the water table. We need to make sure that there are enough barriers between the well and fresh water reservoirs in order to prevent them from being contaminated. In essence, we have to establish a good cementing job and make sure those zones are isolated before actually fracturing a well.

Q: What are your ambitions to use your field lab experience in fields to be awarded in the third integrated service contracts round?

A: Our technologies will be available for the companies that will be awarded those blocks, regardless of whether we are participating as an operator through a joint venture with a Mexican company or with an international company that is interested in coming to Chicontepec, or even if we are not the direct operator of one of the fields. We will be more than happy to work with the operators to implement some of the same technologies that we applied in Corralillo.

Q: How can Pemex leverage the lessons learned through the field labs at Chicontepec and apply these at its operations in other fields?

A: I think the lab concept has been a very successful way for Pemex to test different technologies. Even in marine areas, similar concepts could be used to test different technologies to increase production, after which Pemex can contract with different companies based on the results of those tests. Pemex is moving into a new phase in Chicontepec with the introduction of integrated service contracts, which will attract new companies with different methodologies to drill and operate those fields. Pemex can learn a lot from having different companies focusing on different areas. Pemex could expand its activities at Chicontepec as a means to increase production through competition.

Q: Companies operating field labs share their findings with Pemex but not with other field lab operators. Is this a missed opportunity to accelerate progress?

A: We all share our information and technological findings with Pemex, so in the end Pemex does benefit from all the interaction even though there is no direct communication between the service companies. But on technical forums there are opportunities for the sharing of best practices and lessons learned from those applications.

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Together with Matyep, Katch Kan has worked closely with PEMEX, a State Owned Exploration and Production Company. They evaluated the time and money saved after installing complete Katch Kan RSS and ZSS Systems. Over a five month period Pemex saved over $78,000.00 in time and labour exclusively and $480,000.00 from capturing and reusing Drilling Fluid. During this study there was a Kick, when the Kick occurred that day on the PEMEX Rig the Katch Kan Zero Spill System did exactly what it was designed to do: all components working together captured the fluid and kept all personnel safe.

PEMEX immediately issued a companywide endorsement of Katch Kan and works with Katch Kan through Matyep exclusively. Over the next five years all of the PEMEX Offshore and Land Rigs will be outfitted with Katch Kan's complete RSS and ZSS systems as part of their proactive commitment to Saving Lives and the Environment. Because of this, we are able to continue to gather evidence that our systems have a large return on investment.

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SAFETY AND ENVIRONMENTAL COMPLIANCE DRIVE BOTTOM LINE

Drilling operators are not only following safety and environmental regulations because these are mandatory requirements, they are also pursuing efficiency gains in the process. Katch Kan has managed to save money for Pemex in the company's drilling operations by implementing safety and eco-friendly solutions. "Over a five month period, Pemex saved US$78,000 in time and labor, plus an additional US$480,000 from capturing and reusing drilling fluid," Quinn Holtby, President and CEO of Katch Kan, Ltd. states. "This was prompted by the Rig Safety System and the Zero Spill System solutions that we installed at 16 offshore rigs and one training rig facility for Pemex."

Katch Kan's strategy is based on its focus on environmentally and socially sustainable development. The company created both the Rig Safety System (RSS) and the Zero Spill System (ZSS) solutions with the objective of improving health and safety for workers involved in upstream projects. "The RSS and ZSS drastically reduce pollution and facilitate production in a proactive eco-efficient manner," says Holtby. "Our turnkey systems have been exclusively engineered to address the complex safety and environmental challenges faced by operators and drilling contractors today." Katch Kan's solutions are designed to retrofit any rig, both onshore and offshore, from fixed platforms to semisubmersible platforms, jack-up drilling rigs, and floating production systems.

Katch Kan introduced fluid containment technology to the upstream oil and gas industry in 1994. As the needs of oil companies and drilling contractors evolved, the company responded by designing a complete Zero Spill System. The system controls and redirects drilling fluid, making the work floor and its substructure safer and cleaner, and improving operational performance. "The Zero Spill System includes several products used sequentially to redirect and contain fluid on drilling and service rigs," Holtby explains. "The Kelly Kan, a light-weight polymer-based unit, redirects drilling fluid downward, where the Upper Katch Kan receives it. At the same time, the Second Stage Low Pro Katch Can catches any fluids escaping through the drilling floor and the Adjustable Containment Enclosure contains the fluids that manage to escape through the cracks in the drill floor."

"All major components that our systems include work harmoniously to reduce, reuse, recover, and recycle," Holtby says. "When installed and used correctly, they provide total containment of drilling fluids." Both products reduce the environmental footprint of oil and gas activities while at the same time increasing rig efficiency, reducing injury, and helping companies comply with health and safety objectives. Built under ISO & COR standards and fully encompassing in terms of safety and fluid containment, they also help by significantly reducing vacuum truck requirements and cutting back cleaning needs on the rig and around sub-structures, allowing the operation to be more efficient, safe, and environmental friendly.

Katch Kan also designed the Rig Safety System to increase personnel safety while decreasing operational hazards on the rig floor. The aim is to reduce repetitive strain, sprain, and crush injuries that occur on the rig floor, achieving improved manpower protection. The system is comprised of several components that fulfill different purposes: the Tong Handle Guard reduces hand crush injuries during tong operations; the Katch Mat, which is an anti-slip, ergonomic, temperature, and invert resistant safety mat; the Splash Guard, to keep workers' feet out of the rotary table and foreign objects out of Kelly bushings; and the Kelly Bushing Guard, which is an enclosure placed over the splash guard.

Katch Kan is currently operating with Pemex through its exclusive distributor in Mexico – Materiales y Equipo Petrolero (Matyep) – and has recently obtained a second contract to service both onshore and offshore rigs in Pemex's Northern and Southern regions. "There is plenty of opportunity for Katch Kan technology to be further implemented in Mexico," Holtby explains. "We are working alongside our partners Matyep to provide both RSS and ZSS solutions on the majority of the Pemex's Southern region drilling rigs, and we are working diligently to retrofit rigs in the north as well."

Pemex's efforts to improve and guarantee safety in the workplace are particularly focused on drilling rig operations, due to the catastrophic consequences a spill can bring. "Currently, Pemex is our main focus and we will continue to improve the products and services we are providing them, as well as presenting new technologies that respond to the NOC's commitment to achieving zero spills and zero accidents," Holtby adds.

Coming from Alberta, Canada, Holtby observes Pemex's strengthened commitment to safety and environmental compliance. "While our current focus has been around RSS and ZSS, we recognize that there are many other areas within the upstream oil and gas industry where safety and containment are a cause for concern. We are committed to educating and demonstrating the effectiveness of our products and hope to see them on every rig around the globe, while continuing to bring innovative solutions for these areas of opportunity," he says.

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Many believe that deepwater will prove to be Pemex's salvation, both in terms of reserves replacement and the production that can eventually be obtained. However, in order to tap this potential, Pemex still has a long way to go. Although exploration in deepwater has been a success for the company in the last 12 months, development and production are completely new challenges that the company has yet to face.

In this chapter, we examine Pemex's exploration achievements in deepwater, and analyze what this means for development and production plans; we investigate the geology of Mexico's deepwater regions, and speak with the people who were instrumental in helping Pemex in its deepwater exploration activities so far; we also look at the various contracting methods that Pemex could use to establish the partnerships it will need to successfully explore and exploit its deepwater resources, and the technologies that have been used around the world in order to do this.

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CHAPTER 6: DEEPWATER

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TURNING POINT IN DEEPWATER

"Pemex's exploration activities in 2012 had a heavy emphasis on deepwater," says José Antonio Escalera Alcocer, Subdirector of Exploration at Pemex E&P. "It all goes back to our first efforts years ago to acquire seismic and regional studies to define the best prospective areas." Once this strategy was in place, the company evaluated different basins in the deepwater Gulf of Mexico and decided to focus on five regions: the Catemaco folded belt, south subsalt provinces, the continuation of the Campeche Bay, the Cordilleras Mexicanas area, and the Perdido folded belt.

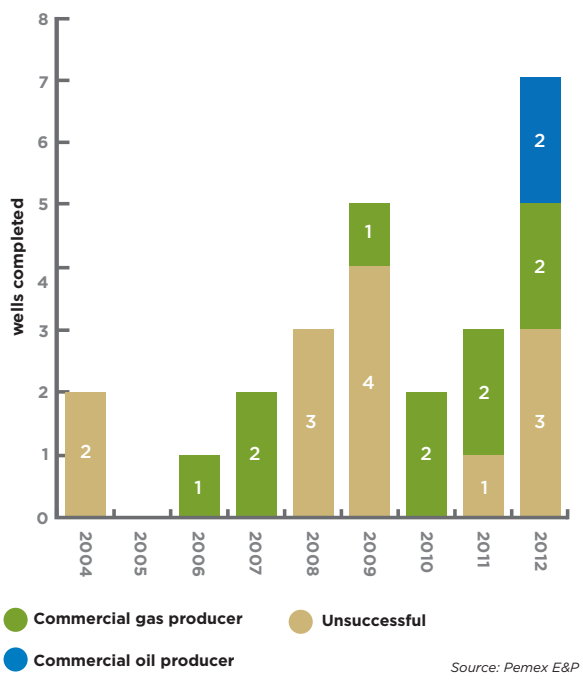
Pemex's deepwater exploration activity in 2012 proved to be extremely successful by international standards: globally, exploration in deepwater usually averages one discovery for every three wells drilled. Thirteen years after the drilling of its first deepwater well, Pemex finally proved its critics wrong by discovering oil in deepwater. "The key factors in our success in deepwater were budget flexibility and the patience to allow the expertise to develop in order to execute our deepwater program," says Carlos Morales Gil, Director of Pemex Exploration and Production. Pemex's deepwater drilling success was based on the drilling of seven wells, which resulted in oil discoveries at Trion-1 and Supremus-1, a wet gas discovery at Kunah-1, where also the first delineation well was drilled, and non-producing wells Hux-1, Caxa-1, and Talipau-1. During the first years of Pemex's deepwater exploration campaign, the company was only able to contract only one rig – Aker's Ocean Worker – that allowed it to drill down to 1,000m water depth.

The exploration division first focused on Catemaco, where the company discovered a gas province. This made the Catemaco folded belt the first targeted area where indications of hydrocarbons were found. "We went there and discovered a vast gas province, with the most representative field being Lakach, which is already in the development process," says Morales Gil. The Ocean Worker – which was designed by Aker – also drilled successful gas-producing wells Noxal-1 and Lalail-1, while the Ocean Voyager – owned by Diamond Offshore and now turned into the Ocean Onyx – drilled gas and condensate producer, Leek-1. After Catemaco, Pemex's exploration sights were set on testing some of the subsalt provinces in the south. "Even though we found hydrocarbons in those provinces, they were not yet ready for extraction," Morales Gil details. "Catamat-1 constituted our first disappointment in deepwater." Besides Catamat-1, drilled by Noble's Max Smith rig, Pemex drilled three more unsuccesful wells in the area: Chelem-1, Holok-1, and Kabilil-1. The first two were invaded by salt water, while the third one ended up being unproductive. In parallel, Pemex started drilling on another basin, Nox-Hux in the deepwater continuation of the Campeche Bay. The wells drilled there – Nab-1, which was drilled by Ocean Worker and Tamil-1, which was drilled by Ocean Voyager – were successful, with Pemex confirming heavy oil in the region.

In 2007, three additional rigs were contracted. The arrival of Centenario and Bicentenario in 2010, and of West Pegasus in 2011 allowed Pemex to venture down to 3,000m. This marked the start of testing a fourth deepwater area for hydrocarbons: Cordilleras Mexicanas. "We drilled three wells there: Caxa-1, Talipau-1, and Puskon-1," Morales Gil says. "Puskon-1, which was the deepest well that Pemex had drilled in deepwater with a depth of 7,632m, turned out to be a very high-pressure well, and, although we discovered hydrocarbons there, the pressure made it extremely hard to evaluate them. Therefore, we decided to leave them out of short-term plans and come back in the future. Caxa-1 and Talipau-1, on the other hand, were a disappointment, but their shallow, tertiary formations might need additional geological surveys to check for the possibility of hydrocarbon content."

Finally, the Pemex E&P division went to the long-anticipated Perdido folded belt, ready with rigs capable of drilling to 3,000m. After the seismic information was analyzed, Pemex decided where to drill first. "We proceeded to drill Trion-1 in the subsalt area of Perdido and we identified the presence of high quality hydrocarbons, in rocks with very good permeability and porosity in several geologic horizons," Morales Gil describes. "After carrying out some drill stem tests, we celebrated our first discovery of light oil in deepwater, adding 350 to 500 million barrels to our 3P reserves." Pemex then divided Perdido into two areas: the traditional Perdido folded belt and the subsalt area,

DEEPWATER DRILLING SUCCESS



Source: Pemex E&P

"The key factors in our success in deepwater were budget flexibility in E&P, and the patience to allow the expertise to develop in order to execute our deepwater program"

which led to a new discovery. Supremus was supposed to be a trial well to obtain information for a better design of deeper wells, such as Maximino. "Surprisingly," Morales says, "we also found some hydrocarbon accumulation in the Oligocene formation, which led to the discovery of around 125 million barrels of reserves." The importance of these two wells was not only the unexpected discovery of oil reserves; it served as confirmation of the existence of a petroleum system that could add up to 13 billion barrels of oil, according to Pemex's estimations. Today, Pemex has over 55 prospects identified in the area, which means that Mexico should have enough oil to remain a power in the global landscape for a good time to come, with the proper exploitation of its deepwater potential.

Between 2007 and 2010, Pemex spent around US$1.8 billion on deepwater exploration, accounting for roughly 24% of the company's total exploration investment during the period. Much of this money was spent on acquiring seismic data and drilling wildcat wells. As a result of its ramped up seismic acquisition program, Pemex collected an average of between 15,000km^2 and 20,000km^2 of deepwater data per year during the period. This led to major exploration success during 2012 with four contracted deepwater drilling rigs and success rates above the average in the market. "So far, we have drilled 25 wells in deepwater, with a success rate of 55%, which is superior to the 33-35% of success that companies in the US part of the Gulf of Mexico have on average," Morales Gil remarks. Even if the natural cycle would be to deviate back to the mean in terms of deepwater drilling success, the current success rate represents a big achievement for the Pemex's drilling history.

WHAT'S NEXT IN DEEPWATER?

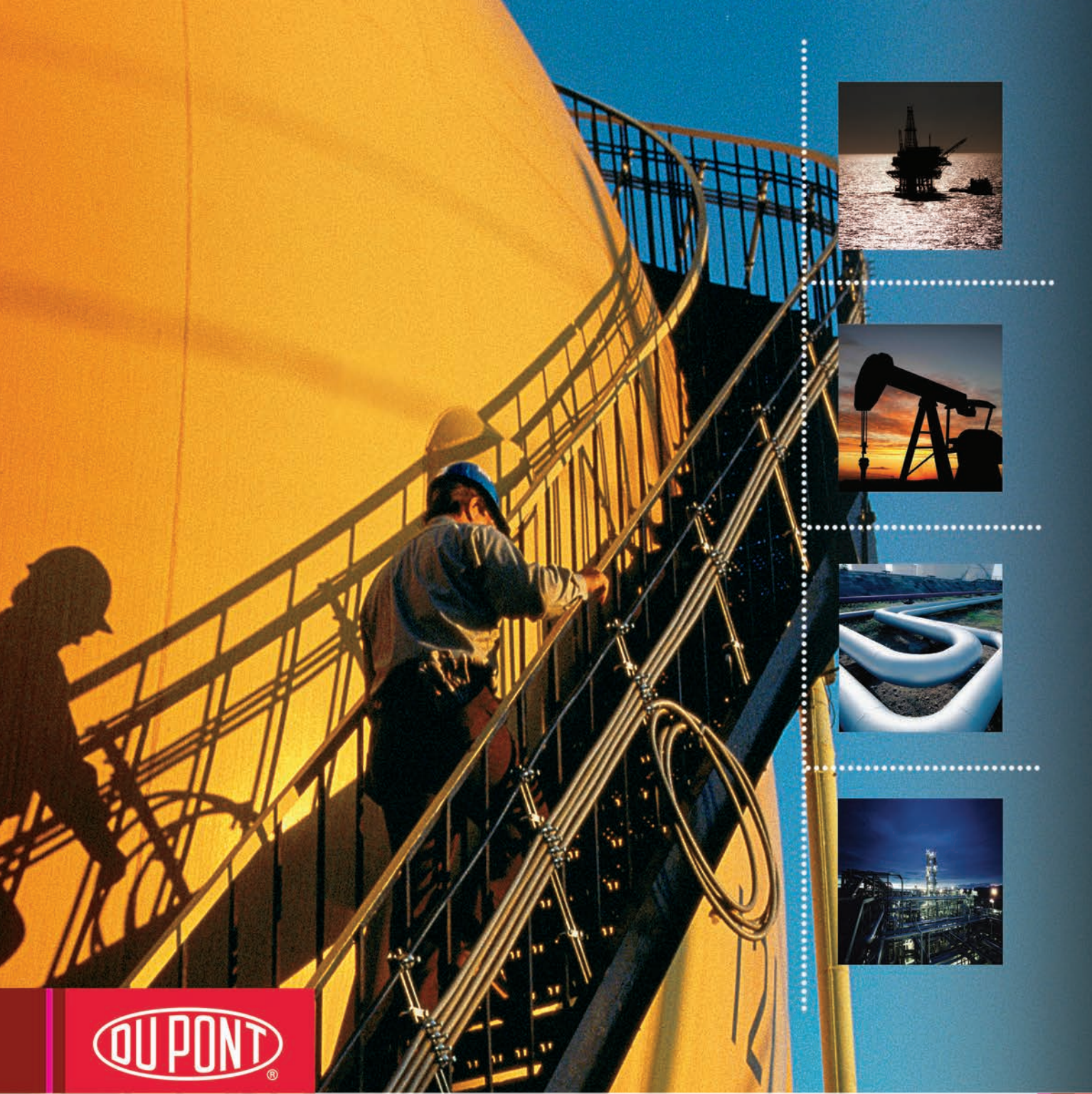
The next steps for Pemex lies in drilling delineation and development wells at all the oil and gas reservoirs that the company has already identified, while continuing exploration activity. "We will develop gas resources in Holok and Lakach with the semisubmersibles, and if we extend the exploration program north, we will contract some ships to perform exploration activities there," Morales Gil says. "Our plan for the short term future will be to concentrate on two wells in the gas province – Piklis-1DL and Ahawbil-1 in the Labay area – and four wells in the north – Maximino-1, PEP-1, Basto-1, and Exploratus-1," explains José Antonio Escalera Alcocer, Subdirector of Exploration at Pemex E&P. "We count on having Centenario, Bicentenario, West Pegasus, and the newly acquired Muralla IV to perform drilling tasks in the next few years. Muralla IV will first concentrate on less complex wells, complying with security best practices since it is a new semisubmersible, and two of the other three rigs will be operating in Perdido, with the possibility of acquiring another deepwater rig to operate there." At the moment, drilling of deepwater wells Maximino-1, PEP-1 and Ahawbil-1 is already in progress.

WHICH ROLE HAS SCHLUMBERGER PLAYED IN THE DISCOVERIES AT PERDIDO AND WHAT DO THESE DISCOVERIES MEAN FOR FUTURE DEEPWATER EXPLORATION AND DEVELOPMENT IN MEXICO?

It is extremely positive that Mexico has now made its first oil discoveries in deepwater, as it proves what experts have been predicting for quite some time. Schlumberger was heavily involved in providing services to both prove the existence of the reserves and the actual drilling of the wells. As much as 90% of the technologies used during the drilling phase were from the Schlumberger portfolio, and we contributed to areas such as well dynamics, fluid dynamics, reservoir interpretation and logging, and geomechanics. We have all the software to interpret such data as well, and we ensure that it can be transmitted and interpreted in real-time.

Juan Manuel Delgado, General Director at Schlumberger Mexico

It is important to stress that the technologies that were used in Mexico's deepwater discoveries were exactly the same ones that have been used all over the world at other deepwater projects. We have provided the tools based upon the strategy and timetable that Pemex chose, and it has proven to be extremely successful. We have been responsible for a large proportion of drilling operations in deepwater. For the geological exploration part: a large portion of the seismic information was acquired several years ago and we participated in some of the data interpretation, based on the locations that Pemex decided to prioritize. Time will tell what happens with deepwater development, which will be a completely different story. The oil has been proven, which is great news; but those wells still have to be completed and tested, which is something that will happen over the following three or four years.



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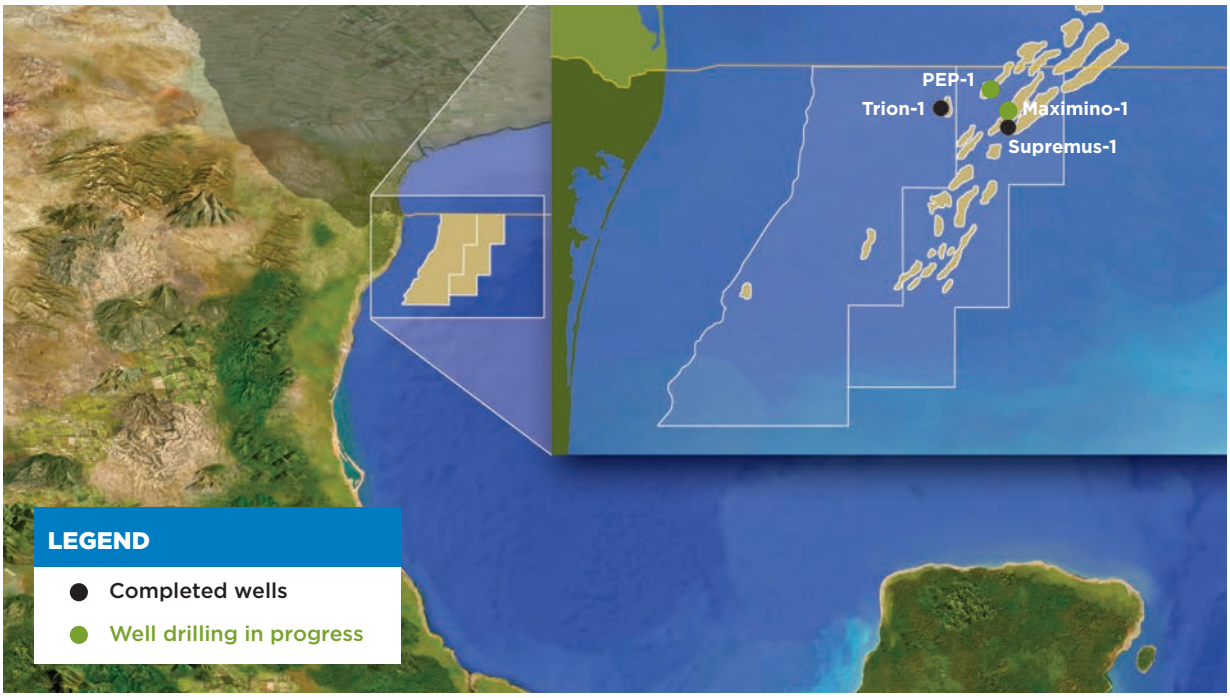
OVERVIEW OF DEEPWATER WELLS DRILLED

Well	Started	Completed	Drilling Rig	Total Depth	Results
Chuktah-201	2003	2004	Ocean Worker	4901	Non-producing dry
Nab-1	2004	2004	Ocean Worker	4050	Heavy oil producer
Noxal-1	2005	2006	Ocean Worker	3640	Gas producer
Lakach-1	2006	2007	Ocean Worker	3813	Gas producer
Lalail-1	2007	2007	Ocean Worker	3825	Gas producer
Chelem-1	2007	2008	Ocean Voyager	3124	Salt water invasion
Tamha-1	2008	2008	Max Smith	3940	Salt water invasion
Tamil-1	2008	2008	Ocean Voyager	3598	Heavy oil producer
Etbakel-1	2008	2009	Ocean Voyager	4232	Salt water invasion
Catamat-1	2008	2009	Max Smith	4819	Non-commercial producer
Leek-1	2009	2009	Ocean Voyager	3700	Gas and condensate producer
Holok-1	2009	2009	Max Smith	5421	Salt water invasion
Kabilil-1	2009	2009	Ocean Voyager	5350	Non-producing dry
Labay-1	2009	2010	Max Smith	3362	Gas producer
Lakach-2DL	2010	2010	Max Smith	3250	Gas producer
Piklis-1	2010	2011	Centenario	5431	Gas producer
Nen-1	2011	2011	Centenario	4350	Gas producer
Puskon-1	2011	2011	Max Smith	7480	Sealed
Talipau	2011	2012	Bicentenario	5028	Salt water invasion
Hux-1	2011	2012	West Pegasus	4550	Non-producing
Kunah-1	2011	2012	Centenario	4550	Gas producer
Caxa-1	2012	2012	Bicentenario	4474	Non-producing dry
Supremus-1	2012	2012	West Pegasus	4029	Oil producer
Trion-1	2012	2012	Bicentenario	6119	Oil producer
Kunah-1DL	2012	2012	Centenario	4515	Gas producer
Maximino-1	06/12/2012	In Progress	West Pegasus		
PEP-1	12/01/2013	In Progress	Bicentenario		
Ahawbil-1	25/02/2013	In Progress	Centenario		
Piklis-1DL	TBC	TBC	La Muralla-IV		

In total, Pemex has drilled 25 deepwater wells of which 15 resulted in a hydrocarbon discovery in 15, resulting in a geological success rate of 60%. Of these discoveries, 12 wells are commercial producers, bringing the commercial success rate to 48% for all deepwater wells drilled in Mexico.

Source: Pemex E&P



During the first few years of Pemex's venture into deepwater, the E&P division devoted itself to learning new geologic acquisition technologies and applying them across the 500,000km^2 of the Perdido folded belt. "In 2007 we defined a new strategy for geological surveys, establishing that the first step would be to identify the areas with the highest probability of containing liquid hydrocarbons. This initial phase was carried out through regional geological and geochemical modeling," recalls José Antonio Escalera Alcocer, Subdirector of Exploration at Pemex E&P.

Five different elements need to be understood in any exploration project: the source rock, the reservoir rock, the trap, the seal, and the sync and migration. "The first step in the modeling phase of an exploration project is to identify where the source rock is located. In order to do this, you have to determine where the proper conditions are available for the rock to be in the source window, whether the search is for oil or gas resources," Escalera Alcocer explains. "The key is to find those five elements within the surveyed geology and work methodically through the exploration process, without skipping any stage, since that would lower our probability of success. This has required a long understanding and training process, and has further allowed us success rates above normal industry levels."

For Pemex to follow the procedure that Escalera Alcocer describes, the E&P division hired a vessel to acquire 3D seismic data for five years, at the same time that they contracted the necessary rigs and platforms, anticipating the market dynamics. "The deepwater area we surveyed consisted of 120,000km^2. Due to the large area we were trying to cover, we had to perform 2D or 3D seismic studies," Escalera Alcocer says. "The acquisition of seismic data that the 8km extension of the 12 cables on the vessel produced was a key component in enabling us to see the subsea structures."

Application of both 2D and 3D seismic allowed Pemex to elaborate geological and geochemical models and focus on inversions. The exploration division devoted itself to understanding and interpreting the results of those surveys to create a list of priorities in deepwater, but they found some challenging aspects within the geology of the region. The effect of salt layers in the Perdido folded belt, such as the saline province of Bravo, stopped the creation of accurate subsea structure models with that technology. This made Pemex take a step forward and use wide azimuth technologies to better understand the formations that data interpreters initially could not see. "We performed a wide azimuth survey across almost 24,000km^2," Escalera Alcocer adds. "Without this technology, we would not have been able to see our work area, and that would have prohibited us from operating effectively. Seismic was extremely beneficial and allowed us to visualize all the elements in the oil system, reduce cycle times and identify Trion."

"The key to understanding the operation was going back to regional models, mastering the geological and geochemical modeling processes, regional sedimentary models and predictive models," Escalera Alcocer stresses. "Even though the technology involved in seismic acquisition plays an essential role in modeling subsea geology, it is extremely important to understand the regional context, since that is the fundamental factor that defines where seismic investments should be made."

1 TRION-1

Located 39km south from Mexico's maritime border with the US, Trion-1 constituted the first commercial deepwater oil discovery that Pemex confirmed on the Mexican side of the Perdido Folded Belt. The area is located in the Gulf of Mexico, 177km away from the coast of Tamaulipas, in the subsalt area of Perdido. The Trion-1 well was drilled by the sixth-generation Bicentenario platform, built in Korea for owner and operator Grupo R, to a total depth of 6,119m. Pemex invested US$120 million in drilling of Trion-1, discovering 350-500 million boe (3P) in a productive interval between 4,250m and 4,322m, in the Cretaceous formations. Trion is the fifth biggest discovery made during the past presidential term. The total saturated thickness of the well is 320m, with 18-25% porosity, and a permeability of 250 milidarcys, sufficient to ensure productivity. The estimated flow of Trion-1 amounts to up to 10,000 bbl/day of 34-degree API light crude. Trion's first well exceeded the international standard rate at which prospective resources are turned into 3P reserves: the time lapsed from the acquisition of the 3D seismic of the field to the confirmation of the discovery was less than two years. The next steps for Trion will be to drill additional wells at bigger depths to evaluate the objectives at the Inferior Eocene (Wilcox arenas) and the Paleocene (the Whopper formation).

2 SUPREMUS-1

Also located 39km south from the maritime border with the US and 250km away from Matamoros, Supremus-1 was drilled by the sixth-generation Korean-built West Pegasus platform to a total depth of 4,029m. The amount of 3P reserves discovered amounted for 75 to 125 million boe, found at the interval between 3,690m and 3,698m. Part of Pemex's US$1.07 billion deepwater exploration budget, Supremus-1 became the second commercially successful well in the Perdido area, even when it was originally drilled just to obtain important geological information for the drilling project at Maximino. The total saturated thickness of the well is 30m, with 30% porosity, and a permeability of 340 milidarcys, which ensures productivity for up to 10,000 bbl/day. The biggest concentrations of reserves within the reservoir are found in the Miocene and Oligocene. Potential resources could reach up to 447 million boe. This discovery was extremely important in the confirmation of the amount of prospective resources that could be found in Perdido, estimated at 13 billion boe, which could duplicate current 1P reserves for the country over time.

3 MAXIMINO-1

Referred to as the "jewel of the crown" of Mexico's deepwater portfolio, the drilling of Maximino-1 started on December 6, 2012, at its location about 320km east of Mexico's northeastern shore and 48km south of the border with the US. Maximino-1 will be the deepest well ever drilled by Pemex, until this record will be captured by PEP-1, expected to reach a total depth of 6,640m in waters of 2,922m. The NOC will employ the West Pegasus semi-submersible rig, contracted from Seadrill, to drill Maximino-1, which is expected to hold the biggest amount of 3P reserves of the deepwater drilling targets in Pemex E&P's pipeline. It is expected to also contain light crude, close to the API quality of Arabian oil, just as the resources confirmed in both Trion and Supremus.

4 PEP-1

At even greater water depth than Maximino-1, the PEP-1 well will be drilled to a total depth of about 7,200m and is the fourth project in Pemex's Perdido drilling program. PEP-1 will be drilled in waters of 2,917m by the Bicentenario semi-submersible owned by the Mexican partnership of Grupo R and Industrial Perforadora de Campeche. While drilling started on January 12, 2013, it is expected that PEP-1 will be concluded in the second semester of the year. Pemex expects to discover light oil at PEP-1, although not in the same volume as at Maximino-1.

MEXICO'S DEEPWATER RIGS

Equipment	Water depth (ft)	Total depth (ft)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Ocean Worker	3,000	25,000	Aug 03-Aug 07				5 wells									
Ocean Voyager	3,000	25,000						Nov 07-Dec 09	5 wells							
Max Smith	7,000	25,000							Aug 08-Dec 11	6 wells						
Centenario	10,000	40,000					4 wells drilled, 1 in progress			Sep 10-Dic 14						
Bicentenario	10,000	40,000						3 wells drilled, 1 in progress			Jul 11-Aug 16					
West Pegasus	10,000	35,000						2 wells drilled, 1 in progress			Aug 11-Aug 16					

Source: Pemex E&P

PERDIDO DRILLING FINALLY IN PROGRESS

The most anticipated discovery in the recent history of the Mexican oil industry was finally announced during the third quarter of 2012. While the Perdido area had long been a prospective source for hydrocarbon resources, rumored since the discovery of oil on the US side of the border, nothing had been confirmed regarding Mexico's potential until August 29th, 2012, when Pemex announced the discovery of light oil at Trion-1. "The operations that we have undertaken in the Perdido area are product of the effort of many people over many years," says José Antonio Escalera Alcocer, Subdirector of Exploration at Pemex E&P. "The exploration process in the new areas takes from five to 10 years to yield any outcome and today we can feel proud as a team for the results we have achieved."

The successes at both Trion and Supremus, where light oil discovery was announced on October 5, 2012, are already in the rearview mirror for Pemex. The NOC knows that in order to produce another successful year and to eventually compensate for declining production at other fields, it needs to discover additional hydrocarbon reserves and put these into production. "We have to keep drilling the prospective fields that we have already identified," stresses Carlos Morales Gil, Director General of Pemex Exploration & Production.

While Trion and Supremus amount to around 625 million bbl in the best-case scenario, Perdido is expected to have around 10 to 13 billion barrels of total reserves. "After Supremus, the next step is to drill Maximino-1 and PEP-1, for which we have huge expectations," says Escalera Alcocer. "If we end up being successful at those two fields," Morales Gil announces, "we will need to hire additional rigs for deepwater."

WHAT IS NEXT AT PERDIDO?

2013 will be crucial in defining the outlook for deepwater, and Perdido will definitely constitute a make-or-break case for Pemex in terms of accomplishment in the segment with the plan to drill six new deepwater wells and to start field development operations in both Trion and Supremus. "We first need to assess the reserves at the discovered fields, drill delineation and appraisal wells, and start planning the conceptual development phase," Morales Gil explains. "Questions still have to be answered about the strategies for the development of Trion and Supremus, especially those regarding the number of wells to be drilled and the infrastructure needed. FPSOs are being considered, while the other option will be to connect to the US pipeline system at Great White." In order to settle upon the second alternative, political agreements, as well as business deals with US companies, would need to be struck.

"We have the target to drill up to six wells in deepwater during 2013, and, even taking into consideration a potential dip in our success rate we expect to uncover production possibilities from two or three of them," explains Escalera Alcocer. The six wells that Pemex is expecting to drill at Perdido are Maximino-1, PEP-1, Basto-1, Exploratus-1, Pelagus-1, and Alaminus-1.

CLOSER LOOK AT THE US PERDIDO PROJECT

The Perdido project, the most technologically advanced ultra-deepwater project in the world, developed by Shell in collaboration with partners BP and Chevron, is located 354km away from Galveston, Texas, and sits very close to the Mexico-US maritime border. The project comprises a spar production facility, which exploits three fields: Great White, Silvertip and Tobago. All three are located in what is known as the Perdido Folded Belt in the northwest section of the Alaminos Canyon outer continental shelf. The water depth in the region ranges from 2,300m to 3,000m, some of the deepest waters in the Gulf. Oil production has already commenced at Perdido, breaking the previous water depth production record by over 50%.

Shell operates the Great White field and holds a 33.34% stake, while Chevron and BP each hold a 33.33% interest. Silvertip is 60% owned by Chevron, while Shell participates in the field with the remaining 40% interest and is the operator. Tobago completes the trio of fields at the US side of Perdido. The field is 32.5% owned by Shell, with Chevron holding a 57.5% interest and Nexen holding the remaining 10% interest. Development of the fields began in July 2007, using a production spar rather than a more traditional tension leg platform (TLP). The three topsides of the platform support oil and gas processing units, living quarters for 150 people and a drilling rig. Subsea development of the fields began soon afterwards. Production began at the end of March 2010 from five wells at the Great White field, with all wells expected to come online by 2016 and produce 100,000 b/d and 200 bcf/d. The total cost of the project is estimated around US$4 billion.

THE EXPERIENCE OF DRILLING SUPREMUS-1

BOB MANKIN
General Manager at Seadrill

Q: Seadrill is the only international company contracted for deepwater drilling operations in Mexico with international experience. What differentiates your approach?

A: As an international company working in Mexico, our standards are based on our experience in Norway, the Far East, West Africa, the North Sea, and the US Gulf Coast. We work according to our own procedures and the West Pegasus is the first rig ever to work for Pemex that has not used Pemex's permanent work system. This is very important for us because our crew is used to our systems, not to Pemex's, and the more familiar you are with systems and procedures, the more successful you will be. From Seadrill's point of view, the rigs are not what determine the performance. It is the processes and the crew used. The West Pegasus is contracted by Pemex for four years, and we have three years left of the contract, which brings stability, time to plan, and also allows us to work the crews without too much turnover. We have a split crew of expats and Mexicans. The majority of the senior people are multinational – Americans, British, and Polish – while most of the junior crew is Mexican. Pemex has 5 or 6 representatives on the rig, who are there to oversee the drilling plan.

Q: How does the West Pegasus compare to other semisubmersibles being used in Mexico right now?

A: The West Pegasus is a sixth generation vessel that was completed in 2011. The hull was built in Europe and towed to Singapore, where it was finished. Seadrill purchased it in the latter stages of completion. The West Pegasus is a single derrick with offline capability, which allows us to build and make up stands of pipe without being on the critical path, and therefore without using up rotary table time. This is the standard for any sixth generation rig; because of the daily operating cost of the rig, companies have honed the operation to the point that they only do on the rotary table what they have to, and move any possible activities away from critical path.

West Pegasus also has a standard 18 3/4, 15,000 blowout preventor (BOP), with six-ram configuration. Seadrill has since decided to go with seven-ram configurations. The BOP on the West Pegasus cost somewhere between US$60-80 million: the cost means that replacements are not kept on hand. We do have a spare stack, but not here in Mexico. However, I can see that in the future we will have to, since BOPs will be subject to more and more inspections and these will be so intrusive that they will not be done online. Therefore, if a deepwater drilling company does not have a spare BOP on hand, they will have to face downtime. I predict that as an industry, we will eventually reach a stage where we will hot swap BOPs. It will require more investment, but we are a service industry and we deal with these big numbers all the time. Our goal is to keep the rig working. If we know that a US$600 million rig will be out of business for three months every five years, then the numbers speak for themselves. If companies have a few rigs, then they can even have one spare BOP and circle it between four rigs, in order to reduce costs even further.

Q: What are the highlights of Seadrill's experience drilling the Supremus-1 well?

A: Although we had an issue with the very first casing we tried to run, the actual drilling of the well went relatively well. Since the rig is rather new, we had some teething problems with the blowout preventer on the seabed, so at one point we had to pull out the blowout preventer to the surface. In the end we were all very pleased with the well, even though we were at the edge of our technical ability due to the water depth. We had some problems, but nothing out of the ordinary, so we are all very pleased we were able to finish it for Pemex.

Q: Pemex has a deepwater success rate of 55%, which is very high by industry standars. Do you think it is feasible that Pemex will be able to maintain this success rate?

A: The technology used to choose deepwater drilling sites has improved immensely, so you should expect to see the success rate actually improving, but also foresee cost increasing significantly. Because Pemex started deepwater drilling quite late in comparison to other operators, it has benefitted from better technology, which helps explain why the NOC has such a high success rate. The reality is that you need technology and money to be successful: Pemex has the money, and multiple service companies have the technology, so expect Pemex's success rate to either grow or stay the same.

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OPPORTUNITIES IN THE CABLING MARKET

JAVIER ANTISTA
Director at Prysmian Mexico

Q: How did Prysmian enter the Mexican market in 2006?

A: Our first work in the Mexican market was with Pemex Refining, supplying industrial cabling at both medium and low voltage for the Tula refinery, and also at some of the country's other refineries. We saw the opportunity to expand our business to the upstream oil and gas industry, and in 2010 started working with Pemex Exploration and Production at Ku-Maloob-Zaap. It was a big project, which involved linking up seven production platforms with medium-voltage submarine cables. We provided the cabling, as well as the services for laying the pipe and establishing the connections.

Q: What do you see as the biggest trends and opportunities for cabling companies in the Mexican oil and gas industry?

A: We are in the business of delivering information and energy. Pemex will need companies like Prysmian as it approaches every one of its most difficult challenges over the next 20 years. In terms of solid business drivers for Prysmian in Mexico, we expect that medium and high voltage linking cables between platforms, and to connect them to the shore, will be one of our more stable businesses in the mid-term. We hope to develop this, and introduce our fiber optic and submarine power cables to the market. Another opportunity for Prysmian was created by the group's 2010 acquisition of Dutch company Draka, which portfolio includes a number of high technology products designed for the oil and gas industry, including sensors for drilling systems, control signals, and power solutions, for both onshore and offshore applications. By combining the experience of Prysmian with the product portfolio of Draka, we have a very strong product offering for the Mexican oil and gas market.

Prysmian also has extensive experience in providing umbilical solutions to oil and gas companies focused in deepwater. In collaboration with Petrobras, we worked in Brazil as one of the NOC's main partners, providing umbilical solutions for their deepwater exploration projects. Since then, the company has worked closely with Petrobras to deliver a wide range of umbilicals for various different uses.

Q: What are your ambitions regarding the introduction of umbilicals into the Mexican deepwater market?

A: We are extremely keen to introduce our umbilicals to Mexico, and are very interested in collaborating with the EPC contractors that will be helping Pemex to complete its deepwater development plans. Our umbilical solutions are tailored to individual circumstances – because of the extreme challenges involved in working at such water depths, we want to make sure that each cable can operate according to the specific conditions it will face during its lifetime. In such conditions, accuracy is critical. Each umbilical can also include several different functions, according to what is required, for example, to inject drilling additives, take samples, send data via fiber optic cable, or even power subsea machinery.

We are now waiting for deepwater operations to ramp up in Mexico, but we know that before deepwater development can begin in any serious way in the country, the proper political and economic frameworks will have to be put in place, so that investment in deepwater can begin. Nonetheless, when this happens, we hope to quickly establish a name for ourselves as one of the key partners in deepwater operations in Mexico.

Q: How does the umbilical business fit in your overall development ambitions for the Mexican market?

A: The umbilical business is at the very first stage, we know that it is necessary to wait some time before this projects reach a greater level of maturity, so that we can develop a local presence as providers. First of all we have to recognize all the opportunities, customize our umbilical solutions, and present them to the different main contractors, which are mostly international contractors.

Prysmian Group manufactures high technology cables and systems for the energy and telecommunications sectors, with sales of more than US$10 billion in 2012. It has subsidiaries in 50 countries, 91 plants in 24 countries, 17 research & development centers worldwide and employs more than 20,000 people.

POSSIBLE CONTRACTING METHODS FOR DEEPWATER

IVÁN ALEMÁN ALEKSEI
Chief of the Legal Unit at Mexico's Energy Ministry

Q: The fourth round of ISC contracts is expected to involve deepwater areas. What are the benefits of continuing to use this contracting model for deepwater?

A: The main advantage is the fact that companies are guaranteed to recover their investment in an efficient way. In Mexico's case, the cost-recovery ratio is 75%. On the other side, these contracts include a variable fee per barrel produced that is directly influenced by the performance and efficiency of the service provider, which creates an incentive to optimize the investment allocation and encourages the implementation of effective new technologies. A benefit that Pemex gets from ISC contracts is knowledge spillover. The clause that enables Pemex to own a 10% participation in the project means that the NOC is guaranteed to have privileged access to learning from service providers.

Q: How could the ISC contracting model be improved?

A: Rethinking the dispute resolution methods and legal frameworks under which the contracts are administered are two things that come to mind. But the contract extension clauses need to be changed. Under the current model, contracts include several repetitions of Constitutional formulas and legal redundancies that, instead of helping companies to interpret the contracts correctly, fill them with unnecessary information that leads to confusion and uneasiness. There is too much information that is already included in different laws and should not be included in the contract.

Rethinking where the line is drawn between the government's influence on exploration and production strategies and Pemex's business decisions presents another area of opportunity. Service providers have the incentive to extract as much as possible from the reservoir during the contracted period, since the variable component of their payment depends on it. On the other side, the integrity of the reservoir has to be maintained without depressurizing or damaging it. The complexity of this decision is where national sovereignty truly lies: it is the government's responsibility to decide at what rate production should be monetized, and if technical issues emerge with the strategies followed by the service providers operating there, the government should have the ability to intervene and halt production, even if it is detrimental to the interests of the operator.

Q: Could Mexico introduce a concession model under the current legal framework?

A: A concession model, by definition, implies resource appropriation. It would grant a private company the whole production responsibility, while Pemex would act as a governing body, in charge of monitoring and controlling the operator, but without the conflicting interest of being part of the business, and charging a fixed concession fee. The private company has the incentive to optimize production over the long term, taking good care of the reservoir, as opposed to the time constrained vision that companies have under the ISC model. However, the current contracting model, and the Mexican Constitution, prohibits private operators from owning the resources being extracted.

Q: Is it possible to introduce a production-sharing agreement model without making amendments to the Constitution?

A: Under the current regulatory framework, it would be possible for private companies to be remunerated in cash and then use that money to buy hydrocarbons from Pemex. While there is no legal or constitutional doubt that Mexico could sell hydrocarbons in Mexico, and that a private company could buy them, I am one of the few people that consider this option to be viable. If this were a strategy to follow, though, the most recommendable thing would be to modify the law to ensure legal certainty. The law should clearly state if a payment scheme of this type could be feasible or not.

Q: What could be learned from other country's experiences to create the right model for Mexico to face the deepwater challenges?

A: Mexico has to build its own model, so it is really important to consider international experiences and combine these with our own peculiarities, working culture, regulatory framework, and historical background, in order to tailor our own contracting model.

INTEGRATED SERVICE CONTRACTS

Integrated service contracts (ISCs) are contracts for which payment is usually determined on an incentive basis, linked to the accomplishment of certain key performance indicators traditional for the global oil industry. The Mexican version of ISCs does not differ much from the international model. Pemex E&P is the field operator and the contracting model allows private companies to perform activities along the whole E&P value chain in the country's oil and gas fields, for 20-30 year periods. ISCs were created in order to diversify Pemex's production base and take advantage of private sector expertise and technology to increase oil production levels, especially in mature or previously-deemed unviable fields for Pemex. ISCs provide two contracting levels: depending on the results achieved during the evaluation phase, Pemex can terminate the contract before moving on to the development phase; but if the contract moves on to the second phase, contractors are obliged to honor minimum work requirements, varying on the conditions of each contract. Under the ISC contracting scheme, service providers receive a fee per barrel – determined based on their bid in the public tender process – and a percentage of recoverable costs, subject to the project's income availability. Variable fees include a production bonus for each barrel extracted above crude baseline levels. Fees can be adjusted every six months in accordance with a weighted Producer Price Index that accurately reflects changes in the international oil and gas services industry.

PRODUCTION SHARING AGREEMENTS

Production sharing agreements (PSAs) are contracts signed between a country's government and resource extraction companies that allow them to be paid with the resource itself. The contracted company provides the capital investment for the extraction of hydrocarbons in exchange for full control of the oilfield and access to the production obtained from it. A PSA contract implies the association of two or more parties – the government and external companies – to explore and/or extract hydrocarbons within a delimited area. The government's role in the agreement is to act as the administrative authority, while awarding the execution of exploration and production activities to oil companies. The country's government shares mineral and financial risks from E&P activities with the oil companies, as well as all the responsibilities, costs, and profits. When exploration, development, and production activities are successful, the oil companies involved are allowed to use certain proportion of the oil obtained to recover capital and operational expenditures – this is referred to as "cost oil." PSA contracts usually include a restriction set on "cost oil" amounts, restraining the company from using all the oil produced in cost reimbursement. The remaining money is known as "profit oil" and is split between the government and the oil companies, traditionally in an 80/20 ratio. PSA contracts usually have a stabilization clause, which limits the governments' ability to change tax rates or modify the conditions set during the original agreement to affect the company's profit.

CONCESSION CONTRACTS

A concession refers to the permission extended by a country's government to allow oil companies exclusivity in E&P activities within strictly defined geographical areas. The grant is usually awarded to one oil company in exchange for a fixed license fee for a certain period of time. In Mexico, concession agreements are particularly common in the mining industry but not allowed in the oil and gas industry.

This type of contract allows governments to receive a pre-defined fee every year from the oil company awarded the concession (known as the concessionaire) in return for awarding an exclusive license to perform E&P activities within a delimited area. While it might sometimes include an additional bonus payment upon the conclusion of the contract, the main income that the government obtains from a concession contract is the established fee which is to be paid from the beginning of the contract, even if there is no production at that stage. Governments can impose expenditure obligations in the form of geophysical investment milestones and targets for the number of exploration wells to be drilled in order to avoid the reassignment of the concession. Certain additional payments may be part of concession agreements, such as production licenses in the case of hydrocarbon discoveries and bonus fees in case a landmark production target is reached.

DRILLSHIPS: OPTION FOR DEEPWATER

Drillships have been used in offshore drilling operations since the 1940s, when the US Navy adapted one of its numerous ships for a drilling operation in California. Currently used all over the world, drillships are modified marine vessels that are equipped with a drilling derrick and moon pool, and have extensive mooring capacity.

Drillships are a viable alternative to semisubmergibles in deep and ultra-deepwater drilling operations. While semisubmersibles depend on various other mechanisms to either be installed, constructed, or transported, drillships have the advantage of being able to move from well to well independently at a speed of 15-16 knots, compared to a semisubmersible's speed of 5-6 knots. Also, drillships are better suited for dual activity derrick, the blowout preventer (BOP) can be carried closer to the waterline, and they usually have more tank space available for liquids. Besides these advantages, drillships have a moon pool at the center of the ship, where drilling equipment is passed through and connected to the well equipment via a riser pipe, a flexible pipe that extends from the top of the well to the bottom of the drillship.

Nevertheless, drillships have various disadvantages, the most important is instability. While they are still able to drill in deep and ultra-deepwater, they can be easily affected by winds, currents, and waves, which can be dangerous during drilling, since the vessel is attached to pipes that are in turn attached to an oil or gas well thousands of meters below. Therefore, drillships are more suitable for locations with benign waters. However, companies like Transocean, Pride, Seadrill, Frontier Drilling, and Noble have created mooring systems that allow for the successful drilling of wells with drillships in most locations. Drillships depend on GPS and dynamic positioning systems (DPS) to keep the ships in place through various thrusters located at strategic locations around the vessel in order to move it and keep it in place, despite winds, waves, and currents. "It is not that one is better than the other; semisubmergibles or drillships each do different things," explains Bob Mankin, Country Manager for Seadrill Mexico. "There is an overlap where both semisubmergibles and vessels could function perfectly, but there are many places where drillships simply cannot work."

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DEEPWATER DEVELOPMENT STARTS AT LAKACH

Arguably, the area of development where Pemex has the least experience as of today is deepwater. Even though the NOC started exploring deepwater opportunties as early as 1999, when the Chuktah-201 well was drilled, Pemex is still learning how to develop this type of field. During 2006, Pemex started drilling the Lakach-1 well in waters of 988m, discovering a natural gas field with 1.4Tcf of reserves, which is currently under development and is expected to begin production in late 2014 or early 2015. Emiliano Pescador Asaf, Country Manager for Technip in Mexico, describes the journey so far in developing the Mexico's first deepwater field.

"Lakach started as a conceptual design. The company went through different options when reviewing the development plan for the field and decided that subsea infrastructure was definitely the best"

Emiliano Pescador Asaf, Country Manager for Technip in Mexico

"Lakach started as a conceptual design," Pescador Asaf recalls. "The company went through different options when reviewing the development plan for the field and decided that subsea infrastructure was definitely the best." Several alternatives were considered, such as floating LNG, but the financials of using a subsea infrastructure, and the prospects of having better results through this method, ultimately pushed them to develop Lakach this way.

Pescador Asaf also points to Technip's subsea expertise as one of the deciding factors in choosing the method for developing the field. "Technip is divided into different regions, and Mexico is part of our North American region, which has its headquarters in Houston," he explains. "The plan for Lakach is to use all of the expertise Technip has from its operations in the US side of Perdido, and add it to the experience gathered from the acquisition of Global Industries and its offices in Ciudad del Carmen to support s-lay pipelay and shallow water activities in the region. This will make things easier, since the field goes from shallow to deepwater."

For the development of the front-end engineering stage of the project, Technip used its high-tech engineering company, Genesis, which worked under the direction of Comesa. "Although Genesis is part of Technip, it has the autonomy to operate by itself, which ensures that the EPC stage of the project would be open to be developed by any company with the correct qualifications." Pescador Asaf recalls.

The front-end engineering stage of the project did not come without obstacles. Technip had to deal with a couple of issues in the project's development, since the plan was questioned by many of the important players with power in the industry. The project's assessment did not look to hold sufficiently positive results to justify the investment. "When looking at the numbers expected from Lakach, one can see that it is not an extremely productive project," Pescador Asaf points out. "However, it still has a positive outcome: it still bears profits for the industry, and, most importantly, it is a very strategic project to start Pemex's deepwater adventure. Lakach is not very complex, with a good, manageable size for contracting and development." It will also serve as a stepping-stone for one of Technip's short-term goals: developing local talent. "We intend to have trained Mexicans in the Perdido developments. We should follow Brazil's example: they started to develop local content in terms of equipment, but also in terms of talent and, after a few years, Brazilians are exporting human resources to technology projects all over the world," he adds.

Pescador Asaf believes that Lakach could become a more profitable project if Pemex continues its plan of linking it to other gas fields, and as gas prices increase from the all-time low levels they are at right now. The main importance that the Lakach field holds as of this moment for Pemex is in the expertise the NOC can extract from developing it, and to apply what they learn at future deepwater developments.

The next step for PEMEX in Lakach will be to develop the EPC stage. "Technip is really interested in the contract for the development of this stage, since Lakach has been a strategic project for the company, however, we know it will be an attractive project for other companies so we expect to have strong competition," Pescador Asaf admits. "Technip wants to help Pemex to obtain the expertise they require in deepwater by bringing the company's experience gained while working with Shell on the US side of Perdido, and several other deep water developments from the front-end engineering stage till completion."

PROJECTING DEMAND FOR ROV TECHNOLOGY IN DEEPWATER

"Until now, Pemex has only conducted exploration drilling in deepwater, which has not left many opportunities for us to employ our ROV technology on these projects. However, now that development work is beginning, and the time to install Christmas trees and other subsea infrastructure is getting closer, we see a lot more opportunities in the market," explains Ernesto Marcos, Director General of Oceaneering International Mexico, a company that specializes in remotely operated vehicle (ROV) supply and operation for the offshore oil and gas industry.

Pemex recently launched the tenders for its Lakach deepwater development project, which will feature subsea production infrastructure, tiebacks to shore, and onshore production infrastructure. Marcos explains that ROV tooling will be a feature of the contracts that will be awarded for Lakach, rather than being a standalone contract, which will mean that Oceaneering will have to compete for work on Lakach as a subcontractor. "We first need to know who will be providing the Christmas trees to the project, as this will be one key area where we can offer our ROV services. This will be where we compete for work on the Lakach project. Ideally in the future, we would prefer to contract directly with Pemex for this type of work," he admits.

Marcos says that his expectations for the development of fields at Perdido are much more positive: "First, there are significant differences between the Lakach project and the Trion project. Lakach is going to be a tieback to shore, there are no large floating assets offshore, and although it is a challenging project, it is not as complicated as Trion, which will involve a water depth of 2500m and a floating asset." With experience of working on the US Perdido project just across the border, Oceaneering has direct experience of installing umbilicals and single well tiebacks in very similar conditions. "The development of Lakach will involve a lot of large infrastructure that is not perfectly suited to ROV installation: manifolds link back to an 18 inch (45.72cm) pipeline at the project, which is too big to be installed by ROV. With a project like Trion, there will be smaller installations that will mean more work for ROVs," Marcos explains.

There will of course be competition for the ROV contracts on offer. "Pemex, as a government entity, has to contract through a formal bidding process, and many times in deepwater, the cheapest solution is not always the best. Even if the company's managers want to do things differently, the contracting structure often hinders their intentions. To resolve this, I would recommend the creation of a material resources group trained and specialized in deepwater, which will help Pemex be more sensitive to the needs of deepwater projects, with smaller tenders for individual technology and services."

Marcos stresses that any short term cost savings will most likely be rendered irrelevant in the long term, after the consideration of downtime and performance issues. "Problems with ROVs mean downtime for other assets. In the early phase of a project, during critical operations, the impact can be exponential." In order to avoid ROV downtime, Oceaneering keeps as many components for its ROVs on its vessels as possible, with remaining components kept onshore, as close as possible to offshore operations. Marcos also explains that Oceaneering employs a team of senior technicians that spend time at each project, executing technical audits to ensure that systems perform as well as possible, not only looking at technical performance, but issues ranging from inventory to training.

DEEPWATER SERVICE PROVIDERS ARE READY FOR MEXICO

The goal of every deepwater operator is to successfully identify the drilling target, reach that target in the shortest period of time, and achieve this at the lowest possible cost. To this end, exploration projects depend heavily on the quality, accuracy, and visibility of the data associated with drilling programs.

Tim Sylvester, Vice President at Kongsberg Oil & Gas Technologies, explains that his company's real-time drilling decision support solutions deployed on rigs for drilling contractors, providing smart agents to the drilling and geological stakeholders within the client's organization, can be part of the solution. By employing SiteCom Well Advisor, technical experts are able to monitor the progress of any well drilled, immediately intervene when necessary to take corrective action, and eliminate non-productive time. Furthermore, SiteCom is an integrated well monitoring and early warning system that represents a step-change improvement in operational safety, well construction efficiency, and well integrity management. Based around operational consoles that integrate pertinent real-time data from onboard infrastructure, diagnostic tools, and models, SiteCom delivers decision-making capabilities to minimize risk and maximize performance.

Furthermore, Sylvester explains that Kongsberg offers a complete asset lifecycle program that allows the operator to design, model, and operate the asset while monitoring the condition and remaining life of elements such as process equipment, risers, and subsea equipment. "Our experience in environmental monitoring and asset integrity management is based on projects in the North Sea, US Gulf of Mexico, and offshore Brazil, working in partnership with ExxonMobil, BP, Shell, Chevron, ConocoPhillips Statoil, and Petrobras," explains Sylvester. "Additionally, our capabilities have been built over many years of R&D, product testing, and extensive field verification, during which we have worked closely with many NOCs as well as IOCs to deploy solutions of the highest quality and reliability."

Kongsberg Oil & Gas Technologies is also eager to bring its wide range of subsea solutions to Mexico. "With over 1,000 completed projects for floating production systems, riser towers, and drilling rigs, Kongsberg provides engineering and consultancy services for risers, umbilicals, flow lines, and subsea production systems for the oil and gas industry," explains Sylvester.

However, the key to successful development in Mexico is efficiency: in people and in capital and operational expenses. It is important to realize that MX$1 billion saved from operations is as important as MX$1 billion of increased production revenue. According to Sylvester, it is Kongsberg's ambition to facilitate Mexico's transition to a more human and fiscal capital efficient oil and gas industry, which can be achieved through a well-trained and effective workforce. Taking advantage of the company's decision support and simulation solutions will enable the workforce to drill effectively, deliver world-class production operations, and extend the life of hydrocarbon and operating assets. The key is to introduce these technologies and concepts early in the project lifecycle. Sylvester states: "Kongsberg's full suite of offerings allow the Mexican oil and gas sector to take full advantage of the technology from early exploratory drilling activities, through project design, construction, operations, and redevelopment."

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PRIVATE SECTOR TECHNOLOGY CRUCIAL IN DEEPWATER

ERNESTO INIESTA
Commercial Director, Subsea Systems of FMC Technologies Mexico

Q: What is your perspective on the current situation of the oil and gas industry in Mexico?

A: One of the main reasons for the oil expropriation was to force the retreat of foreign oil companies. Nowadays, when we analyze the operating environment, we find that there are countless domestic and foreign consulting firms, equipment manufacturers, service providers and drilling operators that are working with Pemex in all areas of exploration and production. Mexico has succeeded in the development of fields, stabilizing production, and is now focusing on the challenges that the future of the industry will bring, such as the decline of Cantarell and the logical sequence that KMZ will follow. Pemex is taking the appropriate measures in order to compensate for these declines through schemes such as the integrated service contracts (ISCs), Chicontepec's reassessment, heavy oil field developments, increasing investment in exploration, new discoveries in the South Region, and the discovery of both oil and gas in deepwater, which becomes tangible in Lakach, Mexico's first deepwater development.

Q: What is your opinion on the ISCs?

A: In order to talk about ISCs, we must first talk about the 2008 Energy Reform, which was a giant step for our government as all political parties agreed on creating the National Hydrocarbons Commission (CNH) to regulate the industry, allowing the entry of professional board members, and developing a new contracting model. However, I must say that the opportunities offered under the new contracting model are still limited in comparison with international contracting practices, but the ISCs are a step in the right direction.

Q: Do you believe that the ISCs could be used as a model for deepwater development?

A: My perception is that more modifications still have to be made to these contracts before they could be successfully applied to deepwater development, which represents a much higher risk for investors, and they would therefore probably like to share this risk. We have had feedback from some producers, who indicate that it would be very difficult to participate in deepwater projects under the current contracting model. This would leave Pemex in a vulnerable position because potential partners will ask to share the projects' risks and profits. Furthermore, the ability to book reserves normally is a requirement for the oil majors, which suggests that a model to attract private investment for deepwater projects would need to find a way to match this requirement with ensuring that all hydrocarbons remain property of the Mexican state. However, we all know that this will not happen. Therefore, it is necessary to find a mechanism that allows Pemex to partner and share profit with producers in a way that allows them to invest in the development of deepwater projects, and contribute the essential experience and deepwater technology that they possess.

Q: What could an appropriate mechanism for deepwater development look like?

A: This will be a key topic for the next energy reform. Our government will have an arduous work in order to convince the different political parties, and public opinion, that Pemex will not be privatized. On the contrary, it will stay as it is and will become a stronger state company. Likewise, we must strengthen both the CRE and the CNH by giving them more resources and authority. Another relevant aspect will be how to attract sufficient foreign investment to these projects, which will require US$5-10 billion per year. Also, we must understand that even though Pemex has ample experience in onshore and shallow water fields, it has no experience in deepwater, and developing this experience will take many years. This is the main reason why Mexico cannot risk investing public money in these projects, as it could be better used for investment in the Mexican states, education and other public services.

Q: How can FMC Technologies help Pemex to develop its deepwater discoveries, particularly in the Perdido area?

A: We are the company that developed the US side of the Perdido area, and we are the only organization that has all the required technology, such as subsea separation and boosting systems for ultra-deepwater, manifolds, and enhanced vertical deepwater subsea trees that were developed especially for Perdido. We are the leaders in this field and our target now is Perdido, which will be a profitable ultra-deepwater project. We have the experience

to develop this field. We are sure that Pemex will need a lot of training, support and expertise, and we are ready to offer this support and to pass on our experience gained on the US side of Perdido.

The upcoming energy reform might allow Pemex to establish a consortium with experienced operators. The outcome will determine how Perdido will be developed. Moving forward without any experience in ultra-deepwater will present Pemex with a tremendously steep learning curve. With our experience, and the experience from others, we can start production in five years based on proven technology and solutions. We would probably be using existing subsea hardware for the development of such fields, and topside facilities, which could be a spar, most likely in combination with an FPSO. These three elements would be key for the development of this project, as well as working with companies that have the required experience. Developing such a project with the companies that offer the cheapest solutions is not the proper way to do it, having access to the right technology and experience is crucial.

Q: If the energy reform would not allow Pemex partner with private companies, or if Pemex would not be allowed to offer attractive terms to these companies, would Pemex be able to execute this project alone?

A: I do not think that Pemex can develop these fields alone at this moment, since they require a lot of experience. Pemex is most experienced and efficient in onshore, shallow water and subsea projects that are not too complicated. Probably, shale gas, transportation and ultra-deepwater projects should be moved to a new entity that is dedicated to strategic projects and can enter into agreements with outside partners. This would enable Pemex to continue to focus on the areas in which it has expertise, while it could attract the required outside experience in the other areas. If Mexico does not open the door to private participation in the upstream oil and gas industry, then IOCs and technology leaders will invest in other countries where they can optimize their return on investment. Africa presents a huge opportunity, Brazil is also interesting, and Colombia is coming fast. Mexico could be the least attractive opportunity, which means that it would not be able to attract the required expertise and capital. We are currently training a team of Spanish speaking people in Houston who are ready to come to Mexico and take on deepwater projects.

Q: If the energy reform does allow private participation in deepwater development in Mexico, then what would this mean for FMC Technologies?

A: We have worldwide alliances with Shell, BP, and Anadarko, frame agreements with Statoil and Petrobras, and good relations with Chevron and ExxonMobil. The opportunities for us are huge. Of course, we will also continue supporting Pemex, which is our main customer. The industry just has to be patient, something will happen and that is the reason why we are here. There is great potential in the deepwater Gulf of Mexico and expectations for the future in Mexico are good. The benefits of deepwater projects will be for the country, and they will start to be delivered during the next presidential term. The energy reform will define how that will be done. We will continue to focus on Mexico. My feeling is that this is the year of changes.

US PERDIDO TECHNOLOGY EXPERIENCE

The US Perdido project, developed by Shell in collaboration with BP and Chevron, started production in March in 2010 from the Great White, Silvertip, and Tobago fields, using a spar production facility. Water depth in the region ranges from 2,300m to 3,000m, breaking the record water depth by over 50% and opening up a new frontier for global oil and gas production.

CHEMICAL COMPOUNDS FOR DEEPWATER PIPELINES

Although historically Arkema has worked predominantly on downstream projects in Mexico, the French chemical company also has a number of products and solutions for the upstream oil and gas industry in its portfolio. As Manuel García, General Manager of Arkema Mexico explains, now that Pemex is ready to move on to more challenging projects, Arkema's upstream portfolio has grown in relevance in the Mexican context: "Now that the era of easy oil is over for Pemex, and the company is moving to more demanding reservoirs, such as those in deepwater, there is an opportunity for us to grow our upstream business." In recent years, Arkema has focused on deepwater solutions, working closely with Petrobras in Brazil to make the process of producing oil in deepwater less challenging for operators.

"We have looked at deepwater from the point of view of the complete production infrastructure. Deepwater wells are being drilled today at water depths of 3km and more, and Arkema has been working to develop chemical products to make that whole process easier for operators." García goes on to detail exactly what this involves, from working with the chemical structure of the construction materials for deepwater platforms in order to make them more resistant to the conditions experienced at sea, to developing special grades of pipeline that can withstand the temperatures and pressures encountered at extreme water depths. "The problem with developing deepwater pipelines is that they need to be able to endure intense temperatures and high pressures, while at the same time they must be flexible enough in order to cope with movements of the topside facility," says García. "In collaboration with deepwater operators and umbilical technology companies, we have participated in a number of different deepwater pipeline projects: we have worked on various different solutions where our compounds can help protect against corrosion and other damage, including coatings, polymers, and multi-layered pipe. Each project requires a tailored approach in order to tackle the individual profiles of each well and develop an optimized solution."

In the Mexican market, Arkema will follow Pemex's deepwater development plans closely in order to make sure that they can partner with the appropriate companies, providing them with the chemicals and compounds they need in order to develop pipes and umbilicals suitable for deepwater. "In Latin America, there tends to be a focus on national content and local development of such materials, but if Pemex decides to work with an international pipe manufacturer for its deepwater developments, that is also no obstacle for an international company like Arkema," García concludes.

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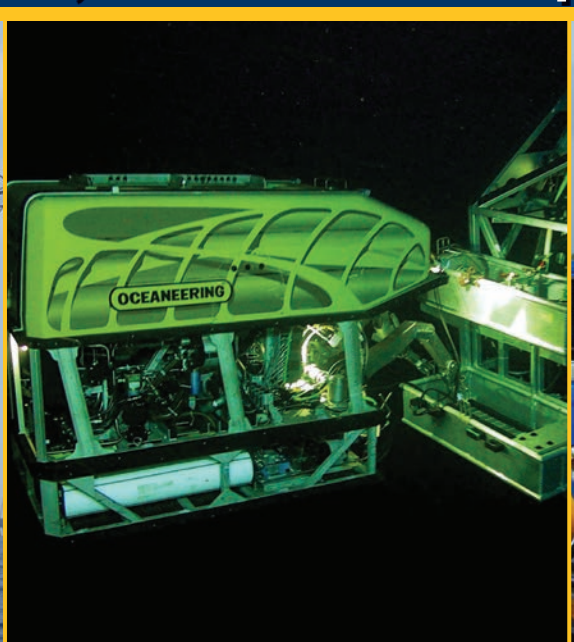

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SIMULATED SERVICE VESSEL FOR DEEPWATER PIPELINE SERVICING

Pemex's recent successes in deepwater exploration wells create the conditions for technological developments in Mexico's deepwater oil and gas industry. Simulated Service Vessels (SSVs) is a technology that the NOC might need for deepwater pipeline servicing.

Insulation – or flow assurance – coatings are commonly applied to offshore pipelines to ensure the flow of hydrocarbons at elevated temperatures. The thermal properties of the insulation system can be readily modeled; however, the performance of the insulation needs to be verified under conditions similar to those encountered in deepwater environments. Simulated service testing is critical for both insulation coating systems that are currently used in the industry, as well as for innovative insulation systems. Current systems require validation prior to deployment of the pipeline to avoid extra costs due to downtime.

Historically, SSVs have been used in the oil and gas industry to test the performance of insulated offshore pipelines by submerging test pipe into pressurized water with constant water temperature, while controlling the elevated temperature inside the pipe. By measuring the heat flow, thermal conductivity and compressive creep of the insulating material, both the thermal efficiency and depth rating capabilities of the insulation can be confirmed. This data can also be used to validate the design and integrity of the insulation system.

As a consequence of the increasingly challenging industry requirements, ShawCor – a Canadian energy services company serving oil and gas companies around the world – has built a new state-of-the-art 82 tonne SSV, the largest such vessel in the world. The new SSV is essentially a large cylindrical autoclave, capable of accommodating pipes 6m long and up to 810mm external diameter. The test pipe is mounted onto a carriage which is attached to the vessel door on one end and rides on wheels on the inside of the vessel on the opposite end. Upon establishment of thermal equilibrium, the vessel is pressurized and held at the required pressure for the duration of the test. The pressure is increased in specific increments to assess the immediate and long term response of insulation properties to changes in pressure at a specific operating temperature which is set by internally heating the test pipe. Alterations in compressive creep and heat flow are also measured over time.

The ShawCor SSV has been designed to test an equivalent water depth of up to 3,000m at an internal pipe temperature of up to 180°C. Futhermore, it has the capability to compare the performance of three insulation coating systems simultaneously, with multiple measurements for each coating system. If required, the SSV can test for cool down time and provide accurate, real-time measurements of creep to evaluate long term reliability of the insulation. The conductive heating system provides tightly controlled temperature within each zone with a maximum variation of +/- 1°C at any point in the zone. A high capacity chiller system maintains a temperature of 4 °C to 6°C around the pipe. Another distinguishing feature of the new SSV is its capability to stream real-time data that can be accessed by the customer 24 hours a day during the entire duration of the test.

Pemex's future projects will require pipeline insulation coatings and ShawCor is ready to support the NOC through its subsidiary Bredero Shaw Mexico, which offers a full range of end-to-end pipe insulation coatings. The new SSV will also be part of the story as a critical tool for validating the long-term performance of the insulation coating systems.

THE EVOLUTION OF WELL CONTROL TECHNOLOGIES

The Macondo Well blowout in April 2010 sent an unprecedented shockwave through the global oil and gas industry. Governments around the world began calling for oil companies of all sizes to have enhanced operational and safety plans in place for offshore and deepwater operations to prevent a major blowout, and to also have sufficient response capabilities – including equipment, personnel and training – readily available to respond to a worst-case spill scenario. Given this new global regulatory and political environment, and the challenges oil companies now face in meeting the regulatory mandates that are critical to gaining new drilling permits, Wild Well Control is playing a proactive role to make its approximately 40 years of well control and blowout response experience available to oil and gas companies seeking to meet the new regulatory requirements.

Safety and risk management are central to Wild Well Control's approach to oil and gas exploration and production, and their business is based on providing the training, equipment, and personnel needed to not only be prepared, but to prevent worst-case scenarios. In response to new exploration challenges, as well as evolving technology and the significant growth in the number of wells being developed, Wild Well Control has expanded its team and offerings. For example, Wild Well Control recently developed the WellCONTAINED Subsea Containment Solution, an integrated, comprehensive solution to deepwater well control issues featuring a modular capping stack, and increased operator flexibility to meet situation-specific demands. The WellCONTAINED system provides operators a full range of solutions for the preparation, prevention, response, and recovery from a well-control event in up to 10,000 feet (3,048m) of water. In addition, Wild Well Control personnel also work with operating companies running emergency response drills and exercises, ensuring their state of readiness to respond to a well control emergency.

Wild Well Control has also significantly enhanced and expanded its Well Control Training program, providing training to approximately 11,000 students in 2012 alone. This practical, hands-on well control training program uses advanced simulator systems and a specialized curriculum designed to ensure that trainees can meet or exceed government safety, training, prevention and well-blowout response standards. Simulators use actual well data to mimic possible downhole conditions, recreating a wide variety of operational difficulties that test a trainee's ability to resolve unique developments and avoid a blowout. The training program is accredited by the American Petroleum Institute and by International Association of Drilling Contractors to provide all levels of WellCAP certification.

Pemex and the Mexican government are proactively addressing potential blowout situations, and are focused on ensuring that personnel across all levels of exploration activities – from the executive suite to the field – are trained beforehand, know their roles, and are not using actual events as 'on the job' training. Finally, since no two well control incidents or blowouts are the same, maintaining awareness, training, and flexibility are critical to effective incident response. For Mexico, whether a well is in the Gulf, the Pacific or the Caribbean, a timely and orderly response from the top of an organization down to the team in the field is paramount to achieving a successful outcome.

PEMEX AND WILD WELL CONTROL

In 2010, 24 deepwater operators were hired to deal with the Macondo accident, and Wild Well Control was among the companies managing the consequences of the blowout. The Texas-based company - which has 17 offices in eight countries and responds to more than 80% of all blowouts worldwide - signed an agreement with Pemex in May 2012, aimed at improving security measures at the NOC's deepwater projects.

It is estimated that the Deepwater Horizon spill cost British Petroleum (BP), the world's fifth oil and gas company, US$41 billion. Even though a series of lawsuits against the platform owner and several operating companies helped cover part of the losses, this figure represents over 2.5 times the entire profit of BP during 2009. Considering that tax levying leaves Pemex a much feebler profit margin, the Mexican company would not have the resources to affront a similar disaster.

Signaling the importance of its flourishing business relationship with Pemex, Wild Well Control built its latest training facility in Ciudad del Carmen, which will start operating at the beginning of the second semester of 2013. Three simulators will be installed in order to train students, Pemex personnel, and employees from the NOC's contractors and subcontractors. In addition, two courses regarding subsea drilling and subsea drilling workover will be offered.

THE ROLE OF INSURANCE IN DEEPWATER ACTIVITIES

To ensure safe operation during drilling procedures, well control and monitoring have to be thoroughly observed and regulated in order to prevent the possibility of hydrocarbons leaking out the wellbore. Those tasks need to be strengthened even more in the harsher conditions of deepwater, since there are additional complex variables to be taken into consideration when drilling at greater depths – higher pressure, higher temperatures, and nature-related variables, such as erosion and water drift strength, among others.

After the Deepwater Horizon incident in 2010, Pemex is carefully working towards bringing additional regulations to anticipate and prevent possible accidents in deepwater. "Pemex requires service companies to increase the number of blowout preventers and divisors to stop hydrocarbons from getting out of the wellbore," details Miguel Ángel Camacho Torres, President of Camacho & Asociados. "However, the inclusion of these precautionary measures does not replace the need to have financial guarantees and insurance to execute the project." Every company that seeks to do business in the Mexican oil and gas industry needs both insurance and bond guarantees before contracting with Pemex. "All service providers need to adhere to a surety bond and an insurance contract – either on civil liability or on the assets," says Juan Pablo Murguía Ashby, Director General of Murguía.

This deepwater incident also caused oil-related businesses to amplify the importance of liability assurance for their deepwater enterprises, as they were reminded of the possible economic and legal repercussions that could come with performing operations at increased water depths. To be able to provide the financial assurances necessary from a risk management point of view, companies in the financial services sector continue to prepare themselves for the future development of deepwater in Mexico. In order to understand the segment better, they have surrounded themselves with oil and gas experts from all over the world. "It is fundamental to rely on experts' assistance for the risk assessment of each project," Murguía Ashby emphasizes. "Our company has been involved in incident management consulting in many high profiled cases such as the Deepwater Horizon blowout," says Bruno Portilla, General Manager of London Offshore Consultants. "We are familiar with deepwater operations up to 3,000m depth based on our participation in deepwater projects around the world."

International insurance companies that have been involved in foreign deepwater enterprises and therefore know about the fundamentals of how the coverage market works globally still need to anticipate to what the Mexican model will look like. In their quest to understand the variables involved with the local culture, they still need answers to many questions, since Pemex has yet to define its approach on deepwater risk administration. "We believe deepwater in the country will be done following the development path that Mexico has traditionally followed," asserts Portilla. "The question is: will Pemex absorb all the construction costs in deepwater, as it does in shallow water and onshore?" This answer might be crucial in the definition of companies' insurance strategies and risk assessment criteria.

Camacho Torres also believes that the main difference for insurance relies on local safety regulations. "Lloyd's Insurance Market has worked in the same way for 200 years, and the company continues to be the insignia for insurers. The difference comes in the legal framework that Pemex and other Mexican authorities have established for other companies to operate in the country's oil and gas market," he explains. "The market already has a very strong regulation with the intentions of protecting the interests of all involved." But these regulations include some conditions that have scared off companies, and some international corporations have even left the Mexican market. "Some international companies no longer work in Mexico due to unlimited liability clauses included in the contracts, which state that the contractors are financially responsible for every possible incident during the period of the contract," says Camacho Torres. "As long as there is no record of the delivery of every job stipulated in the contract, the risk is still on providers and contractors. This is why it is so common for them to get insurance against acts of nature," Murguía Ashby adds.

With a new energy reform on the horizon, the whole landscape for deepwater activities might change, and prospects for a wider insurance market at greater depths will continue to gather momentum. "Political consensus seems to encourage more private investment in the Mexican industry," says Camacho Torres. "With this in mind, and the fact that certain activities are not specifically mentioned in the Constitution, there could be some opportunities for additional opening in deepwater – especially when talking about deepwater drilling."

Pemex needs to define some gray areas within its approach to deepwater projects. As these questions are answered, the already paramount insurance and bond markets will have more accurate regulations that will lead to a safer Mexican deepwater segment.

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DEEPWATER RISK MANAGEMENT

RAFAEL PARRILHA
Director General of Bureau Veritas Mexico

Q: How have regulations for risk management in deepwater progressed in Mexico to date?

A: At the end of 2011, the National Hydrocarbons Comission (CNH) published its first deepwater regulations which require that all companies prove that they are ready to operate in deepwater, and are prepared for the challenges they will face throughout the lifecycle of a deepwater project. We started to develop this regulatory framework with Pemex at the beginning of 2012.

Q: Which standards were taken from international best practices, and which were created specifically for the Mexican market and the needs of Pemex?

A: Bureau Veritas has a remarkable amount of experience accumulated since the beginning of exploration at deepwater fields. For our work on the Pemex regulatory framework for deepwater, we have used our strong network of specialists distributed around the world, but mainly in the countries with relevant experience in deepwater such as France, the UK, and Norway in the North Sea and Africa, Brazil for Latin America, and USA for the Gulf of Mexico. By leveraging our global deepwater expertise we were able to present Pemex with the latest international best practices for deepwater regulation available in the industry. By integrating these into a flexible benchmark Pemex is able to 'tropicalize' the international standards and best practices, incorporate its own best practices, and create a framework that fits the realities of deepwater operations in Mexico.

Our work did not consist of creating standards for Pemex; instead, we recommended that Pemex follows the international trends established by the IOCs in recent years, to search for an unification of standards into ISO standards, and to identify the critical areas where its important for Pemex to incorporate relevant requirements, which also creates a window to introduce technological innovation.

Q: How will the regulatory framework affect companies that will be working in deepwater with Pemex, in terms of their risks, liabilities, costs and strategies?

A: First of all, let me clarify that Pemex still has to implement this regulatory framework. As the regulatory framework was developed based on international benchmarks, it should represent important cost savings for the major players of the industry, since their main technologies already fit those standards. In terms of risks and liabilities, the framework incorporates the experience from the most relevant incidents that have occurred in recent years. Finally, the concept of flexibility will permit the major players to adopt a straightforward strategy to reach the universal objective of all companies in this business: to explore and produce as efficiently and safely as possible.

Q: How do you assess Pemex's current attitude towards deepwater risk management? What are the biggest challenges that still need to be addressed?

A: In my opinion, Pemex is working very hard at risk management for all their assets, including those located in deepwater. This can be confirmed by several initiatives, such as the establishment of their own system for health, safety and environment. Besides, the strategic partnership signed with several international oil companies such as Repsol, Petrobras, and Total reinforce the message that Pemex is aiming to speed up its learning process to move towards deepwater by incorporating the experience accumulated by other companies. To reach its objectives, the main challenge for Pemex will be to reduce its internal bureaucracy that in many cases delays projects and increases costs, and also to reform its organization to allow the integration of the various Pemex organisms into a common homogenized business model.

Q: Deepwater development is a long-term goal for Pemex. What role does Bureau Veritas aspire to play as Pemex further develops its deepwater assets?

A: Based on our experience, we hope to be a major partner for Pemex. We are present in more than 140 countries. We have been in this business for a very long time, and a member of the International Association of Classification Societies for 180 years. We know the technology that has been applied at similar fields in Brazil, Africa, and in the US Gulf of Mexico. The intention of Bureau Veritas is to be one of the most important players and partners in helping Pemex to create a strong culture of safety and risk management.

STRATEGIC ADVISORS FOR INSURANCE OFFSHORE

The risks present in offshore operations in the oil and gas industry have historically compelled companies to obtain insurance and financial guarantees. This is no different in the Mexican market, where offshore projects represent an important part of Pemex's investment budget. Working with Pemex means that insurance policies have to be signed in Mexico and all contract terms have to be based on Mexican law.

This is where the expertise of companies such as Grupo Vitesse, a Mexican strategic consultancy specialized in insurance and surety bonds, and Gard, the world's second largest marine insurer, comes into play. "Whenever you work with Pemex, you need to have sufficient guarantees that validate your operation and the ability to continue working even when an incident happens," says Graciela Álvarez Hoth, CEO of Grupo Vitesse.

"Foreign companies have always been present in Mexico, but given the lack of knowledge of governmental procedures, they frequently work in tandem with Mexican companies," Álvarez Hoth explains. "However, the opening of the industry has brought international companies operating independently into the market."

Norwegian marine ensurer Gard came to Mexico in response to the increased business of Norwegian vessels with Pemex. "As vessels from Norway started to do business directly with Pemex, we came here to cover them," Tore Furnes, Senior Underwriter and Product Responsible in P&I Offshore at Gard, explains. "Then, those companies started becoming partly Mexican, either by opening subsidiaries in the country or by forming partnerships with local companies." Gard has covered Pemex's contractors for 10 years. "We started with a few tankers and now we guarantee many types of vessels for them," Furnes adds. "When we first came to Mexico, it appeared that a lot of the contractors were actually uninsured, thinking that Pemex would provide for them," Furnes recalls. "Some of them still believe this is true, while the reality is that these companies should be looking to insure themselves on their own to support the potentially huge liabilities that working with US$100 million vessels may bring."

Furnes believes that insurance is about advice and trust, and companies need to earn that trust through experience. "Insurance is about consulting with operators and service providers about the risks they are exposed to, and the type of coverage that they need," Furnes describes. "Our company is more than 100 years old and we have focused on offshore underwriting since the early 1970s. We are one

LEFT: Graciela Álvarez Hoth, CEO of Grupo Vitesse
RIGHT: Tore Furnes, Senior Underwriter and Product Responsible in P&I Offshore at Gard

of only three or four companies that provide insurance for rigs and we currently have 450 rigs on our books. We are also one of the few underwriters that do this on a regular basis. With all this experience, we transmit confidence and knowledge. If you are able to convey that to the market, people will listen to you and feel safe buying insurance from you."

With deepwater challenges looming in the short-term in Mexico, insurance companies that want to participate in this segment of the market will have to be able to transmit the same trustworthiness and confirm their expertise. "The technology is different, the equipment usually more expensive and the exposure higher, but we have the know-how and suitable coverage for such exposure," says Furnes. "We have experience covering this type of risk, and are already covering a substantial number of contractors involved in deep-sea installations and deepwater rigs on a worldwide basis."

While Gard is counting on leveraging its global expertise, Grupo Vitesse is approaching this opportunity from the Mexican experience angle. "Grupo Vitesse has developed the correct infrastructure and the capability to cover a wide array of projects in the market: this has led to maintain the quality of our service for 23 years. Success in this market depends on understanding what Pemex wants," Álvarez Hoth says.

But carrying out insurance activities for such large investment projects also requires having a reinsurer able to cover the insurance policy. "We work with the highest quality re-insurance companies, which Pemex and Petrobras also use," says Álvarez Hoth. "We talk to our clients constantly to see what their contracts mean for them in terms of risk and exposure. The high standards of Pemex have driven us to be very conscious about the required insurance capabilities to provide the correct coverage, measuring different types of risk that include those that deepwater might bring."

REINTRODUCED REQUIREMENT CREATES CERTIFICATION BOOM

ECKHARD HINRICHSEN
Country Manager of GL Noble Denton

Q: Pemex introduced the requirement that certification companies must have IACS certification. How has this changed the market for GL Noble Denton?

A: As a result of some bad experiences, Pemex is reintroducing the International Association of Classification Societies (IACS) requirement, which means that only a few select international companies will be qualified to conduct certification activities for Pemex. In the past, certification was not required in all areas of activity, but it is making a comeback, especially in areas such as deepwater drilling, where the National Hydrocarbons Commission (CNH) made it mandatory.

In recent months, our company has worked on a certification project that is just starting up in Veracruz, and we opened a new office in Ciudad del Carmen focused on marine services, which already enabled us to win several contracts. Marine services for Mexico were run from our Houston office in the past, but we realized that, because of the way that companies do business in Ciudad del Carmen, it was much better to have an office there in order to take full advantage of the available opportunities. The work we are doing from the new office includes marine warranty surveys, marine consultancy, and due diligence for vessels. If a bank is asked to finance the purchasing of a vessel, then they employ an independent technical expert to check out the vessel technically, financially, and assess the management capability of the company that will operate it. This is the type of work we hope to be carrying out from Ciudad del Carmen.

We have also continued our work on deepwater drilling and the first Mexican deepwater project Lakach. We are conducting worst-case assessments for deepwater wells and recently we finished the high-level risk assessment and risk management plan for Lakach. Our work certifying pipelines and infrastructure in Pemex's South Region is now winding down, and we are currently conducting a risk analysis project in the same region.

Q: What was the full scope of your work at Lakach?

A: Although Pemex's Lakach project was commissioned some time ago, it is still at the FEED stage, so our work was mainly concerned with giving Pemex guidance about what type of risk analysis and studies would be needed across the life cycle of the project, from FEED stage to abandonment, and across all the assets, from wells to subsea infrastructure, pipelines, and gas plants. We worked with our colleagues from the Houston office and developed a state-of-the-art plan, similar to what the major oil companies are doing for their deepwater projects, but taking Pemex and Mexican requirements into account. These things are always dynamic and they may also change over the course of the project. Companies may come up with better solutions, or change their strategy: it nearly always happens, and then you have to adapt the plan.

Q: How do your services slot into the different life cycle requirements of a project like Lakach?

A: It starts with drilling: we can do evaluation of the well design, plan for worst-case accident scenarios, and do the financial impact analysis, as we do for the wells right now. We can also help with optimizing field design and subsea architecture. We have, for example, a software tool called Optagon, which is used for conducting reliability, availability and maintainability (RAM) analysis. If you have different alternatives for subsea architecture, such as the choice of having one manifold, two, or none, then you can look at all those options and do a numerical analysis to find the best option, and then make a recommendation.

Q: Are there any products or solutions that have good potential for being introduced into Mexico?

A: Uptime is a product for which we see a lot of potential. We have installed the software once in Mexico for Sempra Energy at their gas pipeline system, but we want to push this product more aggressively. In the area of structural reliability and integrity of offshore platforms, we see a lot of opportunities for consultancy and AIM services with Pemex, as platforms are approaching or exceeding their design life.

GL Noble Denton, part of the GL Group, is an independent technical advisor to the oil and gas industry. The company provides consulting, design, assurance and project execution services.

7

In 2011, Pemex created a new development division with a mandate to operate between the exploration and production phases of upstream projects. The intention was to create an organization structure that would enable Pemex to make smarter development decisions at its projects, ensuring that the correct technologies and designs are being used, and planning for the long term exploitation of fields rather than simply finding the production method that would allow the NOC to produce as much as possible, as quickly as possible.

In this chapter, we examine the priorities of this new development division, the investment being put into development by Pemex, and the companies that are providing a wide range of technologies and solutions for the development of new upstream infrastructure. We also look at the main fields that are in the process of being developed this year.

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CHAPTER 7: DEVELOPMENT & EPC

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PRIORITIES OF THE DEVELOPMENT DIVISION

"The new development division is absolutely crucial for the success of Pemex E&P," says its Director General, Carlos Morales Gil. "It has one single objective: to reduce the time between discovery and first production. If we cannot achieve this objective, then we will have failed, and this failure will show in our results in two years." As an example of the success of this new division, he points to Tsmin, which was discovered by Pemex less than a year ago, but is already producing. "However, the real test for the Development division will be Lakach and Ayatsil," says Morales Gil.

The development division of Pemex Exploration and Production already has a number of projects in its portfolio, and under the leadership of its Subdirector, Juan Javier Hinojosa Puebla, it is exploring new technologies in order to find the best methods for exploitation of recently discovered fields. According to Morales Gil, "the development division is doing an excellent job of integrating new technologies at its priority projects such as Lakach in deepwater, and at the heavy oil field Ayatsil. The department has developed new wells designs, and worked on the technological options for the use of FPSOs as an early production solution. At Tsimin, the development division is even incorporating new technologies for the design of fixed platforms," he explains.

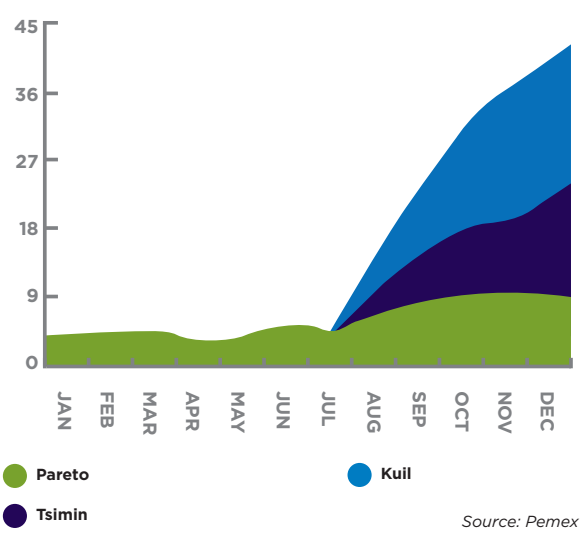
Elaborating on the design of the platforms at Tsimin, Morales Gil explains that the development division realized that it could simultaneously drill wells with dual rigs; either a platform and jack-up rig operating in tandem or with two fixed platform rigs. "This new development is completely production-driven," explains Morales Gil. Other issues that the development division of Pemex E&P has been working on at Tsimin are the installation of separation systems for handling light oil, the next generation of compression systems, and well completion technologies. Morales Gil stresses that all these advancements are technology-driven.

One of the biggest challenges for the development division, according to Morales Gil, will come in contracting the technologies required for the development of its new fields. "Although the process established by the Pemex Law has given us a more robust contracting model, and a better way to analyze contracts, the problem lies in the approval stages that each contract must pass through within Pemex." Under current laws, each contract must attain five separate approvals from various boards and committees within Pemex. Morales Gil hopes that through the restructuring of Pemex, two of these stages can be eliminated, so that the whole contracting process can be streamlined. "You could argue that these two additional approval stages add up to a lot of money in terms of reaching production as early as possible," says Morales Gil. "The value added by these two extra approvals is minimal when compared to this."

Despite the continuing challenge to optimize the approval process to contract new technologies, Félix Alvarado Arellano, Administrator of Ku-Maloob-Zaap (KMZ), explains that Pemex must follow the scheduled program for 2013. According to the KMZ Administrator, the program will cede exploration of new fields to the Pemex E&P exploration division, and after discovery they will be transferred to the development division, which will prepare and execute the development plan and later transfer the field to the relevant administration. For example, in the Ku-Maloob-Zaap complex, Arellano Alvarado explains that the development division will drill the Tson and Tekel wells, and after these have been drilled, completed, and connected to production infrastructure, they will be transferred to the Ku-Maloob-Zaap Administration for exploitation.

If Pemex follows its scheduled plan for 2013, the development division will have more independence and freedom to implement its own policies and processes without interference from other divisions. However, the CEO of CBM, Luis Vielma Lobo, believes that the number of divisions and the interaction between them does not add or decrease value: what matters is how those divisions are organized and how they collectively create value for the whole company. "What matters is how well organized the company is. If it is decentralized enough to make all kinds of decisions separately, but centralized enough to execute an integrated strategic plan, then of course it can be successful," he argues.

NEW FIELDS PRODUCTION IN 2012



Source: Pemex

LITORAL DE TABASCO ATTRACTS DEVELOPMENT INVESTMENT

Pemex's forecasted production plans rely heavily on the development spending it will be doing in 2013 and the years to come: from fourth quarter 2012 production levels of 2.56 million b/d, the company hopes to reach 2.70 million b/d by 2014, and 3 million b/d by 2018. According to Pemex's estimates, projects currently in development should account for 500,000 b/d of that 2018 production figure.

One of the main aims of the development division is to gain a full understanding of new reservoirs and bring them to production as quickly as possible. One of the projects where the division has managed to achieve this has been at Tsimin-Xux, showing that in the years to come, shallow water may still hold a lot of potential for the development division.

"We got the first oil at Tsimin-Xux in July 2012," reveals Gustavo Hernández, Subdirector of Planning at Pemex Exploration & Production. "Pemex has two producing wells at the field today, jointly producing close to 10,000 b/d." The production plan for the field involves adding two more platforms to the two existing ones, Tsimin-A and Tsimin-B, which should be producing by the first quarter of 2014, according to Hernández. The drilling plan for 2013 at Tsimin-Xux has recently been reduced from a planned eight wells down to five, due to delays in the tendering of the necessary jack-up rigs. This will obviously affect the production target for the area, but Hernández believes that each well drilled should produce between 4,000 and 5,000 b/d, given the geology of the area.

The reserve levels at the field are impressive: Tsimin holds an estimated 1.1 billion boe in 3P reserves, with Xux holding 836 million boe of 3P reserves. Both reservoirs contain light crude oil, an extremely useful resource for Pemex given the amount of heavy and extra-heavy oil that the NOC is currently producing at Ku Maloob Zaap: the current plan is to use the light oil to blend with the heavier oil in order to reach the necessary API gravity for refining in both Mexico and the US.

The long-term development plan for Tsimin-Xux involves linking the infrastructure together with the existing production infrastructure of Litoral de Tabasco: Pemex is currently planning the construction of both a low and high pressure compression platform and a production platform at the nearby field by the end of 2015, along with pipelines to shore that will begin their life as oil and gas pipelines. At a later stage will operate as a low pressure gas pipeline, and by 2016, will be operated as a high-pressure gas pipeline. By linking the infrastructure together, and tying Tsimin-Xux to the other production zone, Pemex will create a shallow water production center at Litoral de Tabasco that the NOC hopes will become extremely important in the years to come, as Cantarell declines and the company tries to diversify its production.

As a result, several important shifts in the allocation of the development budget have taken place between 2012 and 2013. The strong focus on the development of Tsimin-Xux is reflected in the budget available for Litoral de Tabasco, which receives 17% of the development budget this year as opposed to 4% in 2012. At the same time, development investment in Cantarell declined only moderately while Ku-Maloob-Zaap's budget only represents 10% of the total development budget in 2013, down from 17% in 2012.

DEVELOPMENT INVESTMENT 2012

FIELD	INVESTMENT	% OF BUDGET
Cantarell	US$1,524 mln	22%
Ku-Maloob-Zaap	US$1,318 mln	19%
Samaria-Luna	US$917 mln	13%
Chicontepec	US$990 mln	14%
Bellota-Jujo	US$638 mln	9%
Abkátun-Pol-Chuc	US$685 mln	10%
Poza Rica-Altamira	US$285 mln	4%
Litoral de Tabasco	US$349 mln	5%

DEVELOPMENT INVESTMENT 2013

FIELD	INVESTMENT	% OF BUDGET
Cantarell	US$1,292 mln	21%
Ku-Maloob-Zaap	US$619 mln	10%
Samaria-Luna	US$765 mln	12%
Chicontepec	US$852 mln	14%
Bellota-Jujo	US$545 mln	9%
Abkátun-Pol-Chuc	US$577 mln	9%
Poza Rica-Altamira	US$100 mln	2%
Litoral de Tabasco	US$1.085 mln	17%

Source: CNH

AN EXTERNAL LOOK AT PEMEX'S DEVELOPMENT DIVISION

JUAN MANUEL DELGADO
Director General of Schlumberger Mexico

Q: What has been the main recent development in the Mexican market from Schlumberger's perspective?

A: The biggest change in the market over the last couple of years has been the introduction of the integrated service contracts concept. This has been advantageous both for Pemex, which will eventually be able to use the projects to boost its production figures, and also for the private sector, which will be able to participate a little more in Mexico. This will give an additional volume of work for service companies in the market, both upstream and in terms of transportation infrastructure.

Q: How have the changes in the structure of Pemex E&P affected the way you do business in Mexico?

A: 2012 has been a transition year for the implementation of this new structure, and Pemex is still adjusting internally to these changes. The production assets are now focused on production and the new development division has a chance to prove itself at two upcoming projects, Tsimin-Xux and Ayatsil-Tekel, but the results are yet to be seen as both projects are still in the planning phase. For Schlumberger, this change means splitting our traditional way of working and contracting, since our company used to be contracted by the drilling department for one specific area into the production team, since they used to have a macro perspective. Now, you have a separate division that is planning much more ahead to create the best conditions to develop a field. That is certainly creating openness to innovation. This does not mean that the new structure will facilitate additional flexibility in the industry: we still have to follow all the contracting procedures and follow the rules in place. However, there is one important benefit: the development division will enjoy its independence to focus solely on field development objectives, without being influenced by production objectives or budgetary issues. The success of this division is to be seen in the future: 2013 will be the year for this branch to prove it can expedite contracting execution and facilitate new technology introduction.

Q: Has Schlumberger made internal changes in its organization to match Pemex's structure in order to better interact with the three divisions that exist today?

A: Yes, definitely. However, we have to be patient, since Pemex is still in the process of finalizing its new administrative processes. This means we will have to wait until everything is more concrete before we set our own processes in stone. We will see what the changes are, how they are going to affect us, and then we will need to adapt very quickly. In the meantime, we are creating areas of focus within the company that are directed specifically to these new processes.

We actually started to shift our own internal organization before the restructuring at Pemex E&P was announced. It

is sort of a coincidence that we have an exploration group that is composed of different segments that participate in exploration projects. While some solutions and technologies in our portfolio are used in the exploration phase, they can be applied across the entire value chain. We will not precisely mirror the changes at Pemex, because we have a measure of overlap between the services we offer across our product lines. We prefer to group our services into reservoir characterization, reservoir production, and drilling. There are services within each of these areas that overlap with the different processes involved in exploration, development and production. We do mirror Pemex in their geographic organization; but our service organization is different. We also have individual experts in areas such as reservoir characterization and petrophysics who provide their expertise across a range of different areas. Each of these experts belongs to a technical pool that we draw from whenever necessary to services any of the three subdivisions from Pemex E&P.

Q: What are today the main topics in your discussions with fellow petroleum engineers in important positions in Pemex E&P such Carlos Morales Gil and Antonio Escalera?
A: The passion and the excitement is high among all the subdirectors who have participated actively in the chain of events. We are delighted to be part of their success, and we are here to contribute to further progress at a project that we desire to be successful, not only as a service company, but also as Mexicans and petroleum engineers, geophysicists, and geologists. Our conversations circle around the fact that 2012 has finally proved that everyone who participated in the project was right: we found oil in deepwater and we now have to focus on transforming these discoveries into a production reality. We have proved our expectations to be correct both to the country and the industry. This makes us proud; it is the reward of many years of hard work.

PERSPECTIVE ON THE DEVELOPMENT DIVISION
It was late, but not too late to realize that Pemex needed to create a specific division for field development. This division must evaluate if the discovery is commercially viable, explore options to minimize development costs, and plan to optimize production through the best available technology.

Lakatch, Tsimin-Xux, and Ayatsil are fields for which the development plan is being processed in this more modern way. It is a very necessary step: Pemex needs to focus on development, before going to production mode. Before, the prevailing mindset was finding the easiest way to connect the well to production infrastructure, without planning to optimize production throughout the field's lifecycle.

This clear division of roles has also made the exploration division stronger: their projects now have their own budget. In the past, this division would drill wells and before they had a chance to analyze them, the production division would push to start working on them. Since it was easy oil, it was all about 'just emptying the tank'. But times have changed and this era is over.

The challenge now is to grant the development division sufficient independence to ensure that its efforts materialize in successful projects rather than disappear into swollen binders. It is also a matter of shifting Pemex's cultural mindset; many field experts have been there for decades, know their reservoirs very well, and are reluctant to incorporate external advise. It is a culture that has to evolve; otherwise we will keep doing the same thing, over and over again.

Edgar Rangel, Commissioner of CNH

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BUILDING FABRICATION EXPERTISE

JESÚS GIL BENAVIDES
Managing Director of Commsa

Q: What is the fabrication experience of Commsa in the oil and gas sector?

A: Commsa has a strong track record of projects for the oil and gas sector, including the fabrication of 42 drilling platforms, four raised platforms, two light design platforms and several compression platforms. We also fabricate living quarters, bridges, and mechanical equipment such as separators for platforms. Although some of these mechanical items are fabricated in Monclova, they are all assembled and integrated at Tampico. Commsa currently has API4F, APIQ1, and ISO9001 certification, which allows us to construct equipment and infrastructure for onshore and offshore drilling.

Currently, Commsa is working on three platform projects: Tsimin-C, Ayatsil-A, and Balam-A. Of these, the largest is Ayatsil-A, which is 11,500 tonnes. All of these projects will be finished on schedule, by the end of 2013. Our overall capacity as a company is seven projects. Competition for this type of project is very high, and many companies simply cannot sustain their ambitions to stay in this business. Over the last few years, the number of companies in Mexico with the capabilities and capacity to work on such large projects has dropped from 12 to six. The key to success is to deliver projects on time and to a high standard. We are pleased that we have been able to stay in this business and continue to win contracts with Pemex.

Q: In platform construction, do you see a difference between the Mexican and international companies that have fabrication yards in the country?

A: The procedures for building rigs are standardized and certified in every country in the world where platform construction takes place, and Mexico is no exception. The only difference is the capacity of the various fabrication yards, McDermott and Dragados have much larger facilities than us, and so they are able to take on larger and more complex projects. However, we are working on improving the capacity of the Tampico yard, so that eventually we can compete for these larger contracts. Even if our yards will not be as big as our competitors' in terms of surface, they will be just as large in terms of capacity. In Tampico, we currently have four skidways, each of which has the capacity to hold 7,000 tonnes. We are now increasing this capacity, and when this project is completed, the skidways will have a capacity of 12,000 tonnes each.

Q: Grupo Industrial Monclova, the group that Commsa is part of, has a number of competencies across diverse fields. Which strengths allow the group to diversify so successfully?

A: Everything we are involved in stems from our core business of fabrication. We started building structures for the oil and gas industry, and from there the next natural step was to move into building offshore platforms. From these, we moved into the gas business, and now we are building a new competency in the construction of gas pipelines. Our next step is to compete for onshore drilling rig contracts, but this is a difficult challenge because of the lack of innovation in this particular segment in Mexico. Pemex needs to refurbish and replace much of its drilling rig fleet, and we will definitely compete for these contracts. However, we need to build our competencies in large-scale and complex engineering projects that involve the integration of hydraulics and electronic systems. Currently, we only build the towers and the chassis for offshore platforms, but we want to gain the technology and the expertise to work on complete solutions.

Q: What is the best way to build this expertise?

A: Finding the answer to this question has proved extremely difficult for us. There is very little incentive for a company that already has the engineering expertise to share it with a company like ours; therefore we have to develop it on our own. This could be stimulated by government investment, but one thing is certain: the expertise will have to be home grown.

Construcciones Mecanicas Monclova (Commsa), part of Grupo Industrial Monclova, has been fabricating steel structures since 1951. The company has constructed over 40 offshore platforms for Pemex at its fabrication yard in Tampico, Tamaulipas, and currently has a capacity of 250 tonnes per month, which equates to four offshore platforms per year.

TRANSPORTATION AND INSTALLATION IN THE GULF OF MEXICO

"I really like what is happening in Mexico right now," says Alfonso Wilson, Dockwise Director for Mexico, Central America, and the Caribbean. "In the past, Pemex did not have the money to reinvest in its operations, but right now there is huge potential because Pemex is intensifying its drill campaign and is planning on having 90 jack-up rigs drilling in shallow water in the near future," he explains. This will open vast opportunities for companies such as Heerema and Dockwise because all these jack-up rigs will need to be transported to their respective projects, and furthermore, after Pemex finishes drilling those wells it will need to hire transportation and installation companies to transport and install the topsides.

In the past, Pemex has focused on the transportation and installation of topsides through the use of heavy lifting cranes and vessels; however, the company is starting now to consider alternatives. "We are working with Pemex, giving seminars, and training courses to Pemex engineers in order to familiarize them with float-over, but we have not gotten to the point we want to reach even though float-over has been approved by Pemex as a viable technology for topside installations," explains Wilson.

"We currently have the ability to install by heavy lifting anything that is up to 14,000 tonnes; anything over that would require float-over"

Even though Dockwise is currently working with Pemex in order to train personnel in the float-over installation of platforms, there also needs to be a change in the engineering design model of the jacket and topside. "The jacket has to be wide enough to allow a vessel to go in between, so the float-over can happen. Other than that, there are just minor changes to the topside," explains Wilson. Currently, Dockwise is participating in bids with Mexican EPC companies to transport topsides and heavy equipment to shallow water wells in the Gulf of Mexico.

Historically, one of the main challenges in the contracting process is the limited amount of time between the awarding of the contracts and the starting date of the work. "The main problem we face is that since bids are announced on short notice and the installation and transportation projects begin right after, we are not able to compete in Mexico because our vessels are already contracted in other parts of the world, such as in Australia, Africa, and the North Sea," explains Octavio Navarro Sada, Country Manager of Heerema Marine Contractors. Fortunately for companies like Heerema, Pemex and private companies offering transportation and installation services are starting to offer contracts well in advance, which is great news for transportation and installation companies, claims Navarro Sada, because it gives them the ability to fill in contracts in advance and be able to better plan ahead and understand how their backlog will look in the next 3-5 years.

Competition is fierce because when it comes to shallow water, there are various transportation and installation companies bidding for contracts. Nonetheless, Navarro Sada claims "the difference comes in the lifting capability of the vessels, and the size and weight of the platforms to be installed." In other words, the larger and heavier the platforms are, the less competition there is. Therefore, if transportation and installation companies want to acquire more contracts they must first develop their capabilities to be able to deal with larger and heavier topsides and equipment. However, Navarro Sada strongly emphasizes that size and weight depend vastly on the varying needs of the client.

Even though shallow water is currently the most appealing market for transportation and installation companies like Heerema and Dockwise, deepwater might eventually close the gap with shallow water because "right now Mexico is in the deepwater exploration phase, but has the potential to really grow in this area. It is incredible how much activity there is in the US Gulf of Mexico, and there is no reason to believe that there fewer oil reservoirs in the south than in the north," claims Wilson.

Even though heavy lift has been used for deepwater, due to the larger size and weight of the platforms and the equipment needed to produce from deeper wells, Navarro Sada claims heavy lift would no longer suffice. "We currently have the ability to install by heavy lifting anything that is up to 14,000 tonnes; anything over that would require float-over. In Mexico, we have never done a single platform that weights this much – the heaviest has been 9,000 tonnes at Ku-Maloob-Zaap – but in the future we might be able to increase our capabilities to satisfy the growing demand for deepwater platforms."

OBSTACLES IN CONTRACTING OFFSHORE INFRASTRUCTURE

One of the main objectives of the development strategy that Pemex presented in 2010 was to acquire 60 additional drilling platforms by the end of 2017. This meant that over a six-year period, Pemex would acquire 12 platforms per year. In the first two years, Pemex was unable to achieve its targets, falling short of the 24 platforms the company planned to contract during this period. Benjamín Torres-Barrón, a lawyer from Baker & McKenzie Mexico specialized in rig contracting, explains the main issues that Pemex has faced to try to reach these targets, and the reasons they have not been able to do it.

"The rig market is not easy," Torres-Barrón explains. "Platforms are a scarce resource for all players in the global oil and gas markets," Torres-Barrón adds. "This enables platform owners to compare the different conditions in the prospective markets they face before choosing where to send their rigs."

Even though Mexico might not have the most competitive conditions, Torres-Barrón believes that the country is a good market for platform operators to work in. "Some countries might have better financial conditions for platform contracting, but it is not only about the monetary aspects of the business. Those countries offering better commercial value might not have the political stability that Mexico has or the big demand for rigs that exists in the country. This mid-term stability that the country has provides companies within the sector enough security to move their businesses to the country."

According to Torres-Barrón, the problem with establishing in Mexico has to do more with the logistic and legal sides of the process: "In both exploration and production, Pemex has the operational need to increase the number of both drilling rigs and production platforms in order to reach its targets. However, on the legal side, the company has to follow internal procedures and policies that came into force with the 2009 Pemex Law, which slows down the contracting process, leaving the operational side short-handed, particularly in terms of offshore infrastructure." While all of this happens, drilling platforms are out there on the free market, waiting for the highest bidder to contract them. "If Pemex does not proceed immediately to secure a contract, some other private company is going to contract the platform," he explains. "Pemex might offer good incentives for rig owners, but often, logistical hurdles and bottlenecks mean that they miss out on the rigs they need."

The problem does not stem from the Pemex Law in itself, according to Torres-Barrón, but at least partially from the inertia of adapting to new contracting methods. "The new set of reforms that began with the 2009 Pemex Law provide more transparency and more flexibility to contract service providers, including the possibility to award contracts directly," Torres-Barrón explains. "But, in the end, the practical application of these new set of regulations is not moving at the pace it should, which might be the consequence of not having the necessary alignment within the company's internal structure towards the same corporate goals."

More conservative rig owners avoid the Mexican market altogether because of the liability clauses in Pemex contracts: "Liability clauses within Pemex contracts continue to be a concern," Torres-Barrón says. "Even though there is typically a capped limit on the level of liability that will stop it from exceeding the total amount of the contract price for the platform, there are certain exceptions, such as with environmental responsibility. Companies are therefore exposed to joint liability, when environmental regulations are infringed, ending in penalties for both the operator responsible for causing the environmental fault and also the owner of the equipment." This creates additional uncertainty for companies trying to enter the Mexican rig market.

Pemex is trying to improve its efficiency in contracting offshore infrastructure, and is attempting to do this through awarding contracts directly. "The Pemex Law allowed Pemex to offer direct awards where they can be justified, and the lack of supply in the offshore infrastructure market is a good example of when these direct awards can be applied," Torres-Barrón says. "Pemex has also been adapting some of the economic conditions in the agreement template in order to make it more efficient. The business terms for the contract – legal terms and conditions, day rates, and so on, can be improved slightly to offer more competitive conditions in this type of market."

In the end, Torres-Barrón believes that, even with the restrictive conditions that Pemex offers, the players in the Mexican platform market might be content with just having a clear set of rules. "I think the industry needs to work on more explicit language covering the aspects of the contracts that are not transparent enough." This might improve transparency for international platform owners deciding to work in Mexico, and might even encourage national companies to try and take a piece of the market, with their experience of doing business in Mexico and contracting with Pemex.

FROM ENGINEERING TO EPC

Last year, Mexican engineering companies made important progress in competing increasingly effectively with their international counterparts. Sergio Dan Saldivar Valdés, CEO of NorthAm Engineering, explains how his company was part of this trend and acquired new contracts for production facilities and infrastructure, and what challenges it faces to continue its expansion. These new opportunities have allowed the company to expand in multiple sectors, but most importantly its expansion in the oil and gas market was driven by the opening of new offices in Poza Rica, Reynosa, and Veracruz. "The focus has been on expanding our local presence in the main oil regions, but we are still headquartered in Monterrey, where we have strong execution capacity. Even though we are planning to remain based in Monterrey in the near future, our expansion is guided towards Mexico City and the oil towns," Saldivar Valdés explains.

"The strategy of moving into the main Mexican oil towns has been very successful, because it has allowed NorthAm Engineering to be closer to Pemex, other private companies, and the oil fields, but also because it has increased the company's chances of becoming the engineering firm of choice in the various regions," says Saldivar Valdés. "For example, the company is currently executing small projects, totaling over 50,000 man-hours, in the Aguacate field in Poza Rica. It is a complete development with a pipeline, compression station, separation batteries, and sweetening. This is something we would not have been able to achieve without our local office."

Therefore, NorthAm Engineering will focus on taking advantage of the opportunities in other areas, such as downstream. Projects like the Tula Refinery, the Salamanca Reconfiguration, and also smaller projects offer great potential. "There will be a big jump in engineering for these contracts in late 2013, 2014, and even in 2015, since the Salamanca Reconfiguration and the Tula Refinery will enter the EPC phase most likely by the end of this year," Saldivar Valdés emphasizes. However, since its main opportunities are in basic engineering rather than the EPC phase, one of the main focuses of NorthAm Engineering is acquiring the financial strength that is crucial to eventually become an EPC company. However, Saldivar Valdés believes it also needs to partner with other companies that already have EPC capabilities to start bargaining for the engineering and some procurement work, and eventually move into construction." Since there are only a handful of companies that are capable of executing large EPC projects in Mexico, Saldivar Valdés is focused on creating strategic alliances with these companies as a means to acquire the necessary skills, and capabilities to eventually become a successful EPC company.

The other important part of NorthAm Engineering portfolio of services is providing basic engineering services to fabrication yards: "There is significant fabrication capacity in Mexico compared to other countries. Nonetheless, with all the work that is coming the EPC companies will get swamped very fast, leaving limited execution capability for large platforms anywhere in Mexico," Saldivar Valdés

"The cost of labor intensive fabrication work in the US Gulf Coast significantly exceeds Mexico's cost level because of high salaries"

Sergio Dan Saldivar Valdés, CEO of NorthAm Engineering

On the other hand, even though many Mexican engineering companies have been successful in acquiring contracts for shallow water infrastructure projects, there are still limitations on their potential participation in offshore engineering projects. This is the case because all engineering work for such projects is included in engineering, procurement and construction (EPC) contracts, which creates a situation where fabrication yards rather than engineering companies are best positioned to win the contract. Saldivar Valdés believes this will continue to limit the opportunities for shallow water engineering projects for NorthAm Engineering because EPC companies will continue to be awarded projects over engineering companies.

emphasizes. "It is necessary to increase yard capacity nationwide in order to increase Mexico's production volume and offer more opportunities to Mexican engineering companies". He believes this will not be a challenge, because in the next five to ten years fabrication yards in Mexico are expected to grow drastically, partially driven by the fact that high labor costs are constraining the growth of fabrication yards in the US. "The cost of labor intensive fabrication work in the US Gulf Coast significantly exceeds Mexico's cost level because of high salaries. Since the other cost drivers, such as materials, procurement, and equipment, are subject to global market prices, more and more Mexican yards will use this competitive edge to go after projects elsewhere in the world," he concludes.

MEXICO AS A SOURCING HUB FOR SHELL

Alberto de la Fuente, President and Director General of Shell Mexico

As well as watching the evolution of the Mexican oil and gas industry very carefully and trying to participate wherever possible with ideas and proposals for its future development, one of the main goals for Shell Mexico in 2013 is to develop its Mexican sourcing office, one of only four such offices around the world.

According to Alberto de la Fuente, President and Director General of Shell Mexico, there were three reasons behind the choice of Mexico for this regional sourcing hub. First is the location: with proximity to the critical North American markets, and good access to the US Gulf, Mexico is well placed in terms of logistics handling and delivery times. Second, the quality of labor is very good in Mexico, with de la Fuente noting that Shell has been very happy with what the company has seen and experienced so far in the country. "The oil and gas service industry in Mexico has been working for Pemex for many years and is used to working along the guidelines laid out by demanding and competitive companies." Finally, de la Fuente cites cost as one of the contributing factors for choosing the country. "Mexico has good labor for competitive prices. We believe that Mexico can be competitive in the international bids that Shell offers all around the world."

Mexico is one of Shell's four international sourcing offices; the others are in China, India and Russia. De la Fuente explains that Russia was chosen because of local content regulations, China because of the size and potential of the domestic market, and India, like Mexico, was chosen for the quality of manufacturing and the availability of cost competitive skilled labor. "I have to say that our presence in Mexico looks beyond simply serving the domestic market and is influenced by global strategies and regional opportunities. Someday we will be able to compare the four offices and see how competitive they are amongst each other, but this will take time. The Mexico office has just been established, for example, but China has been operating a sourcing office for over four years. However, the end goal is for Mexico to be competitive against these other three countries," de la Fuente explains.

Although some in the industry might question the logic of choosing Mexico over Brazil as the location of the Latin American sourcing office, de la Fuente defends the choice: "Doing business in Brazil is often complicated, because of the tax structure. We also chose Mexico not only because of its physical proximity to the rest of North America, but also because of the free trade agreements that are in place. When all these factors are considered, it is plain to see why we chose Mexico."

However, there are some hurdles standing in the way of Mexico being the perfect location to place a supplier base. "What we need to do is bring all these companies in line with Shell's standards when it comes to bribery and corruption, ethics compliance, and HSE standards, just in the same way as these companies prepare when they want to participate in a Pemex tender," says de la Fuente. In order to combat these challenges, Shell is auditing its suppliers and working closely together to bring their performance up to the standards required for participation in international bids. Shell Mexico's President notes that international bid regulations can sometimes be very different to those on the Pemex tenders for which Mexican suppliers are used to competing, and adapting can sometimes be a lengthy process.

Although de la Fuente is deliberately vague about the types of companies that Shell is hoping to work with in the future in Mexico, he does reveal that they have focused on a mix of Mexican domestic companies and fabrication yards, international service providers operating in Mexico, and international companies with the potential to one day work in the country but currently do not.

The process to become a certified Shell supplier works as follows: first, a company must face an initial audit, where the necessary adjustments are noted that will be needed for the company to meet the standards for the Shell's international bid offers. Once these changes are made, a company goes through a second audit. If they pass, the company is certified, but has to wait for a bid to be launched before they can compete. De la Fuente reveals that to date, there have been some very competitive bids from certified Mexican companies. He hopes that 2013 will be the year that a Mexican company wins a certified bid, conforming the competitiveness of the local supply chain.

When asked why Mexico hasn't taken advantage of its potential as a sourcing hub before, de la Fuente suggests that factors such as the US labor shortage could mean that within the next ten years, Mexico could transform its reputation in the oil and gas industry and take advantage of opportunities, such as those on the US side of the Gulf of Mexico. "Right now, the US rig market is starting to pick up again after Macondo, so there should be some good opportunities for the production of rigs and platforms in Mexican fabrication yards in the coming years."

FEED OPPORTUNITIES FOR INTERNATIONAL EXPERTS

Carlo Orsenigo, Country Manager Mexico of CH2MHill

The success of a large-scale oil and gas project often depends on the amount of time and money spent in the planning phase, otherwise known as front-end engineering and development (FEED). CH2MHill tries to reduce the expenses of its clients by advising them in the FEED stage. "We basically work in the high value range conceptual services by assisting our clients in making their projects happen," says Carlo Orsenigo, Country Manager Mexico of CH2MHill. "We are engineers who understand all construction details and specifications, so we apply that knowledge into designing the most efficient FEED systems to help our clients succeed in their projects."

"Companies working in Mexico spend a lot of time and money on the definition of a project and the acquisition of the relevant permits to operate," Orsenigo explains. "You can have a very detailed evaluation of the right of way required for a pipeline investment, but if you do not make the adjustments required by Mexican law, as well as pay attention to the social and environmental conditions, the process gets stalled." Even detailed planning might end up being insufficient with all the modifications that a project undergoes during the FEED stage. This is what happened with the Morelos pipeline project, which continues to be on standby.

According to Orsenigo, the most difficult stage of a project is during the front-end design. "Getting the pipe in the ground and obtaining the acquisition and right of way permits, and the environmental and social impact statements is the real task," he argues. "The challenges that the market is facing depend on the execution and construction of projects, rather than in the operation." Both planning deficiencies and inefficient operation could affect hydrocarbon distribution in the country, presenting similar challenges to what Pemex is already facing today.

The main barrier that stands in the way of achieving an optimal planning stage is cultural and it has to do with the way investors tend to think. "Usually, investors want an immediate return on their investment to be able to cover their costs," Orsenigo explains. "This encourages them to reduce their investment in the FEED stage, which in the end may have unpleasant consequences. An unwillingness to spend a large sum at the beginning of a project might result in greater costs in the form of adjustment and make-up costs."

ROOM FOR IMPROVEMENT IN SOCIAL SUSTAINABILITY

Manuel Ortiz Monasterio, Director General of ERM Mexico

The observance of the Ministry for the Environment regulations and guidelines by Pemex has been an important factor in helping the Mexican oil and gas industry to raise its performance in environmental protection. Nevertheless, an in-depth assessment of the social impact that projects have on local communities is not mandated in this regulatory framework. According to Manuel Ortiz Monasterio, Director General of Environmental Resources Management Mexico (ERM), this is where Pemex has room for improvement, in order to better align its operations with international best practices, an issue that will become even more critical as new operators become involved in the Mexican oil and gas sector.

Despite working across a range of industries, including the mining and metals, power, manufacturing, chemical, and pharmaceutical industries, ERM provides a good part of its services to the oil and gas industry based on the good fit between its portfolio of services and the needs of the industry. "This is the sector where our most important clients operate," Ortiz Monasterio says. ERM prides itself in providing technical services based on a deep expertise in sustainability protocols based on global industry best practices, which include a strong social management component alongside the usual environment, safety, health, and environmental aspects of corporate responsibility strategies. According to Ortiz Monasterio, community development, stakeholder engagement, and other social risk management strategies are areas where the Mexican oil and gas industry could obtain the greatest potential gains. "ERM assesses the environmental and social dimensions of projects throughout the full value chain of activities related to exploration and production," Ortiz Monasterio explains. "We first assess the probable risks and impacts, and then provide management plans to avoid, mitigate, or compensate them."

Although social impact assessments are not required by Mexican law, ERM's clients in the country still invest in these services because they make business sense. Ortiz Monasterio explains that typically these clients have international operations and understand the positive effects of working with communities throughout the lifecycle of a project. "Based on their experience, they know that social risks need to be properly addressed and managed for projects to be successful, regardless of whether this is required by Mexican law," he adds.

"In Mexico, the permitting process for a new project is more related to its environmental impact," Ortiz Monasterio emphasizes. "In many other countries, companies also need to consider the social impact that a project might have, as this aspect also requires authorization." This might be the missing link to streamline the starting phases of a project, and a necessary step to accommodate the arrival of international companies. However, in this regard, Pemex has made an effort by establishing some social requirements for private companies interested in the integrated service contracts.

When asked who should be in charge of establishing these guidelines for oil and gas projects, Ortiz Monasterio expresses the view that a government entity such as the Ministry of Social Development could be charged with the task. Requiring social assessments for projects in the oil and gas industry should be the responsibility of a government agency other than the Ministry for the Environment and the Energy Ministry, since both of these entities already have many other functions, and the task would require an agency with more resources to dedicate to the issue.

"The first step has already been taken at Chicontepec, where Pemex worked with the United Nations Development Programme (UNDP) to include a chapter on social development and local environmental sustainability, which contains an annex that ERM helped to write in the contract for hydrocarbons production in the area. This has been working well, and is starting to be used widely across new projects," Ortíz Monasterios explains. "They are aware of the problems Pemex has had in the past, and want to do things differently and strengthen the social focus in sustainability programs."

ERM continues to lobby for the inclusion of more social components in the permitting process. "We can see a significant shift happening soon, with companies proactively asking for these changes to take place in order to make their operations simpler and more efficient. One example of this, is the work we have been doing at Etileno XXI, by helping the companies to comply with very strict international environmental and social standards." More and more, multinational companies are proactively seeking for the so-called 'social license to operate', in addition to official permits and contractual obligations.

Ortiz Monasterio believes this is an extraordinary opportunity for companies operating in the Mexican oil and gas industry optimize the social, environmental, and also financial sustainability of their operations in Mexico.

ADVANTAGES OF INTERGRAPH SOFTWARE FOR EPC COMPANIES

ADRIÁN HERNÁNDEZ LÓPEZ
Director General of Intergraph Process, Power & Marine

Q: What is Intergraph's approach to introducing software services to EPC companies and Pemex?

A: Due to the fact that the Mexican energy sector is nationalized, our main customers in the sector are Pemex and the Federal Electricity Commission (CFE), Mexico's two national energy companies. The other part of our business is convincing Pemex and CFE to request the use of our software from engineering, procurement, and construction (EPC) companies operating in the country. We are currently using this top down strategy because the market has changed drastically in the last decade. Before, Pemex and CFE were indifferent to the software used by the various EPC companies in Mexico, so we used to approach the companies independently. However, now that Pemex and CFE are more interested and involved in such decisions, we have adapted our strategy to raise their awareness of the value proposition of our software services. It has been a complicated change because Pemex and CFE want EPC companies to use our software, but they are skeptical of requesting this specific service from them because they fear it could potentially increase the cost of hiring them.

Q: What arguments are the most convincing in offering your solutions to Pemex and EPC companies?

A: Our software helps with asset design, installation, and plant management. It would add great value to Pemex to reduce the cost of engineering, procurement, and construction projects because the company tends to invest a lot of money in the conceptual phases of the engineering process in order to define, visualize, and create the engineering plans for what they want to accomplish. This can be cost and time consuming if the plan changes multiple times throughout the process; therefore, our software could help EPC companies and Pemex create a thorough and well thought-out plan in order for there to be no changes in the execution of the project.

An example of this is the reconfiguration of the Minatitlán refinery that started back in 2002-2003. It has been a mess because the plan, even though well-defined at the beginning, was not executed correctly, which in turn led to various complications in all the phases of the EPC. The project was supposed to be finished by 2008 - it was originally defined for five years – but it took longer than expected. For this reason, we try to convince owner operators to create an integrated environment with all engineering information that supports procurement, construction, testing, startup, operation, and maintenance activities throughout the lifecycle of a project.

Q: How hard has it been to overcome the challenge of introducing new technology to Pemex?

A: Every single day is a challenge; however, I strongly believe that with the new Director of the development division, Juan Javier Hinojosa, Pemex will be more inclined to bring in more technology. I believe this because in 2003 we worked with him on a reconfiguration of infrastructure for the Ku-Maloob-Zaap field, and we were able to convince him to apply new and better technology on 17 platforms. Furthermore, the issue of software is very complicated because various fields in Mexico use different software, so there is no standardization. In order to fully implement new technology Pemex needs to standardize the software used, and this is where we hope to succeed with our technology.

Q: What do you see as the main growth opportunities for Intergraph, and what needs to change to capitalize on these opportunities?

A: We expect Pemex to start opening multiple projects, like Cadereyta, that was supposed to be open two years ago (August 2010) but nothing has happened. Besides this, we are hoping for cultural change to take place in the country. There seems to be a serious lack of continuity and constant altering of projects that has led to EPC companies losing money and not being able to invest in technologies like the ones we offer. This is a vicious cycle that is neither helping EPC companies nor the whole oil and gas industry.

Intergraph is a provider of engineering and geospatial software that enables customers to visualize complex data. Its industry-specific software is used in more than 60 countries to make processes and infrastructures better, safer, and smarter, empowering customers to build, protect, and operate more efficient plants, ships and infrastructure.

BRIDGING THE GAP BETWEEN DESIGN AND INFRASTRUCTURE

3D scans and modeling are vital tools in the construction, design, maintenance, and quality control processes of large infrastructure projects in the oil and gas industry. This technology has brought positive change to the industry in a variety of ways: by quickly capturing all of the measurements of any physical object, by saving time in design work, and by comparing "as-designed" models to the "as-built" condition of manufactured parts. Jorge De Dios Morales, CEO at Grupo Diarqco, believes that "3D scanning and modeling is a whole new style of engineering design that functions more as a database utilized in a variety of ways, than a simple visual representation of a structure."

"3D scanning and modeling is a whole new style of engineering design that functions more as a database utilized in a variety of ways, than a simple visual representation of a structure."

Jorge De Dios Morales, CEO at Grupo Diarqco

Grupo Diarqco started operating in 1993 as a small company focused in computer-aided design (CAD), and by obtaining state-of-the-art domestic and international safety technology and engineering design certifications is on track to become a leading firm in 3D scans and models in Mexico. The 3D scans and models help operators to optimize production of a platform: "Creating a model that is connected to software that functions like a brain utilizing state-of-the-art technology, allows you to access all the necessary information to successfully manage, control, and maintain a platform or any other type of oil and gas infrastructure," De Dios Morales explains. "These 3D scans are used to detect changes to equipment and tools, and make it easier to detect the need for and manufacture replacement parts." This is extremely important because tools in the oil and gas industry are usually hand-tuned. By using 3D scanning the deficiencies are digitally detected and transferred to software that gives the exact specifications for a new replacement part, helping to overcome potential discrepancies between the platform design and the end product.

Mexican engineering companies such as Grupo Diarqco have been successful in acquiring contracts in the Mexican oil and gas industry by creating strategic alliances with the leading technology companies from around the world. "This strategy has been successful because, even though we have been in the business for over 20 years, people are still skeptical about Mexican technology," De Dios Morales says. "To mitigate this, we offer proven international technology in the most important cities for oil and gas in Mexico: Villahermosa, Ciudad del Carmen, Reynosa, Paraíso, and even in Mexico City. Our location in these strategic oil cities, and our connections with key Pemex executives and private oil companies, allows us to be at the forefront of potential opportunities and interact with the most important and experienced design engineers in the country."

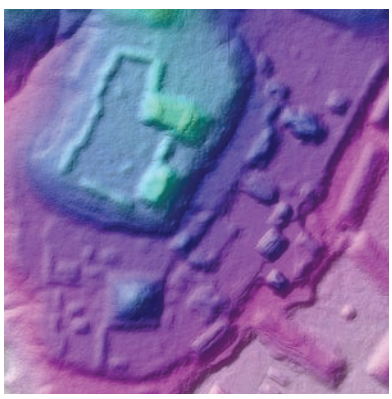
In order to successfully maintain platforms using 3D design scans and models, it is extremely important to maintain clear lines of communication between the design team and the operator. "Communication between the construction and the design company is crucial, in order to successfully build and install all the necessary parts and prevent any discrepancies in the implementation of the original design," De Dios Morales explains.

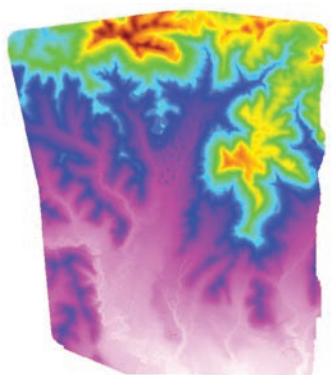
Besides optimizing the design, fabrication and maintenance of oil platforms, 3D scans and models allow oil companies to stay up-to-date on safety and regulatory compliance. The oil and gas industry is constantly evolving to prevent accidents and mitigate its environmental impact; therefore, having a mechanism that can rapidly capture all the data of a platform in its current condition, as opposed to the as-built condition, allows owners to update their platforms and adapt them to new safety and environmental standards. Additionally, these 3D scans and models allow operators to further improve safety and security on platforms by creating models and simulations to better understand personnel demand and capacity.

Although Grupo Diarqco has been very successful over the past 20 years, it is currently searching for new opportunities by creating alliances with international companies with expertise in designing well-management systems. These solutions measure the percentage of each fluid or gas coming out of a well and positively affect an oil company's ability to optimize production through real-time decision making. De Dios Morales is certain that this will mark the new era of Grupo Diarqco.

ARCHAEOLOGICAL PRESERVATION

During seismic exploration, companies may discover geological patterns different to the hydrocarbon-based formations they are looking for. During one of the many seismic data acquisition projects carried out in the center of Chicontepec, Geokinetics stumbled upon an unforseen discovery: a polygon of 1,221 hectares worth of cultural heritage. Immediately after the discovery, made using aerial scanning surveys and 3D seismic, Geokinetics gave notice of its findings to the Mexican Anthropology and History Institute (INAH) and Pemex.





This unexpected turn of events led to the creation of a joint archaeological heritage program in the Tajin area, the main goal of which is to preserve the cultural heritage found there. Geokinetics and INAH, with Pemex's help, continued to use new exploration technologies, such as LIDAR (Light Detection and Ranging), photogrammetry and thermography, to further investigate the area. As archaeological findings increased, both Geokinetics and Pemex ramped up their commitment to help INAH in its quest to preserve them. A joint operation managed by the three institutions, aimes to better gauge the importance, not only of the resources found in the hydrocarbon-rich area, but also of its cultural and archaeological value. Combining the efforts of both the public and private sector in the geophysical, hydrocarbon, and cultural domains, the archaeological heritage program in Chicontepec is unique in Latin America and has earned more than 27 awards, including a National Award for Best Research Project in the Country. INAH manages all of the upper surface exploration studies, while Geokinetics continues to research the geological subsurface. Exploration activity is still a priority, but whenever archaeological zones are encountered the INAH is brought in to study the area and approve the next steps in terms of the land use. When seismic techniques are found to be too invasive, different techniques are employed to preserve the cultural heritages of the paleochannel of Chicontepec. The archaeological heritage project that INAH, Pemex, and Geokinetics are executing demonstrates the importance of establishing multi-institutional, multi-disciplinary, scientific teams, and marks a lasting breakthrough for the Mexican geological landscape.

THE ROLE OF FIELD LABS IN DEVELOPING CHICONTEPEC

Pemex implemented a new strategy in Chicontepec three years ago where private companies were awarded blocks, known as field labs, where they can implement production and drilling technologies to optimize production. However, according to Pedro Silva, Subdirector of Technical Resources Management for Pemex Exploration and Production, running the field labs has been complicated. "In Chicontepec it was hard to run the field labs because each company had its own ideas, but non-conventional drilling and non-conventional completions were the most successful technologies implemented, even though we also learned about water injection, CO_2 injection, and continuous injection, which unfortunately did not work deliver optimal results. As a result, we started using cyclic steam injection, which has been working well."

These various technologies, which have led to the drilling of 600 to 800 wells per year at Chicontepec, represents a massive development according to Gustavo Hernandez, Subdirector of Planning and Evaluation at Pemex E&P. The field lab program has led to an increase in production from 29,500 b/d in 2009 to 68,560 b/d in 2009. Hernandez is optimistic that Pemex will be able to reach its ambitious production targets at Chicontepec. The NOC recently launched the third round of integrated service contracts (ISCs), "that will consist of six different blocks in Chicontepec, with over 2.6 million barrels of prospective resources, and, roughly four or five billion barrels of reserves, which is 10 times bigger than the first round of ISCs and around six times bigger than the second round," Hernandez explains. Competition is expected to be tough for the third round of ISCs because, due to the field labs, companies are now able to drill faster and extract more oil than before; "even though we are still learning we are becoming better and better at extracting as much oil as possible from Chicontepec," explains Fluvio Ruiz, Pemex Professional Board Member.

SEISMIC FOR FIELD DEVELOPMENT

By providing thorough information about the physical structure of the reservoir and its geological characteristics, seismic data acquisition plays an important role in the field development process, both to shorten the time to first oil and optimize oil production over the field's life. The data obtained from seismic reflections is processed and interpreted to obtain a coherent geological picture of the reservoir, which is then extrapolated into a geological model. However, according to Ignacio Orozco, Geokinetics' Mexico CEO, the seismic business is no longer just about having the best technology, since in so many areas leading companies have reached parity: the key to success is also about integrating the concept of service along with the technologies and the endogenous factors in each region.

"The key to success is also about integrating the concept of service along with the technologies and the endogenous factors in each region"

Ignacio Orozco, Director General of Geokinetics Mexico

"All technologies can be acquired," Orozco explains. "The thing that actually provides added value in seismic operations is to be able to integrate every factor into one equation. The service that we offer is tailored. We call it 'seismic for field development', and it consists in talking to geologists, interpreters, and the region's inhabitants, to understand better their concerns, the background of the fields, and the studies previously made. This way we address all the circumstantial factors surrounding the project, and provide targeted seismic that varies from region to region."

This does not mean that the importance of technology is minimized; rather that there are other factors that are as important in the equation that are often overlooked. The ability to take them into consideration, and combine them with expertise in geological services is what makes Geokinetics one of the market leaders, both in transitional zones and onshore. "Managing the social component and complying with social sustainability has allowed us to perform well, and in a timely fashion," Orozco proudly comments. "If you do not have a good relationship with the local communities, your project will probably fail." This creates a distinct advantage for geophysical service companies with a strong domestic presence and experience in working effectively with local communities across Mexico's oil rich states. "Local companies that understand the rules and regulations, the local customs, and can interact with the local community are far more successful," David Pring, Country Manager Mexico at Petroleum Geo-Services (PGS), explains. "Those people can get to the field and achieve a survey in a far more efficient way than most companies coming from outside." Once the social component is tackled, there are two other steps to be addressed to accomplish integrated seismic for field development. The first relates to technology. "Data acquisition is progressing quickly. We have tested new autonomous or nodal equipment, which is able to record data wirelessly. This technology can be applied at both shallow and deepwater projects," Orozco explains.

An example of how Geokinetics is facing new technological challenges and integrating their results into their unique formula is the San Luis-3D project in Valle Hermoso, Tamaulipas. "In this project, Geokinetics is currently recording 6,000 channels, which is something that has never been done in Mexico," remarks Orozco. "Before getting started, we faced challenging social complications, due to the agricultural projects that already exist in the area." The company drew on both its social management capabilities and the technologies required to execute project successfully.

The final step to be taken into account in the seismic for field development formula is the interaction with the field experts. "Geokinetics works with operators in order to better understand their needs and gain access to the existing data they already have on the fields in question. That way, we can apply the different processing tools needed to achieve both their objectives and ours," Orozco explains. "In this way, Geokinetics has been developing feasibility study programs with Pemex, which involves analyzing the NOC's historical field data, from records and regional experts. After doing this, we perform various analyses on the fields, and finally present our recommendations, given Pemex's needs, local concerns, and the perspectives of the regional experts."

The integrated equation that Geokinetics uses for seismic services is a good formula that takes every single aspect of a project into consideration. Combining the various factors that are at play in a field is an important way of understanding the way the oil business should interact with its surroundings, and maintaining a win-win relationship.

FLEXIBLE FALLPIPE VESSEL FOR SUBSEA INSTALLATION

Subsea Rock Installation is a proven, advanced technology that has been used in the Mexican oil and gas industry during the last few years. The purpose of this technique is to protect oil rig foundations, level the seabed prior to the placement of pipelines and cables in coral and reef conditions, and stabilize and protect pipelines and other oil and gas production equipment against miscellaneous threats. This technology is offered by specialized dynamically positioned vessels that can work in water depths surpassing 1000m.

This technology has been applied for many decades – mainly in the North Sea – for the installation, foundation, and protection of pipelines on the seafloor based on a thorough design and planning process, which requires seabed inspection to examine soil consistency, and analyze additional requirements for stabilization. Engineering teams study the seabed surveys in order to establish a suitable route for pipelines to be placed. "If any voids underneath the pipeline would exist, what we call a large free span or rupture could occur," explains Jos Wellink, Regional Manager of Van Oord Offshore. "As oil fills the pipeline its weight increases, weakening the pipe's support and possibly risking it to break. Our technology helps to build additional support made out of rock and placed on the sea floor to sustain the pipeline on key locations, starting from the middle." Also the influence of currents and waves could cause displacement of the pipeline. The uneven conditions in some areas of the sea floor in the Gulf of Mexico mean that this type of protective and stabilizing measures need to be applied before the placement of pipelines.

"Last year, we worked with Pemex on the rock installation over pipelines and cables and we also worked with Mexico's ports doing the maintenance dredging for the Port of Coatzacoalcos, for instance, to build steadier routes for those pipelines within the Gulf of Mexico," explains Wellink. "There is more work to be done now in Mexico since Pemex is issuing more projects. The the development of Ayatsil, which will have a large number of platforms and requires extensive pipeline infrastructure, additional work will be required to create the conditions for a stable road there."

Van Oord Offshore's vessel Tertnes is suitable for the conditions and infrastructure of Mexican ports, and has already executed several projects for clients working in the country during the past few years. The rocks (that have a diameter of 2.54cm to 12.7cm) used on the project are taken from the rock quarry along the coast into the port, where they are loaded onto one of the flexible fallpipe vessels. Up to 9,600 tonnes of rock are transported in the hull of Tertnes, a vessel that has been modified from a bulk carrier and that is equipped with state-of-the-art rock placement equipment. Once seaborne, the rocks are brought up from the hull to the deck and into flexible fallpipe line. This system consists of a string of retractable buckets that are connected by chains. The fallpipe is lowered all the way down to the sea floor, so that the rock can be accurately placed over the location specified within the design parameters. The ROV (Remotely Operated Vehicle) at the end of the flexible fallpipe has a survey equipment to accurately position the fallpipe and monitor ongoing operations. The rock is placed on the seabed to create a rock berm, on which the pipeline is subsequently laid. This gives the pipeline the necessary stability so that it endures the conditions of the sea, the changing nature of the seabed, and the erosive properties of strong currents pressing against the pipeline infrastructure.

This technology is also suitable for deepwater applications, such as the creation of a stable foundation on the sea floor prior to the installation of deepwater production equipment. However, this application demands a bigger emphasis on analyzing the seabed conditions. The consistency of the soil needs to be studied to see how much weight it can take so that the equipment does not sink. Afterwards, a plan is made on how much rock is needed to create the necessary foundation to hold the equipment's weight. This application is very common in the North Sea, and could be an operation needed for the development of deep-water fields such as Lakach, Trion, and Supremus in the future.

Flexible fallpipe vessels can also perform maintenance tasks to re-establish the stability of pipelines and cables. To safely and accurately perform this work, Van Oord's flexible fallpipe vessels carry sophisticated survey and positioning equipment that even allows the company to work on live pipelines and cables. "Companies like Pemex monitor their pipelines continuously since subsea infrastructure is unpredictable by nature," Wellink describes. "Even properly installed pipelines that have been recently inspected can lose their support on the seabed: strong sea currents might disseminate the sands under pipelines and erode the seabed in which they are standing." Van Oord Offshore's Regional Manager explains that there are two ways of facing problems like this. "You can either wait for it to happen and address the problem, or do preventive maintenance by putting rock on top of the pipeline for it to be fixed on the seabed." This service – which the company calls 'scour protection' – has become part of the portfolio that Van Oord offers to support Pemex in its shift towards preventive maintenance.

INTRODUCING DOPELESS COATING TECHNOLOGY

Liquid-based lubricants have traditionally been applied to casing and tubing connections in the mill for storage and again manually with a brush in the field to make up connections. Tenaris has developed Dopeless technology, a dry, multifunctional coating applied in a controlled industrial process that assures the exact amount of lubricant is evenly applied to each connection. Dopeless technology provides lubrication for multiple make and breaks, avoiding corrosion and offering rig-ready pipes. "Dopeless connections are able to withstand even the most demanding operating conditions, such as offshore, Arctic, desert, shale, and jungle environments. More than two million meters of pipe with Dopeless connections have been run worldwide in more than 30 countries. Investments have been made to introduce dedicated production lines at our facilities, accessory and repair units on four continents. The benefits of our dope-free technology have been proven in different drilling applications for more than a decade," says Tomás Castiñeiras, Tenaris's Dopeless technology project manager.

Tenaris recently inaugurated a new, dedicated Dopeless coating line at its mill in Veracruz in order to cut time to market. This line has the production capacity to supply oil and gas customers operating in the Gulf of Mexico. "With Dopeless technology, pipes arrive rig-ready, avoiding the need to transport the materials to cleaning or preparation areas for dope replacement before delivery to the rig. By simplifying handling and installation procedures, less manpower is required. This is an added value in terms of safety and time reduction, especially for offshore operations in the Gulf of Mexico. In Mexico, Dopeless technology has been used successfully in offshore and onshore operations with positive results and very good feedback from operators and drilling companies," says Luis Conde, Tenaris Technical Sales Manager Mexico.

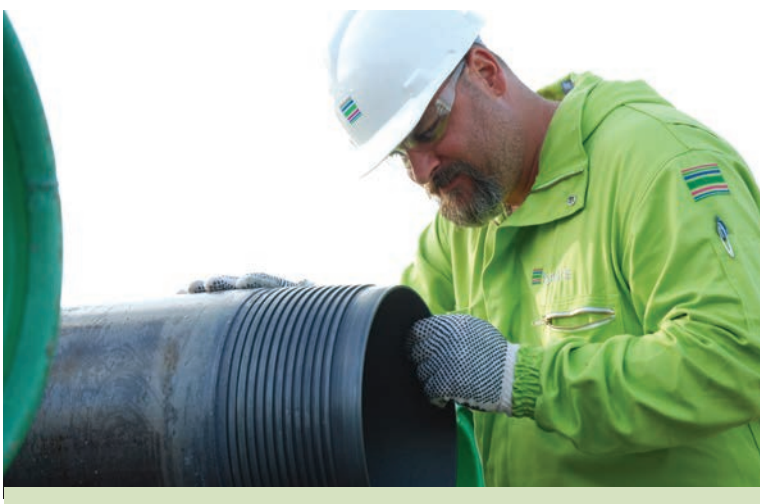
Tenaris Tamsa expects Dopeless technology to continue growing throughout North America as offshore operators recognize its impact on string installation reliability, rig time efficiency, well productivity and HSE. The following four case studies demonstrate the benefits gained in these areas.

GULF OF MEXICO – STRING INSTALLATION RELIABILITY

A major operator in the US used Dopeless connections successfully in a deepwater well in the Gulf of Mexico. In 6,000 feet of water, Dopeless technology ran flawlessly, avoiding re-makeups and rejects. In addition, the absence of threading and running compounds minimized the impact on the environment and ensured cleaner and safer working conditions.

EASTERN SIBERIA – RIG TIME EFFICIENCY

In Eastern Siberia, temperatures consistently remain below zero. In this Arctic environment thread compounds freeze to the connection threads, inhibiting the possibility of removing the protectors. Given the harsh environment, the customer was looking to drill a large number of wells in a short period of time, making operational efficiency a necessity. Dopeless technology renders thread compounds superfluous making operations simpler and cleaner. Connections with the proprietary dry coating performed flawlessly in this difficult climate, with zero rejects and increased efficiency. Compared with doped connections, Dopeless technology produced more than a 25% running time savings.



MIDDLE EAST – WELL PRODUCTIVITY

A major operator experienced formation damage caused by dope in an onshore gas carbonate reservoir. The problem affected every well in the field and many remedial actions were taken to remove the contamination in the formation. The operator decided to use Blue Dopeless connections to ensure smoother downhole operations and prevent further formation damage caused by the dope. An estimated US$100,000 would have been lost if the operator had not switched to Dopeless technology.

PERUVIAN AMAZON – HSE

An important oil and gas customer was drilling in a delicate habitat, home to numerous indigenous communities and rich biodiversity. In this setting, it was necessary to protect the environment, avoiding the release of potentially hazardous chemicals while cleaning, making up or breaking out pipe. The company decided to use 100% Dopeless coating on all casing, tubing and liner strings, making it the first eco-well in a jungle environment. The adoption of Dopeless technology also meant that no storage or running compounds were needed.

TIME FOR CARRIZO PRODUCTION

The Carrizo field, which was discovered in Tabasco in 1962, was producing up to 1,200 b/d in the 1990s. However, due to the intrusion of water into oil deposits, Carrizo suffered a steep decline and Pemex decided to abandon the field in 1999. Since then, Pemex has had the ambition to restart production at Carrizo, but due to lack of funds and outdated infrastructure, the NOC has not been able to do so. The 2008 Energy Reform gave Pemex the freedom to associate with private national and international companies under integrated service contracts (ISCs), a new strategy was adopted that allows Pemex to take advantage of the technology of private companies to extract as much oil as possible from mature fields.

Pemex awarded Schlumberger the integrated service contract to restart production at Carrizo. Even though the original winner of the field was Administradora en Proyectos de Campos (APC), with a bid of US$5.03 per barrel, the Mexican company was unable to complete the required legal paperwork according to Pemex, and Schlumberger was awarded the field at their offer of US$9.40 per barrel.

Schlumberger has not begun operations at Carrizo since they are currently focusing on solving multiple on-surface issues, but Schlumberger Country Manager, Juan Manuel Delgado, says the company's plans for the reservoir are in development and advancing rapidly. However, Schlumberger wants to make sure the services, resources, and facilities are in place and community interaction is positive before starting production. As a means to achieve this and offer an integrated service, Schlumberger created Schlumberger Production Management (SPM). "We have an enormous amount of knowledge of drilling in Mexico, so all we need now before we begin production is to integrate everything; this organization is dedicated to achieving this," says Delgado. At the beginning of 2012, Schlumberger signed a cooperation agreement with the British oilfield service company Petrofac, the winner of the contracts for the neighboring Santuario and Magallanes fields, and the company with the most ISC awards in Mexico to date. Petrofac and Schlumberger complement each other very well according to Delgado.

Schlumberger believes that even though Carrizo will present various obstacles and complications, it will also offer great opportunities to apply some of the common technologies that have not yet been brought to Mexico. The company is planning to begin operations in the first quarter of 2013. Delgado is excited about the potential of Carrizo, especially because there are still deeper areas to explore, but the company cannot currently speculate on the potential productivity of the field because "this project will be a learning phase for everyone and because those numbers will depend very much on how the field reacts to our tests and studies," he explains.

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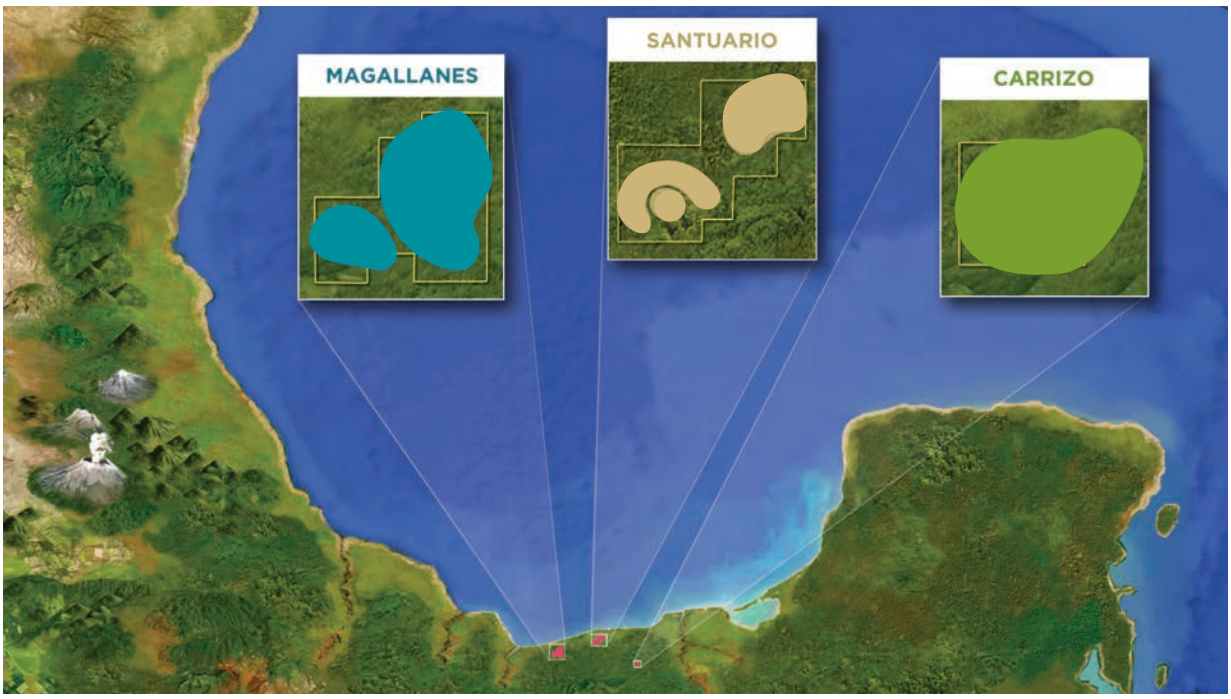

1 MAGALLANES

Operated by Pemex for around 50 years, the Magallanes area, like all of the areas awarded in the first contracting round, is located in Tabasco, and is the westernmost of the three areas. The area is located in the basin Salina del Istmo to the north of the Istmo de Tehuantepec, 50km from the city of Coatzacoalcos in Veracruz. Magallanes comprises two fields, Otates and Sánchez Magallanes, and is the largest of the three areas at 169.06km^2. The area has the largest volume of oil in place, at 1.16 billion boe. Current 3P reserves are 109 million boe, and current production at Magallanes is 6,800 b/d. To this day, 86 sand deposits have been identified and 775 wells have been drilled at Magallanes, of which 324 have been closed and only 54 are currently producing. The two fields of Magallanes are located in a complex of upper tertiary, multiple, fair to good quality reservoir sands. The production challenges at Sánchez Magallanes, the largest of the two fields, are mainly well-related, including sanding up, plugging with paraffin and damage from significant water-flood. Pemex began exploitation of the Otates field in 1965 and now has only a small amount of remaining reserves, which may not be developed, depending on the results of new exploration seismic and reinterpretation of 3D seismic data from 2005.

2 SANTUARIO

Also located in Tabasco, and the central area offered in the first contracting round, is Santuario. The area is located in the basin of Salina del Istmo, like Magallanes, and lies to the west of the city of Comalcalco. It comprises three separate fields, Caracolillo, El Golpe and Santuario, and is the second largest contract with an area of 129.93km^2. El Golpe was discovered in 1963, but production of gas began to decline between 1974 and 1984 because of the presence of water in the wells. Santuario was discovered in 1967, and production started to decline in 1978. The last field to be discovered was Caracolillo in 1969, which was closed in 1993. The Santuario area has 473 million boe in place in total, and 3P reserves of 37 million boe. Current production at Santuario area is 6,700 b/d. The Caracolillo field currently has no 3P reserves in place, with a total of 11 non-producing wells. The other two fields have 200 total wells, of which 32 are currently producing. Like Magallanes, Santuario's fields are located in upper tertiary, multiple, good to fair quality sands. Pemex considered its drilling activity at the Santuario area to have been successful, but now the area needs new techniques to bring back production.

3 CARRIZO

The Carrizo field is the easternmost of the three areas, and the smallest at 13.01km^2 and comprising only one field. The area belongs to the basin of Comalcalco, which is composed of seven sand deposits with an approximate depth that ranges from 500m to 2,000m, is located 8km west of the city of Villahermosa. The producing deposits were discovered in 1962, drilled to a total depth of 1,780m. The well was completed in the range 1.464m to 1.477m, and obtained initial production of 213 b/d of 27° API. Another 43 wells were drilled between 1965 and 1977 to reach the deepest deposits that were over 1,000m in depth. Of these 43 wells, none are currently producing: 30 were closed and 13 were plugged off. Over the last 11 years of its producing life, the field has an average of 13 active wells producing a maximum of 1,200 b/d before water entry initiated a steep decline. Having reached cumulative production of 14.86 MMbbl of oil and 9.60 bcf of gas, Carrizo was abandoned in December 1999. During 2000 and 2001 technological tests were performed in eight wells in order to reactivate the field, but these wells were subsequently closed due to lack of funds for development. Since 2000, installed equipment and systems have been out of operation without receiving maintenance. The remaining 3P reserves, certified on January 1, 2010, amount to 49.80 MMbbl of oil and 5.80 bcf of gas.

8

Production rates are normally the key metric by which oil and gas companies are evaluated: by looking at Pemex's figures, which show a drop from 3.45 million b/d at the end of 2003 to 2.55 million b/d in 2012, it would be easy to criticize the company for failing to maintain its production year-on-year. However, since the decline of Cantarell started, Pemex has worked hard to diversify its production base, bringing new fields into production and increasing production in existing fields in order to stabilize the production figure and build the basis for a return to production growth.

This chapter examines Pemex's diversification strategy for production in depth, looking at the fields driving production today, asking what caused Pemex's production decline over the last decade, looking at technologies that can help Pemex achieve its goals to exploit as much oil as possible from its reservoirs and ultimately return its production to 3 million b/d.

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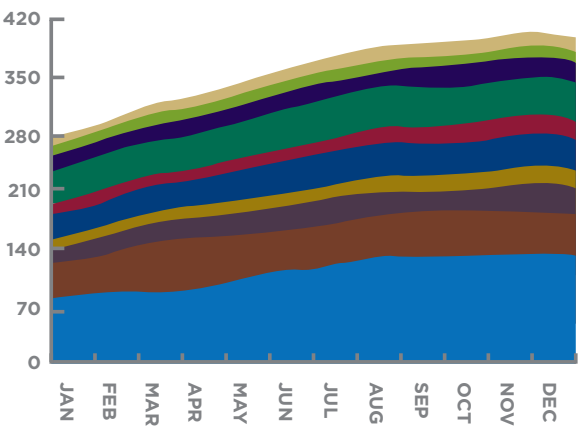
PRODUCTION REMAINS THE KEY MEASURE OF SUCCESS

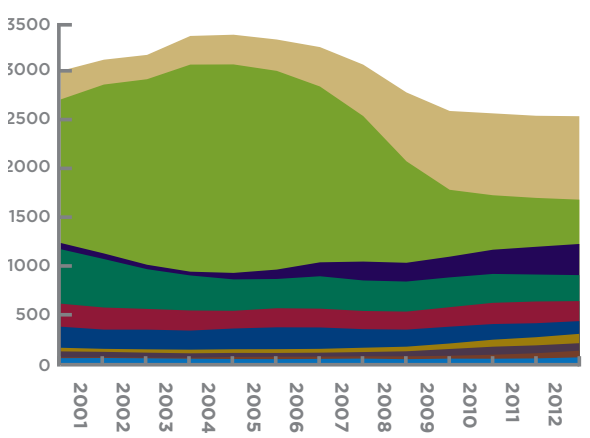
"The headlines in 2009 were that Pemex was running out of crude; that is not the case anymore," says Carlos Murrieta, Chief Operating Officer at Pemex. Since the start of the production decline at Cantarell in 2004, diversification of production assets has been the key to bringing Pemex's production decline down to 0.2% in 2012. This means that production remained stable for three years in a row, reaching 2,577 b/d in 2010, 2,553 b/d in 2011, and 2,548 b/d in 2012. It is expected that by the end of 2013, Pemex will be able to announce overall production growth for the first time in nine years. "The main news we would like to announce in December 2013 is that Pemex has reached its target of increasing oil production to 2.7 million b/d," explains Carlos Morales Gil, Director General of Pemex Exploration and Production. "We expect 100,000 b/d of additional production coming from Cinco Presidentes, Poza Rica, and Chicontepec by next year, while the rest will come from Tsimin, where two wells are already producing 15,000 b/d, and Navegante, where we expect to produce somewhere between 30,000 and 40,000 b/d in 2013. At the same time, we believe that production at Ku-Maloob-Zaap and Cantarell will remain flat."

"At some point, Cantarell was the second largest field in the world; now, we have other sources of oil. Imagine what it took for Pemex to shift its perspective. Sometimes, we disregarded assets when we should not have done so. We needed to stop looking for the next Cantarell and adjust to the times. Now we are focused on getting the maximum value from everything we can," says Murrieta. Since the decline of Cantarell in December 2003, Pemex has made up for a substantial proportion of this decrease in overall output by incorporating new fields and raising production at existing fields in areas such as Cinco Presidentes, Chicontepec, and Litoral de Tabasco. "With the incorporation of the production from Litoral de Tabasco fields, such as Tsimin and Xux, the Terra and Bricol wells in the south, and the contribution of mature fields like Chicontepec, we have been able to keep production figures stable last year," he explains.

PRODUCTION INCREASE AT EXISTING FIELDS (2012)



HISTORICAL OIL PRODUCTION



Source: Pemex

Compared with only eight years ago, Mexico's oil production has been greatly diversified as a portion of production decline at Cantarell and Abkatún-Pol-Chuc has been replaced by production increases and Ku-Maloob-Zaap, Litoral de Tabasco and to a lesser extent Samaria Luna. Oil production highlights in 2012 included the stabilizing of Cantarell, production increases at various existing fields, and the start of production at recent discoveries. In addition to the start of oil production at new fields such as Tsimin, Kuil and Pareto, production increases at a range of existing fields across a number of different assets played a central role in last year's production performance: Sihil and Ixtoc played a key role in stabilizing production at Cantarell, while Yaxche, Kab and May were main drivers of the production growth at Litoral de Tabasco.

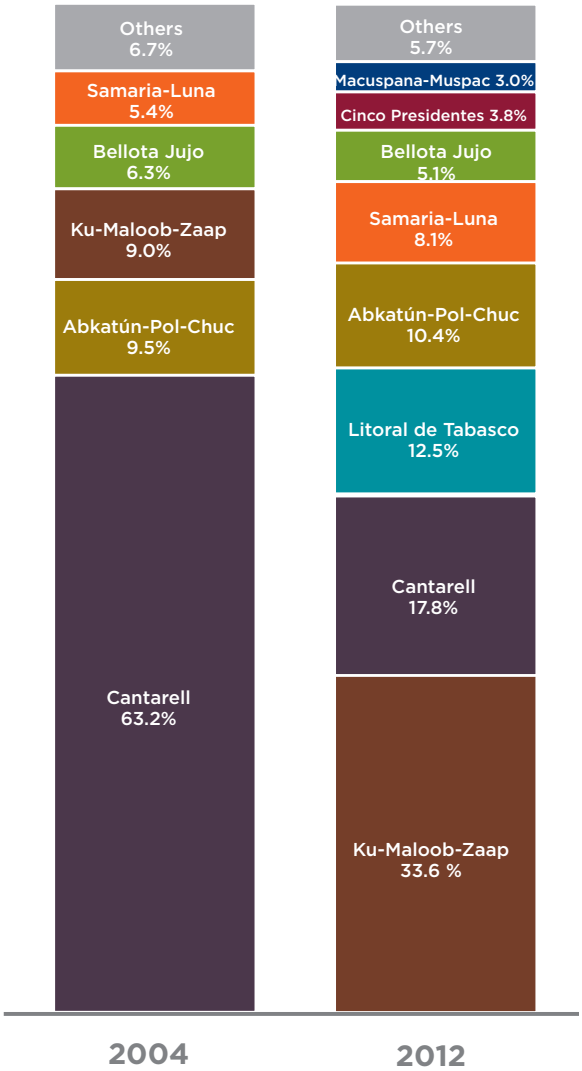
Morales Gil explains that the key to increasing oil production lies in both the ability to reduce the time between the discovery of oil fields and initial production, as well the implementation of advanced technology for mature fields. "In mature fields we must implement horizontal wells, fracking, steam injection, and other means of secondary recovery; however, for deep wells like Navegante and Tsimin, the key success factors will have to do more with drilling efficiency," he states.

In order to increase the number of producing fields as well as their output, Pemex has had to invest in both exploration and technology. The benefits yielded by these actions, however, were not immediate. Héctor Moreira, a Pemex Professional Board Member, cites the example of Chicontepec, which was largely viewed as a problematic asset because it consists of small pockets of oil spread out over thousands of square kilometers. "Chicontepec is an example of technological learning. Because there was no ad hoc technology that could work in this field, the Board requested a demonstration of the technology that would be required. The wells at Chicontepec are also laboratories, and this has greatly increased the production at the field. This is proof that, if you invest in technology, you will eventually generate more production, but this doesn't happen overnight. This is an important message; if production at Chicontepec – the most complex of Pemex's assets - can be optimized, then it is possible to do the same in any other field," says Moreira.

Pemex is shying away from the idea of increasing its production just for the sake of it. Instead, the portfolio strategy at the company prioritizes reserve replacement over production growth. "The key is to have the necessary investment to always maintain our reserve replacement rate at 100%. This should be our first priority. The fact that today we have around 30 years of potential production fully identified gives a lot of certainty to everything we do," states Murrieta.

The lessons learned from the experience at Cantarell have also allowed Pemex to develop a sensibility against over-exploitation of its biggest fields. It is now less likely that the NOC will break the reservoir balance in its assets. "It is very risky to over-exploit a field and break the balance between reserves and production. We only need to have enough production to meet Mexico's hydrocarbon needs, and keep the production level within a reasonable margin. Exploration is the basis; as a consequence of investing in development, production naturally becomes quite large. We need to understand that first, then think of Pemex's portfolio. Pemex cannot concentrate just on one area; it is not enough," explains Murrieta. By incorporating production into a wider strategy that integrates exploration, sound technical and financial planning and technological development, the NOC has ceased to depend on the bounties of giant fields.

PRODUCTION DIVERSIFICATION



Source: Pemex

TECHNOLOGY FOR PRODUCTION LONGEVITY

While Cantarell's production has been declining for almost a decade, the field will continue to play a prominent role in the Mexican oil and gas industry in the foreseeable future. To do so, a wide range of innovative technologies, and technologies that have yet to be developed, are expected to contribute to raising the recovery rate substantially above the 50% that has almost been reached. "I am convinced that Cantarell is going to be one of the few reservoirs of the planet that will go through almost every method of EOR, so you'll have to do nitrogen injection, CO_2 injection, perhaps other injections, like water with chemicals, surfactant injection, foam injection, double displacement. We're going to do all those things at Cantarell eventually," says Edgar Rangel, Commissioner of CNH.

International best practices confirm that traditional production boundaries are being pushed to new levels around the world.

IN WHICH FIELDS DO YOU ACHIEVE THE HIGHEST RETURN ON INVESTMENT?

Carlos Morales Gil, Director General of Pemex E&P

There is no doubt that we obtain the best return on investment in Litoral de Tabasco. It is one of the most profitable areas that we have, which produces very cheap oil from very high-energy reservoirs with very high pressure and very high temperature, despite the fact that the reservoirs are located at relatively great depth. As a result, our production cost per barrel in Litoral de Tabasco is below US$5. When evaluating our production performance and investment decisions, a distinction has to be made between different types of reservoirs and between conventional and non-conventional projects. Based on this set of factors we can define where to allocate investment. The factors to take into consideration are risk, and profitability. Deepwater projects present high financial risks, since the capital expenditure for this type of project is concentrated in the first few years and amounts to a large investment. On the other hand, non-conventional resources, such as Chicontepec or shale gas projects, have low financial risk, since you can stop at any given time and they do not involve peak investment in terms of capital expenditures. These long-term projects provide us with a flexibility range: if there is no money for those projects during one year, or the price is too prohibitive, the project is just slowed down.

Profit is correlated with risk: high profitability is usually present in projects with high financial risk, and low profitability is usually present in reservoirs with low financial risk. Companies follow different strategies to tackle these issues. Some of them manage non-conventional resources in separate subsidiaries, like Exxon with XTO Energy. IOCs usually concentrate in the high risk, high profitability areas, while smaller companies concentrate in the niche of low risk projects with low to medium profitability. Some follow niche strategies, while others follow an association or subsidiary model. Given that Pemex is the only operator working in Mexico, we have to attack all fronts. However, we will concentrate on deepwater and what we call marginated – instead of marginal – or mature fields which represent low-risk and medium-profitability.

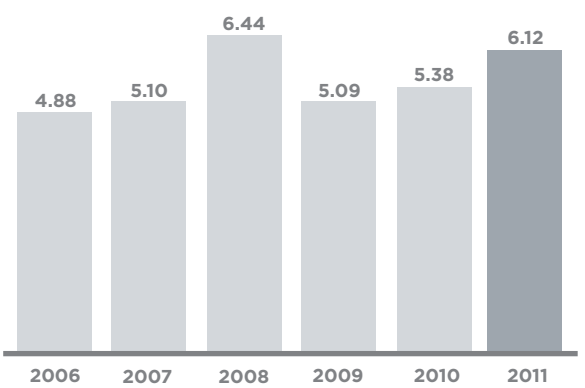
WHAT IS THE CONTRIBUTION THAT THE FIELDS FROM ISCS WILL PROVIDE TO PEMEX'S OVERALL PRODUCTION FIGURES IN THE NEXT YEARS?

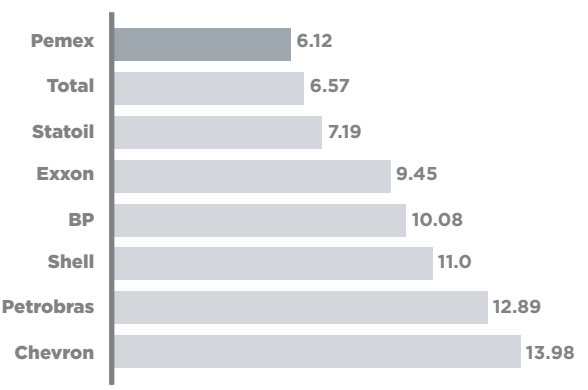
The ISCs that have already been awarded in Cinco Presidentes and Poza Rica, plus the upcoming round in Chicontepec, will amount for 500,000 b/d in the next five years, up from the 250,000 b/d they are currently producing (100,000 b/d in Cinco Presidentes, 70,000 b/d in Poza Rica, and 80,000 b/d in Chicontepec). Contractors will be responsible for 60% of that figure, with Pemex producing the remaining 40%.

PRODUCTION COST PER BARREL (US$)

The move from Cantarell's 'easy oil' to more technologically demanding fields has had a significant impact on the production cost per barrel for the NOC. Between 2006 and 2011, production costs per barrel increased from US$4.88 to US$6.12, with further increases expected in the coming years as Mexico's deepwater production will come on stream, unconventional resources will start playing an increasingly important role, and new technologies are expected to raise recovery and production rates at currently producing mature fields.

Nevertheless, largely based on current production from its legacy fields, Mexico remains one of the world's leaders in terms or production costs per barrel, with only Total and Statoil approaching Pemex's production cost per barrel, while renowned companies such as Exxon, BP, Shell, Petrobras and Chevron are producing oil at a cost per barrel exceeding Pemex's level by at least 60%.

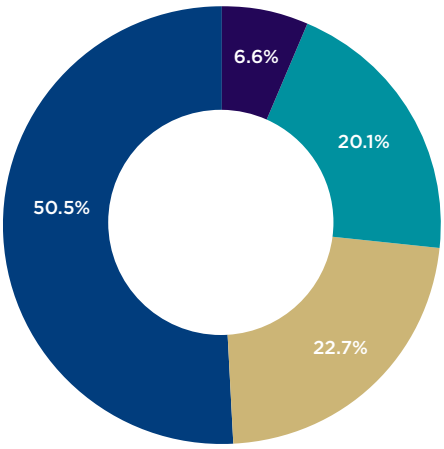




Source: Pemex

PRODUCTION OUTLOOK FOR 2013

NATIONAL PRODUCTION

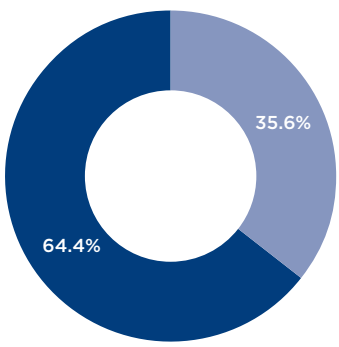


- Northeast Marine Region
- Southwest Marine Region
- South Region
- North Region

According to Pemex E&P's operating plan, the company's oil production is forecasted to increase by 2.9% after nine years of decline. Although Pemex failed to reach its production target during the past four years, planned production in 2012 was 2.602 million b/d while actual production reached only 2.548 million b/d, Pemex E&P's management is optimistic the production target will be achieved in 2013 despite a drop in production to 2.538 on average for the first four months of the year. According to Pemex's production forecast, the North Region will show a modest 1% production growth, the Southwest Marine Region is expected to see stable production, Macuspana-Muspac's 8% production increase will be the main driver of a 4% production increase in the South Region, and the North region's production will go up by 19% as Chicontepec is expected to experience a production increase of 32%.

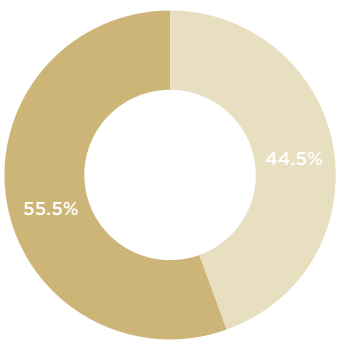
This page presents how Pemex expects to reach its planned production of 2.621 million b/d.

NORTHEAST MARINE REGION



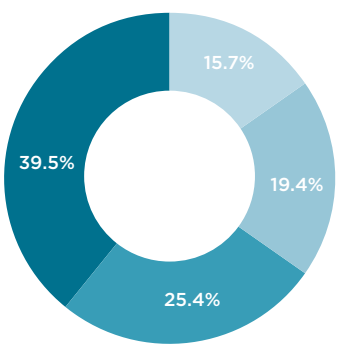
- Ku-Maloob-Zaap (852,000 b/d)
- Cantarell (472,000 b/d)

SOUTHWEST MARINE REGION



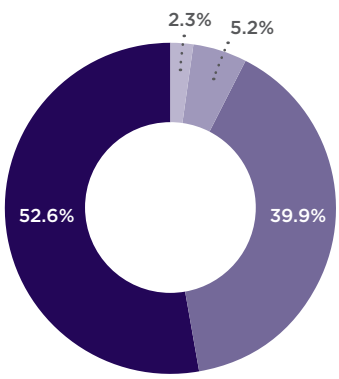
- Litoral de Tabasco (331,000 b/d)
- Abkatún Pol-Chuc (265,000 b/d)

SOUTH REGION



- Samaria-Luna (208,000 b/d)
- Bellota-Jujo (134,000 b/d)
- Cinco Presidentes (102,000 b/d)
- Macuspana-Muspac (83,000 b/d)

NORTH REGION



- Aceite Terciario del Golfo (91,000 b/d)
- Poza Rica-Altamira (69,000 b/d)
- Veracruz (9,000 b/d)
- Burgos (4,000 b/d)

Source: CNH

TECHNOLOGY BEHIND THE TURNAROUND AT CANTARELL

Miguel Ángel Lozada Aguilar, Cantarell Administrator

"2012 has been the first year with increasing production for the Cantarell complex since 2004," says Miguel Ángel Lozada Aguilar, Cantarell Administrator. "This was achieved through the application of new technologies that have not only increased production but also the recovery factors of the fields." Three multidisciplinary teams were put together with the sole objective of optimizing recovery factors and production rates by using new technologies, implementing best practices available in the industry, and utilizing sound reservoir management policies at the ten fields that belong to the Cantarell Complex. These groups are focused on three different field types, divided by field qualities and specifications: the mature field Akal, the largest and most important field with 2.45 billion bbl of remaining 2P reserves and average production of 234,200 b/d in 2012; developing fields such as Sihil and Ixtoc, which produced 133,300 b/d in 2012; and the mature field of Ek-Balam, which have a proven 2P reserve of 550 million bbl and average production of 49,600 b/d last year.

New technologies and methodologies have been implemented systematically in exploitation processes from geological and dynamic characterization, to drilling and well completion. One of the most successful technologies introduced at Akal is Double Displacement Process (DDP). "When you begin producing, well pressure is very high and water levels are low; however, after removing a substantial amount of oil from a reservoir, a gas cap is created and water levels rise," explains Lozada Aguilar. DDP reduces water levels that have risen to over 600m above their original level and will help produce an additional 400 million bbl. "We are expecting the gas-oil and water-oil contact to move down at a 15m/year rate, which means that we will be producing 500,000 b/d of water and will be drilling 40 new water producing wells," Lozada Aguilar explains.

In order to decrease water levels in the Akal field, it is necessary to first install production infrastructure, water treatment plants, gas management and reinjection mechanisms and increase dehydration capacity from 100,000 b/d to 500,000 b/d. Even though this technology is not new to the oil and gas industry, since it has been used effectively around the world to optimize production, it has never been used in a massive complex such as Cantarell.

To increase production in the different fields, engineers are taking advantage of their geologic features and utilizing gravity drainage to naturally allow oil to slip to the bottom of the well and facilitate its extraction. "This strategy has been extremely important because it will allow us to extract as much oil as possible without decreasing the recovery rate. Actually, due to the nature of this process, it would even allow us to increase the recovery rate of fields like Akal because of the resulting decrease in water levels," Lozada Aguilar details. In order to take advantage of the gravity drainage mechanism in Akal, it will also be necessary to drill up to of 150 new wells, 40% of which will be non-conventional wells, either horizontal or long extended reach wells. There is also a surveillance plan for monitoring the gas-oil and water-oil contact to maintain an optimal oil exploitation window.

Lozada Aguilar explains that in the near future an enhanced oil recovery pilot test will be performed in the Akal field. The technology to be implemented has been developed by Pemex, together with IMP specialists and top petroleum universities from the US. The main purpose of this new enhanced oil recovery technology is to reduce the capillary forces using foams with surfactants. The surfactant has been already designed, as well as the pilot test using laboratory tests and the STARS reservoir simulator. Besides gravity drainage, double displacement techniques, and the creation of multidisciplinary groups as a means to increase production and recovery factors at Cantarell fields, Lozada Aguilar believes that past secondary oil recovery processes with nitrogen injection in the Akal field have not only maintained the reservoir pressure and increased production, but allowed field operators to increase the final recovery factor. "Critics claim that nitrogen injection techniques used at the complex have damaged the reservoirs and decreased recovery rates; however, this is a myth, since there is no evidence of any damage," he concludes.

LAST YEAR, PRODUCTION AT CANTARELL DID NOT INCREASE TO 480,000 B/D, WHAT WENT WRONG?

Nothing went wrong. The difference with the 480,000 b/d figure is related to the nature of the industry. It has to do basically with the completion of new wells, since we did not have the supply of rigs we needed to fulfill our production target. Cantarell, though, is performing according to our predictions. We are bound to achieve our target within a 10% range, and we are producing at about 95% of our forecasts.

Carlos Morales Gil, Director General at Pemex E&P

ENHANCING OIL RECOVERY AT CANTARELL

EDGAR RANGEL
Commissioner of CNH

Q: What should the future of Cantarell look like, and what are the most suitable technologies to be applied there to optimize production and recovery rate?

A: We have to make clear that Cantarell is a complex of different fields. It might often be seen as a project, an asset, or an account in the eyes of the Ministry of Finance, but in reality it is a set of fields, with the main field being Akal. When people assert that production at Cantarell has stabilized, in reality they mean that the Cantarell asset has stabilized, because some of its fields, such as Sihil, have increased production, while production at the Akal field has gone down. Historically, when we spoke of Cantarell, we referred to Akal, but output at that field has been declining for almost a decade and is expected to continue doing so, while production at Sihil and other smaller fields has increased. However, the Cantarell asset still has substantial reserves. It ranks number two in terms of proved reserves and number three in terms of 2P reserves, so it is an important mature field.

With an original volume of close to 30 billion bbl of oil in place, Akal is the most important field of Cantarell. In 1979, 60% of that volume was located in the matrix system – the solid parts of the rock – and 40% in the fracture system. Many years later, we have produced almost half of the original oil in place, but most of this came from the fractures, so currently 90% of the remaining oil is in the matrix and 10% is in the fractures. Thus, we do have a lot of oil remaining in Cantarell, but Pemex needs to expel the oil from the matrix system or "wash the rock," and the way to do this is by means of injecting gases and chemicals, such as CO_2, natgas and surfactants or polymers. We at the National Hydrocarbons Commission (CNH) strongly believe that this requires complex Improved Oil Recovery (IOR), as opposed to simply Enhanced Oil Recovery (EOR). This entails a broader range of activities, such as acquiring new seismic data, running modern well logs, and performing reservoir engineering analyses to assess where most of the remaining oil is located in areas that have been partially drained, areas that are being cyclically refilled by gravity drainage, and areas that have been the least produced. Oil has been extracted from different blocks within the field, so Cantarell has been drained unevenly; some areas are relatively dry and others have a lot of oil. CNH recommends a series of recovery measures. New techniques now permit increased recovery when drilling unconventional wells. By using smart completions, you can place the tubing of producing wells in the "oil window," you can also isolate "bad fractures" that are either pulling gas from the cap or water from the aquifer, and perform a variety of other activities to optimize the production of liquid hydrocarbons. In a project management program, using these tools will help to raise the recovery efficiency. We do believe that through all these IOR-EOR activities, it is possible to keep Cantarell's production stable for several decades.

Q: Pemex officials say that production at Cantarell has stabilized. Yet, production numbers indicate this is not yet the case. Where will production stabilize?

A: It will stabilize once Pemex has implemented all these recovery enhancement strategies that collectively make up what we call IOR-EOR. For many years, Pemex has been basically draining the reservoir like a tank. But when the gas-oil contact or the oil-water contact reach the depth of producers, E&P needs to shut down these wells because they start producing significant amounts of gas or water. If you shut many wells per year and you do not replace them, production naturally decreases. Without a sufficient number of producing wells, there is nowhere to get the product from. If you just go and empty the tank - which is what has been occurring in Cantarell – and then you open the valve, you know that the tank has a lot of oil there, but nothing will come out, because you left most of the oil trapped in the solid parts of the rock.

We, as a regulator, have to be strong enough or intelligent enough to convince Pemex that the techniques mentioned will work. Otherwise, Pemex will continue using its current development plan, just draining fields and forgetting about the remaining oil. We need to persuade Pemex that it can both produce the reservoirs in an economic fashion and manage the remaining oil in a more modern way. They are already doing some pilot projects; learning about unconventional drilling with smart completions and studying the applicability of IOR-EOR.

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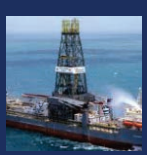

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MAINTAINING A PRODUCTION PLATEAU

FÉLIX ALVARADO ARELLANO
Pemex Administrator of Ku-Maloob-Zaap

Q: In 2010, Pemex announced that Ku-Maloob-Zaap was entering its most productive stage and would probably maintain the same production levels for three years. What is your target for the coming years?

A: Ku-Maloob-Zaap represents one third of Mexico's oil production, and for the third year in a row we have been able to maintain a production plateau of around 850,000 b/d, and we are expecting to continue like this until 2017. After this, inevitably, the production of Ku-Maloob-Zaap will decline because of the natural depletion of the complex.

Q: What are the main obstacles to maintaining a production plateau of 850,000 b/d at Ku-Maloob-Zaap?

A: The greatest obstacle has been the acquisition of drilling equipment to maintain a steady production. Even if we do not have access to the planned drilling equipment, we still have to operate the same number of wells. However, to maintain a steady production of around 850,000 b/d we have adopted an operational philosophy based on the application of reservoir management best practices, establishing and using specific measurements and criteria to manage production limits per well, regional production, reservoir pressure maintenance through the injection of 630 million cubic feet (17,839,613.4m^3) of nitrogen, and with an exhaustive field monitoring campaign to make real-time decisions in the exploitation of the different fields. Another challenge in maintaining a production plateau is the fact that we do not have control over exploration activities at our field; Pemex Exploration & Production manages all exploration activity, and it is not until the field has been developed by the field development division before it moves to the control of the Ku-Maloob-Zaap Administration.

Q: To which extent is the experience at Cantarell being used for the identification of production technologies and strategies that could be successfully implemented at Ku Maloob Zaap?

A: The lessons learned during the lifecycle of Cantarell inarguably have served as a platform for the identification of new technologies not only for application in Ku-Maloob-Zaap, but for the whole Northeast Marine Region. However, we have only adopted technologies that fit the specific geological and technical needs of our complex, such as nitrogen injection, after doing specific studies on the economic and feasibility of the technology for Ku-Maloob-Zaap. Furthermore, we have created a specific document for the reservoir management of the Northeast Marine Region, where we describe in depth all the tools and technological practices used in each field and how they can contribute to optimizing production and increasing the recovery factor and maximizing value generation at Ku-Maloob-Zaap.

Q: What technologies or processes will play a major role optimizing production, increasing the recovery factor, and maximizing value generation at Ku-Maloob-Zaap?

A: As part of Ku-Maloob-Zaap's development strategy we are planning on introducing and implementing the following technologies and processes: (1) management of crude in three phases: short, medium, and long term with regard to well control using water injection, segregation of humid currents and dehydration within wells, and desalinization in offshore and onshore wells; (2) smart well completions that will allow us to reduce maintenance costs by placing opening and closing systems that are controlled from the surface; (3) injections of residual gas into the reservoir to increase the recovery factor by 2% while at the same time obtaining operational flexibility of gas management; (4) long-term enhanced oil recovery projects, with an emphasis on the injection of carbon-dioxide (CO_2).

Q: How do you overcome the challenge of maintaining the production plateau without affecting the reservoir's long term production prospects?

A: The fields in the Ku-Maloob-Zaap complex are hydraulically anticline structures connected through a common aquifer. Oil and gas is stuck in the upper part of the reservoir and the lower part constitutes the aquifer. Due to this, we maintain a strict policy of not reducing the pressure in any of the interconnected reservoirs in order to avoid reducing changes in pressure in one reservoir that could potentially affect the rest. Under this strategy, it is possible to analyze and manage each reservoir, always taking into consideration temperature and pressure, as well as the level of contact between water and oil, and gas and oil.

EXPLORATION AND DEVELOPMENT

Pemex's current internal structure means that, before a field begins production, it has already passed through the hands of the exploration and development departments. The exploration stage involves searching for hydrocarbons through different technical methods, which help to determine the location size, and type of hydrocarbons located in a given area. Once this data has been collected, exploration and appraisal wells are drilled to determine the extent of the reservoir. If the discovery is deemed to be commercially viable, then it is passed on to the development division.

Pemex's development division, is tasked with preparing projects for production, requiring an evaluation of the best way to ensure long-term efficient production and maximum recovery, and confirming the extent of the reserves discovered. It also involves the design and construction of the field's infrastructure. The exact production plan is then created. In an ideal world, this will take into account the whole life of the project, envisioning the best way to produce from the reservoir according to Pemex's needs.

It is understood that not every eventuality over the life of a field can be planned for, and that to a certain extent, the production plan has to be dynamic. However, the development division was created with the specific purpose of reducing the number of variables that have the potential to adversely affect production, and ensure that as many scenarios as possible have been planned for. When little regard is shown for the development phase of a project, the results can be a production plan that is reactionary, which naturally impacts the sustainability of a particular project.

The production phase of a project is generally broken down into three stages: primary recovery, secondary recovery, and tertiary recovery. These stages are natural divisions, and reflect the changing conditions that occur at the different stages during the life of a producing field. Each of the three stages requires a different set of techniques and technologies to maximise extraction, while ensuring sustainable exploitation. These techniques have been developed by the global oil and gas industry based on years of experience in dealing with the different stages of production. In the following boxes, you will find a more detailed explanation of each of these phases, and examples of the technologies and methods used in each phase.

PRIMARY RECOVERY

Primary recovery relies on the natural energy of the reservoir in question in order to drive production. This is caused by the expansion of reservoir fluids, moving into the space created by the drilling of the well. Because the wellbore has a lower pressure than the reservoir rock, the oil flows into it, and to the surface. This pressure is usually created by one of two processes, known as water drive and gas drive.

Water drive is where the oil in the reservoir is pushed into the wellbore by an active aquifer, generally below the hydrocarbons. Water is compressible to a small degree, and as hydrocarbons in the reservoir are depleted, the water compressed by the hydrocarbons will expand a little, maintaining the pressure to continue production. If the aquifer is active, meaning that water is constantly flowing into it to some degree, then pressure can be maintained consistently until the amount of water in the reservoir reaches the well. At this stage, primary recovery has ended and new techniques will be required to continue production.

Gas drive is broken down into two sub-categories: solution gas drive and gas cap drive. In a well driven by solution gas drive, the gas creating the pressure in the reservoir is present in the oil solution, due to internal reservoir pressure. As the oil is extracted from the well, the drop in pressure causes the gas to separate from the solution, forming a gas cap, which increases pressure on the reservoir. With gas cap drive, the unproduced reservoir already has a gas cap on top, which expands with the depletion of the reserves. With these types of gas drive, the production is steady until the gas cap expands to the point where the well will eventually produce predominantly gas.

The key to primary production is that the reservoir pressure is higher than the pressure in the wellbore. This can be increased through the use of artificial lift systems, which are still considered to be a primary recovery technology.

The factors that influence the amount of oil produced by primary recovery vary wildly depending on several factors: the type of drive pushing the oil out of the well, the viscosity of the oil being produced, and the permeability of the reservoir in question. Generally, primary production accounts for between 5% and 20% of original oil in place.

SECONDARY RECOVERY

As primary recovery progresses, the pressure of the well drops. Once the pressure drops below the point where it is sufficient to bring oil to the surface, secondary recovery methods are applied to maintain reservoir pressure to a level at which oil will continue to flow, and displace hydrocarbons in the direction of the wellbore. This flow of energy into the reservoir replaces the natural drive of the reservoir with artificial drive. Common secondary recovery tools are water injection, natural gas injection, and gas lift.

Water injection is used to both increase pressure and sweep unproduced oil towards the production wells. Injection wells are drilled, and water is pumped into the reservoir. A common source for the water used is produced water, which reduces the chance of damaging the formation as a result of incompatible fluids. This also solves the problem of disposing of produced water. However, the volumes of produced water are never sufficient to replace the combined production volume of oil, gas and water, and so additional water must be provided. Seawater can also be used for injection, but only after it has been filtered, deoxygenated and biocides have been used. Water from other aquifers can also be used, as can river water.

As its name suggests, natural gas injection involves the insertion of natural gas into the reservoir, typically at fields that contain both crude oil and gas. Associated gas from the well can be collected and stored during the primary recovery phase, and can be particularly useful in wells that produce heavy oil, because the gas dissolves into the oil again under pressure, lowering its viscosity and aiding its production. As well as re-using produced gas from the reservoir, other gases can be used, such as nitrogen or carbon dioxide. However, using produced gas for secondary recovery can be an excellent strategy to remove the need for gas flaring.

Gas lift should not be confused with gas injection: while injection involves the insertion of gas into the reservoir, gas lift is a technique to lower the pressure by injection of gas into the tubing-casing annulus. The injected gas aerates the fluid, thereby reducing its density, to the point where the pressure differential is enough to enable the oil to be recovered. Generally, at the end of secondary recovery, between 35% and 45% of the original oil has been recovered, when added to the amount retrieved by primary recovery.

TERTIARY RECOVERY

Tertiary recovery, also known as enhanced oil recovery, is the final stage in the life of a producing reservoir. As well as maintaining reservoir pressure, the aim of the third stage of recovery is to alter the properties of the oil remaining in the reservoir in order to make it easier to extract. The main techniques used are chemical flooding, thermal recovery, and miscible displacement.

Chemical flooding involves injecting chemicals into the reservoir in order to help free trapped oil. Micellar polymer flooding involves pumping a polymer into the well to reduce the interfacial and capillary forces between oil and water, triggering an increase in oil production. Another type of chemical flooding uses alkalines such as sodium hydroxide or sodium carbonate, which forms surfactants in the reservoir, reducing the interfacial tension and again, increasing oil production.

Thermal recovery techniques heat the oil in the reservoir, improving its viscosity and making it easier to produce; methods include cyclic steam injection and steam flooding. Cyclic steam injection, or 'huff and puff', works by injecting steam into a well for a period of time in order to heat the oil, leaving it to sit in the well for a period, and then producing from the same well. This is repeated once production has slowed. Steam flooding or steam drive is very similar to the secondary recovery technique of water flooding, with the added advantage that, as well as displacing the oil in the reservoir, the steam also heats the oil and improves its viscosity.

Miscible displacement, or gas injection, is the most common enhanced oil recovery technique, in which miscible gases are injected into the reservoir to restore well pressure and improve the viscosity of the oil. Gases used include carbon dioxide, nitrogen, and natural gas, although the fluid most commonly used for miscible displacement is carbon dioxide, due to the fact that it reduces viscosity in the reservoir and is less expensive than other alternatives.

Other tertiary recovery techniques also exist, including microbial injection and combustion. Enhanced oil recovery is not suitable for all fields, and involves much higher costs than primary or secondary recovery, but improving the ultimate recovery factor at fields has become a priority for many operators trying their best to improve the profitability of their assets.

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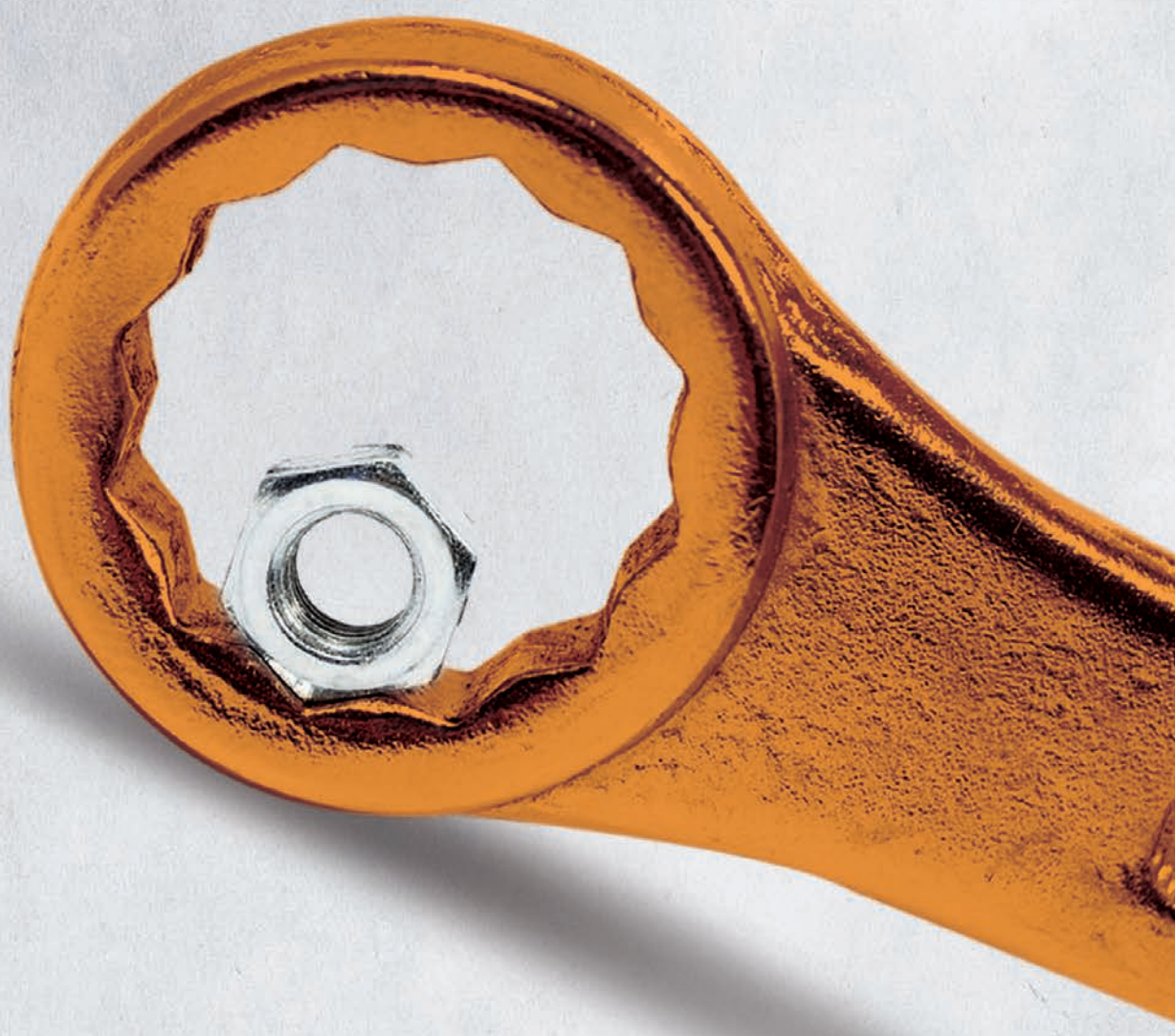

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ENHANCED OIL RECOVERY TECHNOLOGIES

During the last few years, Grupo Diavaz has taken pride in successfully applying enhanced oil recovery (EOR) technologies to stimulate production at several fields. Whether it has been through collaborations with other companies or by developing the technology in-house, the company has succeeded in its efforts to increase production in the mature fields of the Ébano-Pánuco-Cacalilao sector, almost doubling the amount of oil extracted from 2007 to 2012. With the experience at those fields, Luis Vázquez Sentíes, President of Grupo Diavaz, is trying to repeat his company's success at Cantarell and Chicontepec.

While gas injection is the most commonly used EOR technology, Grupo Diavaz is also experimenting with other well injection techniques to stimulate production at each of the fields it is working on. "We are currently developing tests with steam, placing heating devices on diverse areas and monitoring the results," says Vázquez Sentíes. His company is also focused on testing a new water injection technique in Chicontepec. "The results of our pilot project with Sinopec at Chicontepec have been excellent," Vázquez Sentíes proudly emphasizes. "We've seen an increase from 3,000 b/d to 11,000 b/d at wells where we have tried our technology."

The first step for Grupo Diavaz to undertake this new enterprise at Chicontepec was to become a certified operator under the Mexican Constitution. "It was a rough beginning for us, due to the lack of expertise we had," says Vázquez Sentíes. "But after overcoming the initial hurdles, we introduced new techniques to the field, such as water routing. We started drilling at 900m depth first, since we wanted to get certainty of the condition of the well." Once the reserves were located, water was injected and circulated horizontally to increase the pressure in the reservoir and thereby increase the production factor. Water was injected both to support the pressure of the reservoir and to push the oil out from the reservoir to the well. "This technique increased our extraction factor by 88% to 92%," Vázquez Sentíes claims. "We began with a baseline of 16,000 barrels of recoverable reserves and managed to raise this number to 120,000 barrels. We still have the conviction that we could get up to 1 million barrels of reserves there."

Grupo Diavaz, along with Sinopec, had to innovate on drilling techniques to overcome the harsher conditions of the fields at Chicontepec, compared to what the company was used to Ébano-Pánuco-Cacalilao. "Some of the wells that we drilled used to get flooded with water during the rainy season. At the beginning, we had no choice but to close them and stop production, since we did not have a solution to fight off the weather invasion," Vazquez Sentíes explains. "We then decided to install small platforms at the well, so that the water could not flood the borehole during the rainy season of June and July."

Secondary recovery techniques, such as water and gas injection, are crucial in enhancing production factors in challenging mature fields, but they can also work in helping to optimize production in fields where part of the reserves were overlooked. "Currently, Cantarell has two main issues," Vázquez Sentíes says. "The first has to do with diluted oil. Since resources used to gush out of Cantarell with minimal effort, as soon as the easy oil has been produced, companies closed the well and moved on to the next one. The diluted oil remaining was left there, untouched, whereas in some countries, companies keep a profitable operation even when the oil is 95% composed of water." Grupo Diavaz is trying to emulate what international companies do in other oil and gas markets and exploit the reservoirs in Cantarell that still have diluted oil reserves. "Our strategy is to associate with Norwegian companies to study the possibility of installing dehydrating facilities at our platforms to separate the water from the oil, filter it, deoxygenate it, apply biocides to it and return it to the sea, while we exploit the remaining 5% oil," Vázquez Sentíes describes. These tests are being currently performed with an American company and Grupo Diavaz as the main technology provider.

"The second problem that we have observed in Cantarell is the result of years of nitrogen injection – another secondary oil recovery technique," Vázquez Sentíes explains. "When nitrogen is injected into the well, more nitrogen is produced as a result. The inconvenience is that the amount of nitrogen that comes out is too much for companies to reacquire in full and reuse it. Technologies, such as nitrogen absorption equipment, which can be mounted at any platform, enable us to recover most of the nitrogen originally injected, remove the contaminated liquids from it, and use it again in the reinjection process." Grupo Diavaz is looking to form joint ventures with companies that currently use these technologies, in order to achieve better results in production. Building on its offshore success, Grupo Diavaz is currently planning to use this technology onshore at Poza Rica. While companies such as Praxair already inject 10 times the amount of nitrogen, obtaining more penetration at a higher cost, the small-scale nitrogen absorption technology that Grupo Diavaz is trying to import seems to be cost-effective and reduces the waste in gas that comes from the original injection.

UNDERSTANDING THE RESERVOIR ROCK

JOHN D. LAWRENCE
Director of DTK Group

Q: What have been the highlights for DTK Group during 2012, and what has been your participation in the deepwater discoveries?

A: Business has been going very well; we have been particularly active on the core analysis side, where we have been working mostly on cores from offshore wells, including those that have come from the deepwater exploration wells drilled last year, which are becoming extremely important for the future of Mexico. It was interesting for us to be analyzing those cores and identify the interesting opportunities that are present there with what appears to be very light oil in productive reservoirs.

Q: Pemex has increased the number of core samples taken from each well, from two to an average of six, while extracting up to 20 in the more complex wells. How has this affected your work?

A: There has been a significant increase in the number of cores taken, especially in exploration wells. Our focus is on attending to the client's needs and requirement for quick information, especially for wells where decisions regarding testing potential reservoir production have to be made. To better attend to those needs, we are constructing a new facility in Villahermosa that will duplicate the size of our operation. We hope that shortly we will be opening a lab in Poza Rica as well.

Q: How long does it take to run a sophisticated core analysis for each of those samples?

A: Depending on the rock type and the situation, the results of doing advanced flow studies can take up to two years. That tends to be a worldwide problem in the industry, because it can often be that two years later the information is of no use anymore. Because of timing alone, there is an enormous opportunity for technology based on microscopic imaging, and doing analysis on computer models built from the imaging, which recreates the internal structure of the rocks and enables all kinds of analysis, including flow studies, to be done on the models rather than on the rock. The turnaround time for this kind of studies – called e-core analysis – is much faster and this is one of the main reasons why e-core analysis is gaining importance in the oil and gas world today.

Q: What advantages does the e-core analysis hold against conventional core analysis?

A: You can actually apply e-core technology to all kinds of rock samples, whereas with conventional core analysis you must have a core. Therefore, the analysis you can do is limited to the depths where you obtain the cores. Perhaps this explains the more frequent cutting of cores for traditional analysis. Even so, six cores represent only six 9m intervals along the whole course of the well, which may or may not coincide with your key reservoir depths. E-core technology can be applied to core samples, but also to sidewall core samples, and to drill-cutting samples. Its microscopic technology only requires a very small piece of rock: any reasonably sized drill cutting can be used to obtain those images. Therefore, it lends itself to taking samples from a large number of depth points during the sequence of the well, including frequent points throughout the interval of most interest, which is the reservoir that will be producing. E-core technology gives you the opportunity to have much more complete sequence throughout the most relevant depth interval while conventional core analysis does not do so much.

With this being said, I have to point out that e-core analysis is not something that DTK Group proposes as a replacement of conventional core analysis: there is really nothing that can replace physical tests on rock samples. There is very little in the industry that provides the opportunity to do a real test on a real piece of rock, and the majority of technologies are based on remote sensing methods. E-core technology is not quite remote-sensing, but does not take measurements directly from the rock sample: it is recreating the internal structure of a rock sample in a computer model at a microscopic level and then blowing up the scale of that model, rather than analysing the physical rock. The technology is not cheap, but it is not as expensive as traditional core sample analysis.

Q: What does DTK Group identify as the main opportunities for core analysis in deepwater and shale gas plays?

A: The deepwater success in 2012 at both Trion and Supremus certainly indicates that there will be a lot more opportunities in deepwater, and I am sure there is going

to be plenty of work bringing those fields online and searching for new opportunities. We are also waiting for Maximino's results to start core analysis there. Operations on deepwater drilling rigs are so expensive that the time required to cut a core in a deepwater well is consuming an awful lot of money. If you can provide the same information by doing analysis on samples that you can obtain without cutting a core then you are saving a lot of money. E-core technology certainly is a tremendous potential application for deepwater wells because of the economics.

For shale gas, it is more a question of the application of technology, rather than economics. Doing conventional core analysis on shale samples is extremely difficult, time-consuming, and costly, while the results obtained are questionable because of the characteristic of the rock. Shale rock has virtually zero permeability, so carrying out flow studies on a piece of shale and making a fluid flow through that piece of rock is pretty much impossible. To achieve that, it takes quite a sophisticated system and a long time. Whereas e-core technology microscopically recreates the internal structure of the sample and performs the analysis on that model, enabling to carry the whole process at a microscopic scale and extremely low permeability values, but in a much shorter time and with better precision. From a technical point of view, it is the better option.

E-CORE ANALYSIS APPLICATIONS

Understanding the geophysical and geochemical characteristics of a reservoir is essential to optimize production strategies for effective reservoir management. One adept technology for executing an in-depth analysis of rock formation and characteristics within a particular well is core analysis. DTK Group offers two different variants of core analysis technology: conventional core analysis and e-core analysis. Conventional core analysis consists of analyzing a core sample from a particular well to determine its characteristics. The results of the single sample analysis are then extrapolated to model the whole reservoir's features. The technology has limitations, especially regarding the number of core samples extracted from the selected well. Each core gives a nine meter biopsy of the well's petrophysical composition, which might not necessarily correlate with the key well sections that need to be scrutinized. While the response to this problem might reside in increasing the number of samples extracted, the cost implications of each core excision are high. This restricts the efficiency of the technology, also taking into consideration the fact that core analysis can take up to two years to be processed.

A solution to reduce the time and cost gap of conventional core analysis is e-core analysis, which can be based on sidewall core samples and drill cutting samples, apart from conventional core samples. Its microscopic imaging technology enables the company to recreate the internal structure of rocks and model them virtually. In the 3D model of the rock, petrophysical/single phase parameters are calculated, producing results on the porosity, absolute permeability, formation factors, elastic properties, and other sophisticated flow variables in weeks. The information is then extrapolated to constitute a network model, which helps in the calculation of two phase parameters, such as capillary pressure, relative permeability, and resistivity index, as well as the results of wettability sensitivity tests.

While Pemex has increased its requirements for core samples in some exploration wells from less than five to as much as 20, the new challenges that the NOC faces in the coming years demand a shift to e-core analysis. Operations on deepwater drilling rigs average higher expenses than conventional offshore or onshore operations. This translates into a higher overall cost to halt operations and take the time to extract conventional core samples. E-core provides the same information by doing analysis on samples that can be obtained without cutting a core, and this represents considerable financial savings.

The possible application of e-core analysis also extends to the future of unconventional reservoirs, with the necessity for a profound understanding of the different shale rock characteristics along the diverse geology of the country. Conventional core analysis of shale samples would be extremely time consuming and costly, resulting in questionable conclusions due to their zero permeability feature. Instead, e-core technology microscopically recreates the internal structure of a shale sample and enables its analysis even at extremely low permeability values in a shorter time and with better precision.

While e-core analysis is not a replacement for conventional core analysis, both technologies complement each other to better typify rock characteristics within reservoirs for a more refined understanding.

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MAXCOR® LARGE-DIAMETER ROTARY SIDEWALL CORING TECHNOLOGY

Core analysis is an essential part of understanding the geophysical and geochemical characteristics of an oil or gas reservoir. By acquiring and studying rock samples from reservoirs, operators are able to accurately understand the porosity and permeability levels in a well, and have better insight and understanding of the challenges and complications they will face, as well as the strategies they will need to apply to successfully extract the hydrocarbons in place.

Core samples are cylinder shaped rocks taken from the side of drilled oil or gas wells and are usually dissected into multiple samples. In order to successfully acquire oil and gas reservoir core samples, drilling must halt at the top of the subsurface of the reservoir, and the drilling bit must be removed and replaced with a rotary coring bit that is usually composed of diamond, solid metal or tungsten. Unlike the drilling bit, the rotary coring bit has a hollow center called the core barrel, where the core is stored. After the core sample has been acquired, the rotary coring bit is retrieved and the drilling bit installed for drilling to resume. Following recovery of the core sample, it is analyzed in order to understand the porosity and permeability of the rock, but also to uncover the fluid saturation and grain density in order to better understand the conditions of a specific well and the potential productivity levels it may have.

Baker Hughes' MaxCOR® Large-diameter Rotary Sidewall Coring Technology offers the fastest, most efficient technology for acquiring high-quality 1.5" (3.8 cm) core samples that enable accurate reservoir evaluation and ultimately maximized hydrocarbon recovery. This new technology, which was commercialized in 2011, has a large-diameter rotary sidewall coring tool that can tolerate high-pressure and high-temperature environments, and has the capacity to acquire three times more volume in around the same amount of rig time it takes to deploy standard 1in (2.54cm) rotary sidewall coring tools. Additionally, these larger core samples also give operators the ability to more accurately analyze reservoirs and optimize the hydrocarbon recovery rate of reservoirs since the MaxCOR® sidewall coring service is able to obtain 60 samples in a single run, and operate at up to 25,000 psi and at temperatures of up to 204°C, which are the highest temperature and pressure ratings in the industry according to Baker Hughes. Moreover, this new technology does not only offer more volume in the same amount of rig time, it also offers amore accurate measurement of vital reservoir characteristics such as porosity, permeability and geomechanical properties.

Even though there are multiple options available for core analysis services in the market, according to Baker Hughes MaxCOR® is the only coring technology that has the ability to offer core analyses services after a well has been drilled or is being drilled. Most coring services require the drilling to stop at the top of the subsurface of the reservoir, but this technology has a direct-drive electric motor in place of a traditional hydraulic motor to power the bit, providing maximum power transfer efficiency under all load and borehole temperature conditions, which increases the rotational speed of the bit and radically reduces coring time.

In addition to its applications in conventional oil and gas reservoirs, MaxCOR® Large-diameter Rotary Sidewall Coring Technology also has a proven ability to function in unconventional reservoirs, such as shale plays, and in deepwater wells. In Brazil, Baker Hughes has recovered 94 offshore cores with 100% core recovery efficiency, and in a secondary exploration region, the company claims to have successfully acquired 54 cores with a 30-core tube configuration. Even though these were the first successful large-diameter sidewall core field tests in deepwater, the company is extremely certain of its deepwater capabilities.

"MaxCOR® technology has been used successfully in a number of US shale reservoirs, including the Barnett and the Eagle Ford shale basins," says Luis Moncada, Vice President of Baker Hughes' Mexico Geomarket. "This service is invaluable for providing the high-quality core samples operators need to more accurately characterize complex deepwater and shale reservoirs."

IMPLEMENTING IMPROVED OIL RECOVERY

NANSEN G. SALERI
Chief Executive Officer and President at QRI

Q: How do the geology and the historical production in Mexico compare to other oil-producing countries?

A: Across the entire planet, both in the oil and gas industry and in other industries, technology is driving transformation. New ways of approaching challenges are becoming the norm, and this has substantial consequences for the oil and gas industry. I can think of no better example of this than the oil and gas renaissance that is currently taking place in the US. This did not happen because of politics or legislation: the turnaround was a direct consequence of the technology revolution. In the past, energy independence was not considered to be a possibility for the US, but today it is a big part of the American energy discussion. The same thing can and will happen in Mexico, and Pemex will drive this evolution.

Q: How effectively has Pemex used new technologies for enhanced oil recovery (EOR) over the decade since Cantarell began its decline?

A: A new phase in Pemex's development has already begun. For the first time in the last decade, Pemex has nearly stabilized production at around 2.5 million b/d. If structured properly, and supported by appropriate investments and technologies focused on human management support initiatives, the company can target a much higher production figure of around 3 million b/d over the coming years.

The selection, application, follow-up and due diligence of technology applications is not a trivial matter. This is where organizational capabilities come in, and operators must have the right structure and organization, relationships and knowledge management. It is not just about the right investment level, but also about planning this investment well. Pemex is just entering that phase. I give the NOC very high marks for the initiatives and direction it has embarked on so far.

EOR is part of a much larger portfolio that I call IOR (improved oil recovery). EOR deals specifically with the displacement efficiency of a reservoir, which is only one small part of IOR, which includes horizontal wells, new-generation multilateral wells, and maximum reservoir contact (MRC) wells, something that I introduced at Saudi Aramco, which are typically 10km structures within the reservoir. Computer technology has also driven rapid development of IOR techniques, and an incredible amount of intelligence has been brought to the design of wells, facilities, and the exploitation of oil as a result. Wells today are no longer the inanimate objects they once were: they have automatic controls, automatic shutdowns, and the ability to separate different fluids.

Q: To what extent can the use of IOR solutions be applied dynamically? How much planning is required?

A: The best approach is a mix of both: operators can plan ahead, but they also need to make decisions on a day-by-day basis. This is exactly what is happening at both Cantarell and Ku-Maloob-Zaap today. Also, there are a number of new techniques and extraction methods being developed that will require customized analysis and planning before they can be applied elsewhere. Mexico does not have homogeneous geology, so technologies have to be evaluated for their applicability at each reservoir.

Q: What are your perspectives on the production potential of Chicontepec?

A: Chicontepec by itself is a huge prize because of its size and the need for a new way of thinking regarding its exploitation. One of the first challenges of Mexico and its oil and gas institutions, beginning with its research and technology centers, is to first determine the size of the prize, because Pemex has to know this to be able to plan the amount of investment and where to focus it. That in itself is a challenge, and it is very important for future generations.

The geology of Chicontepec straddles the line between conventional and unconventional, and therefore some of the technological miracles that have been witnessed in the US with shale gas development cannot be directly imported to the region. Each technology and technique needs to be assessed on an individual basis. This is the dilemma that Pemex is facing. Based on QRI's experience with unconventional resources in other parts of the world, we would recommend a front-loaded knowledge

management generation program, while continuing to incrementally increase production. Once the knowledge management component of the program is completed, or at least 80% achieved, Pemex could accelerate production, because this knowledge makes any development program much less risky. An ambitious drilling program today would most likely result in a higher chance of failure than success. The alternative to this is to continue drilling at a modest pace in areas where there is a lot of knowledge and control, and risk is minimized. At the same time Pemex could embark on data management and analysis in a very heavily loaded diagnostics phase, once the key aspects such as well design optimization have been worked out.

Today the code has not been broken that will unlock production at Chicontepec. It will be broken: 100 years from now, when people look back, they will say that in 2012, Pemex was still struggling, but the breakthrough came soon afterwards. Right now, it is within striking distance, but it requires very focused effort. It is only a matter of time until Pemex finds the best ways of extracting oil there. Once that happens, we can have a massive capital investment program, which could lead to production of 500,000-700,000 b/d or even higher. This same philosophy can be applied to all of Pemex's current challenges. The secret to increasing the country's daily oil production can be seen as one huge risk management exercise. The key to the success of this exercise is good management.

Q: How do you strike the balance with companies like Pemex, which have contrasting priorities between increasing production and adding reserves?

A: These management decisions are challenges for every oil company around the world. Exxon, for example, is sitting on a diminishing reserves base. How much do you invest in the future, which is not going to bring a return to investors right now, and how much do you invest in the present? This problem is even more magnified in the case of Pemex, where the pressures to increase production are very well understood; they are not exaggerated at all, and the NOC has no choice but to work towards this goal. The answer is almost obvious: these oil companies have to find the right balance between these two activities.

RCAA IMPROVES AKAL'S PRODUCTION PROFILE

For the last three years, QRI has been working with Pemex on its Akal asset, helping to develop a plan to maximize the remaining production at the main field of Cantarell. Andrés Brügmann, QRI's Business Development Manager for Latin America, explains the opportunities that improving overall recovery factors at mature fields can bring to operators: "QRI believes that with the proper investment, Pemex has the potential to reach a 50-60% recovery factor at Cantarell and Ku-Maloob-Zaap, which would mean almost doubling the initially anticipated production over the entire lifecycle of the fields. We still think that there is a lot of potential in mature reservoirs in Mexico's shallow waters." Brügmann goes on to explain that this potential is not only for further production, but that it also represents an opportunity to increase a return on investment. "If you measure the return on deepwater projects compared to shallow water projects, or secondary oil recovery projects like water flux, there is no match for the return you get on a project like Cantarell or Ku-Maloob-Zaap. It still makes sense for Pemex to concentrate on its shallow water assets."

The work that QRI has been conducting at Akal is based on the company's RCAA approach – Reservoir Competency Asymmetric Assessment. Brugmann explains that "this is a process that involves looking deeply at the projects and assets, assessing them based on their technical profiles and complexities. We believe that each field is unique, and it is our aim to profile the DNA' of each field that we work on, in order to understand the best way to exploit it. This has led to global benchmarking of reservoirs and fields, and this experience helps us on every project we work on."

Through an RCAA analysis of Akal, QRI was able to suggest new technologies to be employed at the field in order to boost production. Brügmann explains that the declining production at Akal has been slowed through the use of top-of-the-line horizontal wells, and by utilizing intelligent well completions in order to gain more contact with the reservoir and achieve a more stable production. "The RCAA method helps us to understand the different processes and initiatives being utilized on a project, and then select the best production approach and technological solutions for the reservoir. We look at the way these different technologies react to each other, and what will happen as the project develops and time passes. By combining this with an understanding of the DNA of the reservoir, we can infer which strategies should be accelerated, which technologies should be introduced, and which technologies should be abandoned to optimize the production profile."

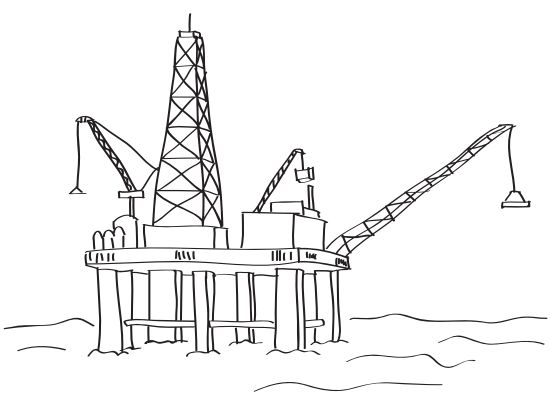
CUSTOMIZED WELL INTERVENTION SOLUTIONS

When Welltec was created in the 1990s, the company offered a well intervention solution called Well Tractor, which, according to Reinaldo Maldonado, the company's Vice President for Latin America, revolutionized the well intervention business. However, in 2003 the product was improved and modernized, allowing Welltec to replace traditional technologies used at conventional wells with more reliable and efficient technologies across the Latin American oil and gas markets.

Welltec has been so successful in Latin American markets not only because of its experience working with NOCs and implementing its Well Conveyance and Well Intervention solutions, but also because it offers a service that is customized to the specific needs of its clients. "One of our competitive advantages is that we do not simply create technology and find clients that are interested in it; rather, we focus on analyzing our clients' needs, adapting our technology to offer customized solutions," Maldonando says.

Welltec began working for Pemex focusing on well maintenance, but with time the company has been able to offer a wider range of technologies and services. "We have recently developed, in conjunction with Pemex, a new well intervention technology that has replaced flexible pipelines and allowed Pemex to optimize offshore well operation times, which represents a large return on investment," explains Maldonando. By following this strategy of replacing conventional technologies, such as flexible pipelines, with simpler, cheaper, more efficient, reliable technologies, Maldonado believes the company will be able to compete in a crowded and competitive market. "Welltec will continue to grow inorganically, independently of the organic growth of the market, because our technologies, regardless of the current state of the industry, will always be needed because of their adaptability and proven success," he emphasizes.

While Welltec is an international company with over 900 employees, it is not the only company able to offer well intervention solutions to Pemex and other Latin American oil companies. However, Maldonado believes Welltec's size – which he considers to be small to medium – offers a great competitive advantage because when companies acquire other companies and grow too fast they may become so large and rigid that they lose their ability to respond to time-sensitive issues. "In an industry such as the oil industry, reaction speed and awareness to various issues is a key aspect of success; therefore, due to our size and ability to adapt accordingly, we are able to deliver customized and timely services to our clients throughout the world," he adds.



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SLOTTED LINER APPLICATIONS FOR PRODUCTION OPTIMIZATION

Designed primarily for sand control, but with several other uses, slotted liner is a fairly well established and low cost oil and gas technology for open-hole well completion. It serves as an alternative to pre-holed or pre-drilled liner, where sand flowing into the well can often cause production difficulties. There are two main alternative sand control technologies currently being used by operators around the world: gravel packs and sand screens. However, as John Bilsland, Director General of Regent Energy Group Mexico explains, "on one hand, the gravel pack is often a less exact solution when it comes to sand control. On the other hand, sand screens are effective, but the cost of placing them in long sections of horizontal pipe is often prohibitive."

In some ways, slotted liner works in a very similar way to gravel pack solutions: a natural barrier is created that stops sand from flowing into the well. Regent Energy Group produces a liner for this purpose that has very fine slots - ranging in thickness from that of a sheet of paper to around 6 millimetres and with an approximate length of 4 centimetres - depending on data received from the customer regarding the formation they are drilling in and the granule size of the sand in the formation where the liner is to be inserted.

The slots are cut longitudinally in the pipe, and as oil flows through the slot, it carries sand with it. This sand is stopped in the slot, where it forms a natural bridge, and acts as a filter for fine sediment, which results in cleaner oil flowing into the liner. "Slotted liner provides you with a better grade of oil, as well as fewer processes at the surface to get rid of the sand, and the resulting crude is a lot easier on your surface equipment because you are not bringing up abrasive sand with your oil," Bilsland asserts. This works best when the slots in the liner are seamed: after slots have been cut in the pipe, they are transversally rolled at a given pressure, which forces the top of the slot to close slightly, forming a slot with V-shaped sides, with the wide end of the V facing into the liner. As sand comes into this slot, it stops at the top, where the gap is narrower. This shape is also intended to make blockages in the slots much less likely to occur: the V-shape means that the built up blockage can easily flow out of the slot.

Bilsland explains that there are additional applications for slotted liner. As well as being used for sand control, the liners can also be utilized for steam injection, a key tool in producing heavy oil. Vacuum insulated tubing allows operators to maintain a high steam temperature all the way down into the well and to the slotted liner, where it is then distributed throughout the well via the slots. "Often, if steam has not been run through vacuum insulated tubing, it has turned to water by the time it gets to the end of a horizontal well. Hot water injection does have some value, but it is nothing compared to applying steam," says Bilsland. Regent also has tools to ensure that distribution of steam is constant throughout the well, rather than having poor distribution of steam towards the toe of the well.

"If steam has not been run through vacuum insulated tubing, it has turned to water by the time it gets to the end of a horizontal well. Hot water injection does have some value, but it is nothing compared to applying steam"

Another application for slotted liner, currently being tested in a pilot project, is water injection in marine environments. "Slotted liner allows for water injection throughout the formation, while being able to manage the pressure of the water being injected," Bilsland details. The company is also investigating applications for slotted liner in coalbed methane and shale gas production.

Whilst slotted liner has been used for some years in countries like Canada, Colombia and Venezuela, its introduction in Mexico is a fairly recent event. Because Pemex is now tackling the challenge of heavy oil in fields like Samaria, steam injection is being used increasingly, and slotted liner is increasingly being applied to the NOC's heavy oil extraction projects. Pemex also has to deal with sand control issues at some wells, according to Bilsland, which means that the potential demand for the company's liner is growing. Regent Energy is also finding work with private sector service providers and integrated service contract winners.

Another area where the company has seen some early success in Mexico is working with Pemex on well recompletions. A pilot test at a well that was recompleted with Regent technology has seen great production improvements, and according to Bilsland, Pemex was extremely happy with the results. It seems that, given the multiple applications for slotted liner and the NOC's receptiveness to it, this technology is destined to gain increasingly widespread acceptance in the coming years.

BUILDING BLOCKS FOR GROWTH

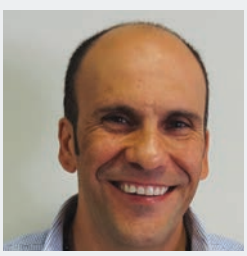
"Through modular production facilities, we are able to adjust the production capacity in accordance with the potential of the well, by adding or removing modules as required"

Bolívar Araujo, CEO of Sertecpet in Mexico

Ecuador produced about 500,000 b/d during 2012, leaving substantial potential for future production increases considering that the southern Amazon region has not been explored yet. For 2013, a 10% increase in production is expected. Fueled by its growing oil and gas industry, Ecuador has been able to develop a number of companies offering high quality products and services that allow them to compete in the global market, where major multinational companies have been operating for longer periods of time. According to Bolívar Araujo, CEO of Sertecpet in Mexico, this is one of the reasons why Ecuador is nowadays exporting its technology to Mexico. "Even though Ecuador is a small country compared to Mexico, it is very important in terms of technological development in the oil and gas industry," Araujo says.

Now based in Villahermosa, Tabasco, Sertecpet first came to Mexico in 2005, but it was not until 2011 that the company got its first contract with Pemex. "We signed a general agreement on September 24, 2011 and a specific contract with the southern region a month later," describes Araujo. "With this contract, Sertecpet implemented six Jet Claw Pump System in the Muspac field. When the results of the operation were presented, the asset managers of the Cinco Presidentes field also requested five Jet Claw Pump Systems. We believe that opportunities will continue to grow in Mexico with the NOC's aggressive drilling strategy to achieve oil production targets," Araujo explains. Expecting tentative opportunities in Pánuco, Magallanes, Santuario, and Chicontepec in the future, Sertecpet continues to prepare by adjusting itself to the Mexican way of working. "Mexico is different from other Latin American countries," Araujo says. "Those differences merit that the company's future plans include bringing the whole operation to Mexico. Currently, we are manufacturing additional equipment for future operations locally; some components are made in Tultitlán, Querétaro, and Mexico City. By providing the design details and plans, we commit to a strategic partnership with Mexican companies for the manufacturing process."

SMART WELL TESTING



Horacio Ferreira, General Manager of Surpetrol

In a country like Mexico, where Pemex requires that any new technology to be introduced to the oil and gas industry must be tested on Mexican soil before it can be implemented, well testing is a key service. As Horacio Ferreira, the company's General Manager explains that work with Pemex began in its South Region, and has since expanded to cover onshore, offshore and subsea work. "We feel that we have many opportunities in Mexico since reservoir management and production optimization are high priorities at many fields. Well testing plays a key role in these two areas, since we have the tools to measure the effectiveness of new techniques, technologies and strategies."

"We are very proud of the fact that we consider ourselves a world leader in well testing, thanks to the non-conventional multiphase meters we use in partnership with a Norwegian company," Ferreira explains. Having built a service plan around the technology, Surpetrol presented the package to Pemex, and the two companies have been working together ever since. "The combination of our value-adding service and its ability to lower production costs, along with the demands on Pemex from the CNH to carry out more well and production monitoring, meant that our business had an excellent opportunity to grow."

Since the start of operations in Mexico in 2012, Surpetrol has carried out over 50,000 well tests. The wealth of knowledge that the company has gathered during its time working with Pemex has allowed the company to grow its list of services beyond well testing, as Ferreira explains. "Information on well productivity is key data needed to develop a production plan, or to understand the opportunities and limitations of a particular field. We gather this information on a large scale for Pemex, and following the interpretation of this data we can offer advice

This is just the beginning for Sertecpet, since the company intends to stay in the country. "The stakeholders' philosophy is to invest in Mexico and create local jobs," Araujo reveals. "Currently, 85% of our associates are of Mexican origin and are being trained to operate our hydraulic pump system, which is slightly different from traditional pneumatic pump systems that have been used here in the past. As business opportunities continue to grow, so will Sertecpet. We're looking at the possibility of building a plant in Mexico."

INTRODUCING INNOVATION

"We are introducing an innovation to our Jet Claw Pumps, which is currently being tested in field operations back in Ecuador," Araujo details. "In recent years, in order to extract data from the wells while carrying out completion operations, the pump had to be removed from the well to download data from the sensors for evaluation. With this innovation, electronic sensors can extract data while the pump is in operation, and transmit it to our software, allowing field managers to access information on a real-time basis."

The importance of this innovation is that it saves time during the operation: while the pump continues to perform artificial lifting tasks, the field manager can analyze reservoir behavior and make decisions faster. "Data such as permeability and pressure, besides the possible damage that the well might have suffered during the operation, are available for decision-makers to react quickly." While this system continues to be tested in Ecuador, Araujo believes it will not be long before Mexico can start reaping its benefits.

MODULAR DEVELOPMENT

Another growth area for Sertecpet in Mexico is modular production systems. The company wants to bring the expertise acquired during their implementation in Colombia, Ecuador and Peru, in order to facilitate early production in the Mexican market. "We believe that proper planning can produce significant savings at different production stages in Pemex's South Region," Araujo says. "Sometimes, the information of a reservoir's potential is not accurate – due to additional discoveries or miscalculations. When this happens, there is a huge possibility of building oversized or undersized production facilities." This represents an additional cost to the NOC and engineering companies. "Therefore, through modular production facilities, we are able to adjust the production capacity in accordance with the potential of the well, by adding or removing modules as required."

OPERATOR AMBITIONS

The next stage of growth for Sertecpet in Mexico will include entering the exploration and production market, as the company has already acquired the competencies and experience to do so. "In Ecuador, Sertecpet started as a service provider, and now operates different fields," Araujo comments. "Once we fully position ourselves in Mexico, with patented technologies such as hydraulic pumps and modular production systems, and thanks to the opportunities that Pemex has given us, the next step will be to become operators in the country. We have already bid in Carrizo, and we will actively participate in the next round of ISCs."

on how to increase productivity at its fields. By focusing on reservoir management and production optimization, companies like Pemex can start to maximize the value of its operations."

One opportunity for Surpetrol came at Pemex's Chicontepec region, where the company was providing well testing services. After understanding the productivity challenges at the field, Surpetrol suggested a new type of artificial lift to increase production: "Progressive cavity pumps are used in many fields around the world where heavy oil needs to be extracted, but this technology had never been tested in Mexico. We made an alliance with the industry leader in progressive cavity pumps, and brought the technology to Mexico to be introduced at Chicontepec," Ferreira reveals.

At Samaria-Luna, Pemex is working to develop new heavy oil areas, which will bring additional opportunities for technology introduction for Surpetrol. "We are currently in the process of carrying out well tests for Pemex at the field, and we hope that there will be opportunities in the future to implement technologies designed to optimize production of heavy oil, such as cyclic steam injection, also known as Huff and Puff." Ferreira explains that Surpetrol is the only company with the equipment to conduct well tests at wells that are utilizing steam injection technologies, as the temperatures are too high for conventional testing equipment to be effective. "There has been some interest from the companies providing steam injection technology to Pemex to cooperate on pilot projects, in order to offer integrated solutions to the NOC that can add more value than just presenting the technologies independently," he says.

With expertise in Pemex's Southern region, Surpetrol hopes that the introduction of integrated service contracts will present an opportunity to win more business in Mexico. Indeed, the company has already worked with Petrofac at Santuario and Magallanes, blocks awarded during the first round of ISCs, to provide well testing services. "We also hope to work with Grupo Diavaz at its Ébano-Pánuco project, because it is a mature field where production optimization will be a priority and well testing services will definitely be required. We also hope that technology such as progressive cavity pumps can be brought to the project in the longer term," Ferreira explains.

EQUIFLOW AUTONOMOUS INFLOW CONTROL DEVICES

Halliburton acquired the Norwegian company Easy Well Solutions AS in 2005 with the goal of further developing one of its abandoned, but innovative technologies: the Inflow Control Device (ICD). Even though the Norwegian company had the basic idea and concept of the technology, the device created by Halliburton in 2012 was drastically different from the original model.

The creation of the Equiflow Autonomous Inflow Control Device (AICD) took two and half years to create because of various complications and unforeseen events. The first design of this technology was extremely expensive and too large – about 5 inches (12.7cm) in diameter and 2 feet (60.96cm) long – while the final version is smaller than the size of a credit card – 1/8th of an inch (3.175mm) thick and 2 inches by 1 1/4 inches (5.08cm x 3.175cm) in diameter. Furthermore, the final version, which won an Offshore Technology Conference Spotlight on New Technology award in 2012, does not have any moving parts and ultimately gives operators the ability to ease production by delaying water and gas breakthrough, reducing water and gas production after breakthrough, and increasing recovery from the well.

Since water and gas are detrimental to oil production and they take up room in the pipe, the EquiFlow AICD uses state-of-the-art technology to identify what specific liquids are travelling through a pipeline. This is achieved because the EquiFlow AICD uses an engineering system that controls the flow of fluids through three dynamic fluid components: a viscosity selector, a flow switch, and a flow restrictor. In order to send the right fluids through the correct flow path, the viscosity selector utilizes a system that detects fluid viscosity, density, and velocity, identifies the fluid or fluids flowing through the Equiflow AICD, and then divides the total flow among two flow paths. After the fluids are divided into the different flow paths depending on their properties, the flow restrictor comes into play by limiting the flow of unwanted gas and water into the wellbore, while providing little restriction to the production of oil.

Halliburton states that the EquiFlow AICD is designed to be a simple, reliable, and cost-effective solution to the limitations of passive inflow control that maximizes reservoir performance, minimizes undesired fluid production, and increases reliability through design simplicity. The first EquiFlow AICD was installed at an offshore platform in Mexico last summer. It has been so successful not only because the device maximizes the ultimate recovery factor of fields, but also because it increases reliability through design simplicity, reduces undesired fluid production, helps reduce cost and risk associated with unwanted fluid production, and helps delay the onset of unwanted water or gas production. The EquiFlow AICD is capable of achieving all these benefits for operators because it functions autonomously, it contains no moving parts, electronics, or connections to the surface, requires no intervention and no downhole orientation, will cease flow restriction if unwanted fluid recedes, utilizes innovative dynamic fluid technology to direct flow, functions as a standard ICD prior to water/gas breakthrough, and each device works independently for precise response to the reservoir.

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WIDENING RANGE OF CHEMICAL SOLUTIONS

ALAN MICHAAN
General Manager of Alquímicos de México

Q: Alquímicos is present in many different segments of the oil and gas value chain. Which advantages does this business model offer?

A: Alquímicos has moved away from the traditional distribution model and focused on being an oil and gas supplier that works at the product level, service level, and solution level. This is something that no one else is doing in the region, and based on the meetings I have had in Houston, it seems like no one is doing it in parts of the US either.

Most chemical distributors and suppliers focus on a few niches in the oil and gas industry, such as mud chemicals, cementing, fracking and well stimulation, and downstream products. Alquímicos along with GTM, our holding company, are putting together a full range of products and services that range from drilling to refining and everything in between.

Q: How has this approach been received by the oil and gas industry?

A: Our division is only six years old, but it has been so successful that our customers have asked us to open offices in other countries, such as Brazil. The first step was to scale up the operation with volume driven commodities – such as barite, cement, and frack sand – which created the scale that allowed us in turn to create value for our customers, our suppliers, and for ourselves. We then started to add other products, that have a higher degree of specialization, such as barite for mud, and then xanthan gum. This was an easy way to create value by using existing products to introduce new ones to customers.

We also realized that we needed to have a certain distribution service level in order to succeed in the oil and gas market. Distribution of chemicals in other industries is generally a 9-5, Monday-Friday job, but not in this particular sector: delivery times need to be short and products need to be available all day, every day. Therefore, we had to move out of our comfort zone and transform ourselves into an oil and gas distributor. This meant creating logistics bases that are open 24/7, and are located close to the areas where our products are needed. Our strategy was very successfully launged in Ecuador, Colombia, Peru, and Mexico, and we now offer the same service in Argentina and Brazil. The next step is having a complete product portfolio while maintaining the balance between having a full inventory for each base without overstocking the products that will not be used.

Q: What is the smart way to manage this inventory?

A: In Mexico, we look at trends, from shale gas in the north, to current and future investment levels at Chicontepec, to deepwater and well stimulation. We go field-by-field and region-by-region assessing the trends. Obviously it would be impossible to cover all the markets in each region. In order to be successful as a young division we must learn to choose our battles.

Q: What difference does it make that you can develop your business strategy and plan your inventories on a regional basis?

A: It creates scale, which is important. There is a big difference between buying 1,000 tonnes of a product and being able to negotiate for 10,000 tonnes to distribute across Latin America. We budget on a country level first, but for key products for the oil and gas industry we centralize the negotiations. We also have support from the group, because some of the products used in the oil and gas industry have shared applications with other industries that we serve. Finally, we can often use our inventories in one country to fill the gaps in the supply to other countries. In emergencies, moving products within the region is much more efficient than importing from elsewhere.

Alquímicos de México is the division of Grupo Transmerquim (GTM) that caters to the oil and gas industry. GTM is a leading distributor of chemical raw materials and related logistical services that caters to a number of different industries. The company maintains a network of distribution and logistical infrastructure in 35 locations and 14 countries throughout Latin America, as well as supply offices in the US and China.

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MEXICO
OIL & GAS REVIEW

CHEMICAL SOLUTIONS TO BOOST PRODUCTION

REGINA OLIVEIRA
Latin America Commercial Director at Dow Oil & Gas

Q: Where do you see the best opportunities for the introduction of Dow's upstream solutions in Mexico?

A: Dow Oil & Gas has solutions for the whole industry value chain – products for exploration, production, refining, and processing: from the well to the gas station. Our focus in Mexico continues to be refining, processing and production. While we are committed to maintaining Dow's well established position in the downstream market, we are striving to expand our presence in the upstream segment of the industry.

The key to our growth in 2013 will be production, where we have been focusing for the last two years. With a new president in power and a new CEO of Pemex, we see a renewed energy for the development of the sector. Although we know there will be big opportunities in the long-term in new areas like shale gas and deepwater, we are focusing on the challenges that we can help to address today, and increasing productivity is certainly at the top of that list for Pemex. Dow recently introduced a new product line dedicated to optimizing production: a new generation demulsifier. Traditionally demulsifiers have been very complex chemicals that help to separate oil from water. Our new product line simplifies the chemical process required to select the ideal demulsifier to be used in crude oil treatment. After introducing the product in southern Latin America, we are now looking at opportunities in the north of the region, especially in Mexico, Colombia and Venezuela. Given the profile of many of Pemex's wells, we believe the solution to be extremely interesting for the NOC.

Q: How does this new generation demulsifier work?

A: Water needs to be extracted from crude oil before it can be transported and exported in accordance to local requirements; which usually 1% or less water in the total final volume. Demulsifiers are chemicals used to effectively separate the water contained in the crude oil. It acts on the water and oil interface breaking down the stability of the water in oil emulsion, and also providing a fast water separation. In some places, produced oil may contain as much as 90% water; in other places, the oil may have very low water content. It all depends on the age and location of the well, but at Pemex demulsifiers are widely used.

Q: What is your strategy to introduce the product in Mexico?

A: As opposed to the downstream area, where Dow Oil & Gas sells its products directly to Pemex, our upstream business sells to both international and domestic service providers. We offer global solutions, but we are sensitive to the needs of the local market. One of the ways we achieve this is by working closely with the end user, in this case Pemex, to better understand the chemical products they require, and using this to tailor the portfolio we offer to the service companies. In Mexico, Argentina, and Colombia, we have developed new products specifically for local challenges.

Q: Over the coming decade Pemex's production profile will experience substantial change. How are you preparing for this?

A: Deepwater and shale gas will drive the most important changes in the Mexican oil and gas market, and Pemex's production profile. We have many products in our portfolio to help companies improve production and productivity from unconventional resources. In deepwater, we have been providing Petrobras with a flow assurance solution that stabilizes temperatures and as a result guarantees that oil produced at deepwater assets can flow from the seabed to the platform. We know that Pemex has been in discussions with Petrobras in recent months and we hope that we will also be able to introduce our flow assurance technology in Mexico as soon as deepwater investment ramps up.

Q: What are the biggest challenges that DOW Oil & Gas has to overcome in Mexico over the next few years?

A: The biggest challenge will be to meet Pemex's need to provide better production and productivity solutions. With a new CEO, and a new direction for the company, we hope our participation in the sector will only increase. We are very keen on the idea of one day conducting joint projects with Pemex, but this is something that will have to wait. In the meantime, we are working with Pemex and the private sector, conducting seminaries to introduce new solutions that we are working on in the US and locally, in order to expose Mexican engineers to our new products and technologies.

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GAS, DIESEL AND BI-FUEL GENERATORS

In November 2012, Generac, one of the leading electricity generator companies in the world, purchased Ottomotores' UK, Brazilian and Mexican businesses for US$46.5 million in cash. With its new owner, both Ottomotores' product portfolio and its ability to launch products into the market have grown. Therefore, the company's expansion plans for this year are aggressive. In 2013, Ottomotores is planning to grow by capitalizing on the enlargement of its product portfolio, thus offering products that currently are not being commercialized in Mexico, such as lighting towers and gas-fed equipment that use either natural or propane gas to generate electricity for residential, commercial or industrial applications.

Ottomotores' access to capital for investment and product development has also increased greatly as a result of Generac's purchase. "Generac is financed by a large group with a large amount of capital for investment. Now that we are part of a larger platform, we are introducing new product lines, we are physically growing with new facilities, and we are investing in people, which are the most important resource for Ottomotores," says Francisco Haro Martínez, General Director of Ottomotores. To this end, the company is designing a training center for employees and customers that will operate at an international level, with the combined aim of developing Ottomotores' human capital and generating clear and direct communication with its clients. "Nowadays, a Generac distributor has to go to Wisconsin to get training, and the information he or she receives is entirely in English. We are bringing that training center to Mexico instead. This will support our expansion strategy, since it will allow us to speak the same language as our customers and supply them with the latest technology without any language or distance barriers," explains Haro Martínez.

The company's focus on training its personnel and providing quality service to its clients will only intensify with its increased capabilities. "I believe that an electric generator is like insurance: you hope to never have to use it, but if you need one then it is better to have it," states Haro Martínez. Appropriate maintenance is crucial to ensure that a generator is ready for use at any time. For this reason, Ottomotores has a fleet of engineers that provide preventive and corrective service to all machines. Now, the company can supply and upkeep generators of up to 3000KW, thus expanding its horizon on the industrial sector.

Ottomotores believes that demand for equipment powered entirely by gas will grow in the near future as a result of low natural gas prices and growing demand for cleaner solutions. He also mentions that there is great potential in the bi-fuel generator market because of the various advantages posed by utilizing an electricity source which works with 60% gas and 40% diesel. "For bigger capacity equipment, the bi-fuel system provides industries with the opportunity to have cleaner emissions and alternate fuel usage, as well as widely proven technology that increases the performance and energy output of a generator. The demand for bi-fuel generators exists, but the market is waiting to be educated about this kind of application," asserts Haro Martínez.

"Bi-fuel generators are designed for prime applications, where plants work for six to eight hours per day. They are safe for continuous use because the diesel motor is not modified and the control system for using dual fuels provides the protection and operation commands required for optimal performance and added efficiency," says Haro Martínez, "a very important feature of the bi-fuel system is that, when operating with a combination of gas and diesel there is an immediate response to sudden loads of the diesel motor, thus avoiding power shortages in crucial production stages."

As environmental awareness and regulation increases in Mexico's industrial sector, more projects demand cleaner and more efficient power generation solutions. Ottomotores currently provides equipment in line with both US and European emissions regulations. The company is growing in all of its residential, commercial and industrial markets, but it considers the oil and gas sector to be very important because of its size and the great technical and service needs it has for power generators. Apart from Pemex, Ottomotores' client list includes Ecopetrol and Petrominerales from Colombia, as well as PDVSA from Venezuela, to which the company sells large quantities of equipment and provides service and maintenance.

Ottomotores is a specialized manufacturer of diesel power generation plants that operates three manufacturing plants in Mexico City where generators ranging from 15kW to 2,500kW are assembled. The company is focused on solving backup electric power demands of its clients, and manufactures and distributes the following brands: Dale Power Solutions, Dawson & Keith LTD, Munradtech LTD, and Scorpion.

MEXICO'S MAIN FIELDS

KU-MALOOB-ZAAP

Ku-Maloob-Zaap, or KMZ, is composed of three fields, Ku, Maloob, and Zaap, discovered in the Campeche basin in 1980, 1984, and 1991, and has become Mexico's main oil-producing field since the decline of Cantarell. KMZ recorded an average oil production of 855,139 b/d in 2012 (one-third of the country's total production). With the decline of Ku since 2008 and Zaap reaching its production plateau in 2009, Maloob has become increasingly important to maintain the asset's production growth. KMZ's reserves are estimated at 6.49 billion barrels of crude and 2.24 tcf of gas, and production is expected to decline by 2017. Pemex is aiming to maintain constant production around 850,000 b/d in years to come.

CANTARELL

Located 70km off the coast of Campeche, Cantarell began producing heavy oil in 1979, and was Mexico's main producing field until 2009. In 2003, Cantarell peaked with average production of 2.21 million b/d, and has been declining ever since. The field yielded a daily average of 454,107 b/d in 2012, which accounted for 17.8% of the country's total oil production. This represents a 9.5% decrease from 2011. Its gas production averaged 1 bcf/d, which accounted for 15.7% of the country's total production, but marking a 6.7% decline from 2011. The asset still holds 5.04 billion barrels of crude and 2.19 tcf of gas in 3P reserves.

ABKATÚN-POL-CHUC

Located in the Campeche basin, the Abkatún-Pol-Chuc asset started production in 1980. Considered a set of mature fields, production in the asset is water-driven, so water injection techniques are being used to extract hydrocarbons from the estimated 1.24 billion barrels of crude and 2.02 tcf of gas in 3P reserves. In 2012, Abkatún-Pol-Chuc yielded 266,248 b/d of super-light oil – ranging from 37°API to 40°API in viscosity and amounting for 10.4% of the country's total production. The asset also produces 523.45 mcf/d of gas, which amount for 8.2% of Mexico's natural gas production.

LITORAL DE TABASCO

Discovered in 1989 in the southwestern area of the Campeche basin, Litoral de Tabasco consists of 11 fields that produce light and super-light oil and condensates with a viscosity of between 30°API and 51°API. The fields in the asset hold 3P reserves of 2.80 billion barrels of oil and 13.98 tcf of gas, and are currently producing at an average of 319,219 b/d, or 12.5% of the country's total oil production, and 735.77 mcf/d, or 11.5% of the country's total gas production.

SAMARIA-LUNA

Located 20km northwest of Villahermosa, Tabasco, the 15 fields of Samaria-Luna have been heavy and extra-heavy oil producers since 1960. During 2012, these fields yielded an average of 205,128 b/d of oil, which represent 8.1% of the country's total oil production, and 695.9 mcf/d of gas, which amount for 10.9% of the country's total natural gas production. The asset is still believed to hold 1.56 billion barrels of oil and 3.88 tcf of gas in 3P reserves.

CHICONTEPEC

Located in northern Veracruz and northeastern Puebla, Chicontepec consists of several unconventional fields that were first discovered in 1926. Following a major discovery in 1973, Chicontepec has grown in importance to the point where today, it is a major target in Pemex's search for production growth. Its 3P reserves stand at 10.71 billion barrels of oil and 27.63 tcf of gas. In 2012, Chicontepec's production average reached 68,557 b/d of oil, or 2.7% of the country's total oil production; gas production average in the basin was 148.8 mcf/d, or 2.3% of the country's total natural gas production.

BELLOTA-JUJO

Located in the southern region of the country, Bellota-Jujo produced an average 130,346 b/d of light oil, which is around 5.1% of the country's total production, and 297.36 mcf/d, or 4.7% of the country's total gas production, during 2012. Probable reserves for the field are estimated at 1.30 billion barrels of crude and 2.34 tcf of gas.

MACUSPANA-MUSPAC

Located near Coatzacoalcos, the Macuspana-Muspac asset began producing light oil in 1972. In 2012, it produced an average of 76,755 b/d, or 3% of the country's total oil production and 542.87 mcf/d, or 8.5% of Mexico's natural gas production. The asset's 3P reserves are estimated at 290 million barrels of crude and 2.3 tcf of gas, which has helped Pemex to maintain a positive outlook on the production future of this complex. Macuspana's facilities were renovated in 2009.

POZA RICA-ALTAMIRA

Discovered in 1926, the Poza Rica-Altamira block consists of 73 producing fields that yield an average of 67,770 b/d of oil, or 2.7% of the country's total oil production, and 119.95 mcf/d of gas, which translate into 1.9% of the country's total natural gas production. Its importance lies in the amount of hydrocarbon reserves still at the asset, which are estimated at 258.7 million barrels of crude and 385.4 bcf gas in 1P reserves, and 919.6 million barrels of oil and 1,509.4 bcf of gas in 3P reserves.

CINCO PRESIDENTES

By optimizing production infrastructure and the discovery of new wells in the past two years, Pemex managed to obtain average production of 95,980 b/d at Cinco Presidentes, or 3.8% of the country's total oil production, and 116.26 mcf/d, or 1.8% of the country's total natural gas production, during 2012. Probable reserves for this Tabasco-based asset are estimated at 333 million barrels of oil and 468 bcf of gas.

BURGOS

Historically the main natural gas producing asset in the country, Burgos is located in northeastern Mexico, in the states of Tamaulipas, Nuevo León, and Coahuila. During 2012, Burgos produced 19.9% of the country's natural gas, with an average production rate of 1.27 bcf/d. It also produces oil, but in trivial quantities, with an average output of 4,771 b/d in 2012, thus accounting for 0.2% of the country's total oil production. 3P reserves at the field are estimated at 8.4 million barrels of crude and 3.79 tcf of gas.

VERACRUZ

The Veracruz asset is one of the prospective areas for shale gas development in the country. Currently producing 3,962 b/d of crude, which barely amounts to 0.2% of total oil production in the country, and 601.34 mcf/d, or 9.4% of total natural gas production, the asset is expected to hold 111.3 million barrels of crude and 809.6 tcf of gas in 3P reserves.

PERDIDO

The main province for deepwater hydrocarbons in Mexico, the Perdido folded belt, is expected to contain up to 13 billion boe in prospective resources. The first major oil discoveries were made last year at Trion and Supremus, adding 482.4 million boe and 98 million boe of 3P reserves. Two more deepwater wells are currently being drilled in the area.

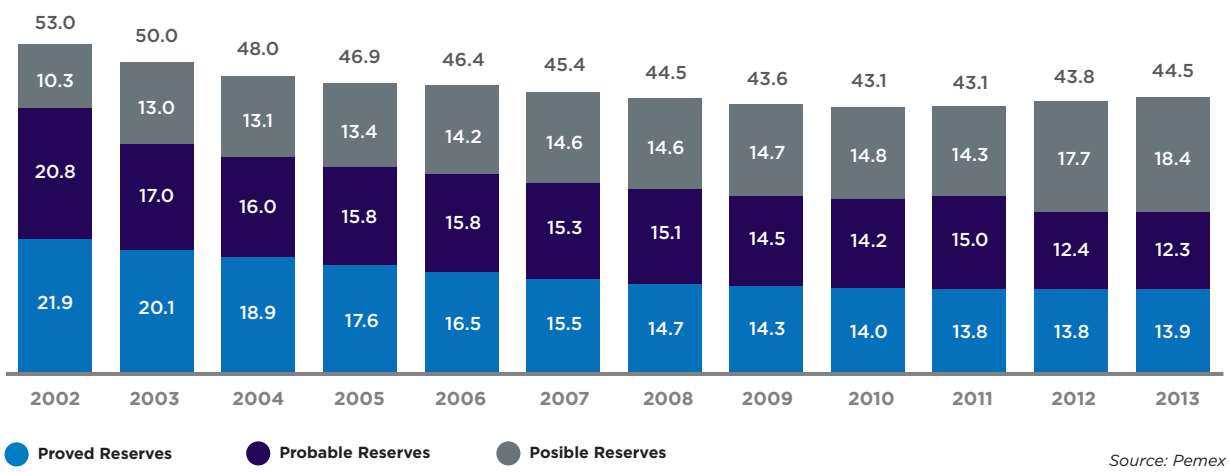
HOLOK-TEMOA

Composed of recent discoveries, Tabscoob, Noxal, Lakach, Labay, Leek, Piklis, Kunah, and Lalail, the Holok-Temoa asset is located at the Catemaco folded belt and has reserves of 1.5-2 bcf of gas, as well as 300-400 million boe of 3P reserves. Lakach is scheduled to become Mexico's first natural gas producing deepwater field by 2015.

AYATSIL-TEKEL

Located 130km northwest of Ciudad del Carmen, near Ku-Maloob-Zaap, the Ayatsil-Tekel complex has total reserves of 1.62 million boe and 1P reserves of 544 million boe. Discovered in 2006, it was labeled as the largest heavy oil discovery of recent times and is slated to start production in 2014, likely peaking at 120,000 b/d production from reservoir at a depth of 3,300-4,240 m.

EVOLUTION OF MEXICO'S RESERVES

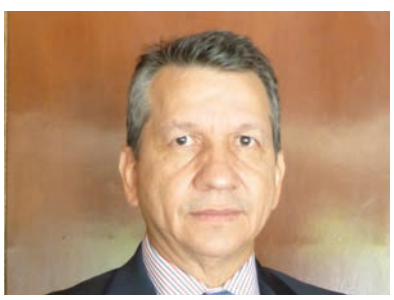


Source: Pemex

DRILLING SPEED IS CRUCIAL

At the beginning of 2012, Key Energy Services was performing 70 well workovers in Chicontepec per month for Pemex; by the end, it was performing around 150. Through the acquisition of an established competitor, the company was able to grow its rig count from 23 to 42 over the course of the year, virtually doubling the size of its operations in Mexico. No less than 36 of these rigs are based in Chicontepec. Key Energy Services has been working with Pemex since 2007, and in addition to well workovers also supplies Pemex with coiled tubing, slickline and wireline services, as well as consulting and project management activities.

Héctor Cabrera Cuellar, Vice President of Latin America Operations at Key Energy Services, believes that the company's main competitive advantage is its operating speed. "We have worked to enhance our drilling and extraction performance, which brings a serious competitive advantage to our operations, lowering the cost per barrel as a result. We have managed to improve drilling performance by 20%, and much of this improvement has come from properly incentivizing our employees. Training and rewarding our personnel is a priority for the company, and engaging with both our employees and their families is crucial in this respect."



"We are planning to expand not only in drilling operations, but also in different areas, such as fluid management, fracking, coiled tubing, and fishing services"

Héctor Cabrera Cuellar, Vice President of Latin America Operations at Key Energy Services

The use of its proprietary KeyView software was another success factor in Key Energy Services' drilling efficiency improvement. This rig data capture system monitors specific operational parameters, thus enabling rig operators to perform their duties better by following optimal procedures. The KeyView software also contributes to worker safety by intervening as soon as the parameters it measures deviate slightly from pre-set limits, preventing errors and accidents.

The company's innovations also contributed to its the success at Chicontepec, where the difficulty posed by the field's geology complicates improving the output per well. By the means of its I am 101 program, the company studies an area provided by Pemex and consequently develops a customized drilling strategy. "As a result, we achieved a production increase of 3,500 b/d after working at Chicontepec for only two months," says Cabrera Cuellar. At Chicontepec, Key Energy Services is also testing a new technology called Torpedo, which is used to stimulate oil flow. "In essence, the Torpedo is a controlled explosion that fractures the rock at the bottom of a well to stimulate the flow of oil. It is similar to a controlled demolition at a building," explains Cabrera Cuellar. "We are also trialing underbalanced drilling in the region, which we believe will increase production because it won't damage oil fields as much as other types of perforations."

Key Energy's expansion has allowed the company to get involved in a growing number of onshore projects, such as Veracruz where the company has started working in multiple fields. Although Pemex is the company's main customer – making up 95% of its business in Mexico – Key Energy Services is also working as a service provider for Schlumberger on its integrated service contracts in Tabasco and Tampico. The company has the ambition to move its well workover services offshore. "What we want to do is transform our current rigs into modular rigs and to install them at existing platforms. In other words, we want to use onshore rigs, modify them, and use them as modular rigs for offshore well workovers," Cabrera Cuellar says. "This is our plan, and although we have not tried it yet ourselves, it is being done in other countries. We are also looking to probably buy or enter into a strategic alliance with a company that is well established in Mexico. We are aiming to start our offshore operations this year."

The company's growth targets for 2013 are no less ambitious than its record from the past year: "We aim to keep growing by increasing our operations in Mexico and expanding into Ecuador, Venezuela, and Colombia. Also, in the next year, we are planning to have at least 500 rigs and 60 work-over rigs. Growing hasn't been difficult, but to sustain that growth is very complicated," says Cabrera Cuellar. "We are planning to expand not only in drilling operations, but also in different areas, such as fluid management, fracking, coiled tubing, and fishing services. There is a lot of room for improvement regarding Pemex's operations, because so many different companies perform a wide array of services to Pemex. We already have ample experience in all of these areas, so I believe that we can improve operations and management by working both with Pemex and its suppliers in these business lines," Cabrera Cuellar reveals.

ROLE OF SERVICE PROVIDERS IN PRODUCTION GROWTH

JUAN MANUEL DELGADO
Director General of Schlumberger Mexico

Q: What will be the role of integrated service providers such as Schlumberger in helping Pemex to minimize time to first oil and manage costs while optimizing production to meet Pemex's objectives?

A: We are here in Mexico with a full portfolio of services to be provided to Pemex. So far, Pemex has given no indication that it would like the current relationship to change; the company is not looking for a partner in the development stage. As a service provider, we will simply have to wait and see what happens, and adapt accordingly. It is Pemex's decision when to use the array of technologies that are available in Mexico.

Schlumberger might partner with Pemex, cooperate with other contractors, or just provide services. At the end of the day, Pemex sets the rules of the game and Schlumberger and other service providers decide to play or not.

Q: What are the most successful technologies that Schlumberger has introduced at Mexico's mature fields to stimulate production?

A: Schlumberger usually provides a set of discrete services to Pemex as part of their larger projects. At mature fields we have contributed a lot in terms of reservoir knowledge; understanding what needs to be done to increase production. As projects have reached the drilling stage, we have brought our global expertise and reduced the number of days it took to drill a well at Burgos from 30 days to seven, and at Chicontepec from 24 days down to four or five days. These contributions were driven by big project management changes that we implemented. For instance, the design of a drilling bit might boost better efficiency at Chicontepec, but that could not happen without improving the hydraulic system.

The biggest contribution we are making to such projects is not a specific silver bullet technology, but rather our project management expertise that has come from handling drilling projects around the world. Project management adds the value to all individual processes while creating greater efficiency and setting new standards. This continuous benchmark-setting practice has made us leaders in drilling operations. Pemex had not yet integrated such practices at its mature fields until recently, as they now allow service companies to implement their processes to improve production.

Q: What are the main technologies that Schlumberger is working on today at the global level that could be introduced in Mexico in the coming years and would make a real difference in the industry?

A: Seismic is a key area. We are developing new ways to measure in a much faster, efficient, and accurate way. We are also improving seismic technologies, resulting in innovations such as the UniQ Land Seismic Acquisition System; a highly flexible point-receiver system that delivers data acquisition ranging from fast-moving, low-density exploration surveys to wide-azimuth, broad bandwidth, point-source/point-receiver reservoir surveys. We are also working a lot on reservoir characterization and the measurement of petrophysical data to provide better data interpretation and facilitate better decision making regarding field development. Therefore, our core business is data acquisition, interpretation, and software development.

Q: What are the ambitions for Panuco, and how will the cooperation between Schlumberger and Petrofac work?

A: The ISCs are new for both us and for Pemex. There is a new contractual framework which means that once the development plan has been agreed upon by both parties, we will be reimbursed 75% of the cost. In addition, parties will receive a fee per barrel for production increases. The elements for this to happen are currently being implemented by Pemex. We cannot start this project without both parties agreeing beforehand on how much the field is currently producing. Previously, all the fields in the region had their production mingled and counted together; however, now the infrastructure is being put in place to monitor production separately for Ebano, Panuco, and Altamira. This is why we have not yet started operations even though we have agreed on the actions that we will carry out there. We can start drilling and conducting well workovers, and once we have a complete evaluation we will be much more aggressive in field development. If what we believe is true, the level of activity in Panuco is going to be very interesting in the following years.

PERSPECTIVES ON ISC BENEFITS FOR SERVICE PROVIDERS

Upstream-Downstream Specialized Services, an American company providing exploration, production, development, and refining services, began operations in Mexico in 2001 with a crude transportation project at the Cantarell complex. Although they have not worked with Pemex since 2001, UDSS Country Manager Jorge Martínez claims the company has been able to successfully operate in Mexico due to the magnitude and market potential and the various services they have been able to provide to companies such as Halliburton, Schlumberger, Baker Hughes, and Weatherford.

"Even though we pay taxes and are registered as a Mexican company, we still have to follow certain global UDSS policies, standards, and processes that severely limit our chances of acquiring contracts due to our inability to decrease our prices"

Jorge Martínez, Country Manager of UDSS

UDSS has been able to expand its operations and services in the oil and gas sector due to its aggressive business model focused on expanding beyond Mexico and the USA, acquiring contracts and providing services to Argentinian, Venezuelan, Colombian, Ecuadorian, Brazilian, and even Spanish and Italian markets. Now that UDSS is a well-established company in the international oil and gas market, it has the clear and ambitious vision of "becoming the leading provider of specialized services in any relevant aspect of the life of an oil field, including exploration, development, production, and refining," claims Martínez.

Even though UDSS is present in multiple Latin American countries, the company is focused on Mexico "because it is currently the number one oil and gas market for international companies given its potential in deepwater, shallow water, and onshore projects – even though the market is currently controlled uniquely by Pemex," explains Martínez.

The advancement of the integrated service contracts (ISCs) makes Mexico more and more attractive for companies like UDSS. However, Martínez claims that there is still a long way to go before the real potential can be exploited and the attractiveness fully acknowledged. Although incredible improvements have been made in the interaction between Pemex, the Mexican government, and domestic and international companies, there are still various limitations. One of these limitations, according to Martínez, is finding the right balance between quality and price. "The Mexican constitution limits the interaction between Pemex and private companies, but since the 2008 Energy Reform – where Pemex was given the freedom to award ISCs – we have seen an ongoing tendency to award contracts based on price," states Martínez. This is a detrimental limitation on the attractiveness of the Mexican oil and gas market for international oil companies because, "even though we pay taxes and are registered as a Mexican company, we still have to follow certain global UDSS policies, standards, and processes that severely limit our chances of acquiring contracts due to our inability to decrease our prices," he explains.

Pemex's tendency to award contracts based on price rather than quality has been slowly changing and Pemex has demonstrated a strong desire to listen to its clients as a means to improve in every aspect, specifically with regards to their operations and contracting system. "We trust and believe Pemex is engaging in the correct discussions and taking the right decisions and we are extremely positive about the restructuring of Pemex, especially with the new young, vibrant, and brilliant Pemex CEO, Emilio Lozoya," Martínez believes.

Despite these limitations, UDSS still has an ambitious growth agenda in the areas of exploration and production, providing services for onshore and offshore platforms, specifically in deepwater, since these are the areas that are currently offering the best financial rewards. Nonetheless, UDSS is still trying to find new opportunities and alliances with Mexican companies that acquired contracts in the first two ISC rounds. Despite their efforts to work with Mexican companies, Martínez argues that his company has been most successful in creating strategic alliances with international companies with a strong presence in Mexico.

These various projects in Mexico have allowed UDSS to grow an astounding 600% since 2006, and Martínez claims that Mexico was a vital factor in this exponential growth; therefore, "we want to have a continued presence in Mexico, preserving the business relationships and projects we are currently engaged in, but at the same time contributing to the growth of the Mexican oil and gas sector with new propositions and solutions to the problems encountered in such a complex business."

ISCS AS PRODUCTION DRIVERS

"Pemex's attitude 20 years ago was that it did not need any help to develop its fields from exploration phases to production. Fortunately the company has now evolved. Pemex can still perform all the operations needed in the process to extract first production, but it has now realized the urgency of getting production as quick as possible. ISCs contribute to accelerating the process from exploration to production and let Pemex reap the benefits sooner."

Carlos Rafael Murrieta Cummings, Chief Operating Officer at Pemex

"Production for ISCs awarded in Cinco Presidentes and Poza Rica, plus Chicontepec, will amount to 500,000 b/d in the next five years, doubling from the 250,000 b/d they are currently producing: 100,000 b/d for Cinco Presidentes, 70,000 b/d for Poza Rica, and 80,000 b/d for Chicontepec. Contractors will be responsible for 60% of that figure, and Pemex for the remaining 40%."

Carlos Morales Gil, Director of Pemex Exploration & Production

"The ISC contracts are new both for us and for Pemex: there is a new contractual framework that establishes that, once the development plan has been agreed upon by both parties, the company awarded the contract will be reimbursed 75% of its development cost. A fee for additional production is also included, so a production baseline first has to be defined to correctly determine what should be considered as additional production. Previously, all the fields in the region had their production added together; now the infrastructure is being put in place to monitor production separately for Ébano, Pánuco, and Altamira."

Juan Manuel Delgado, Director General at Schlumberger Mexico

"We have to acknowledge the commercial success of ISCs in terms of the value of reference and fee per barrel. Comparing the fee per barrel proposed by the winning companies in both tenders to the reference value, it is a great business for Pemex, since it maintains huge profitability margins and obtains production increase without spending on field development; but it is also a great business for the bidders, or they would not have agreed to the price."

David Enríquez, Partner at Goodrich, Riquelme y Asociados

"The total production coming from the blocks licensed in the first and second rounds should be around 34,000 b/d this year and increase up to 73,000 b/d during 2014. On the other side, our target for Chicontepec in 2013 is to get to 100,000 b/d. For 2014, we expect to produce 140,000 b/d, with just 20,000 b/d coming from the ISCs. However, we foresee that figure to reach 60,000 b/d in 2015, 90,000 b/d in 2016, and finally 140,000 b/d in 2017. We expect the total Chicontepec production figures to exceed 200,000 b/d based on the knowledge we have acquired from the unconventional wells drilled in the area and assisted by the additional production that the ISC winners will bring."

Gustavo Hernández García, Subdirector of Planning and Evaluation at Pemex E&P

"We are expecting that operators awarded the ISC blocks in the first two rounds can implement good technology solutions for each particular situation. ISCs represent a good opportunity for us to learn and share experiences with international companies about production enhancement technologies and past operations in the field. It is going to be a team effort, even though there are limits to Pemex's participation. We are really looking for the opportunity to cooperate and learn, and to review some of the proposals that the ISC contractors might have and try them."

Pedro Silva López, Subdirector of Technical Resources Management at Pemex E&P

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STEAM INJECTION FOR HEAVY OIL PRODUCTION

PETER COLONOMOS
Chief Technical Officer at NorthPoint Group

Q: What are the roots of NorthPoint Systems, and which production solutions are you implementing in the Mexican market?

A: NorthPoint is a relatively young company comprised of personnel with long careers in the oil and gas sector. While the company was originally founded in the United States, NorthPoint currently operates in various countries, including Canada, Venezuela, Colombia, and Mexico. Experts within the company have devoted their time to designing advanced solutions for steam injection and other enhanced oil recovery technologies, as well as the development and manufacturing of patented technologies for more efficient hydrocarbon production. Since 2009, NorthPoint Systems has been working closely with Pemex on developing a cyclic steam injection project in the Samaria Neogono field, which belongs to the Samaria Luna asset in the southern region.

Q: How does cyclic steam injection work and where is it being employed successfully?

A: Steam injection allows for the production of heavy and extra-heavy crude oil through the injection of high temperature steam directly into the reservoirs where the resources are confined through specialized high temperature completion tools. Steam is created on the surface by running softened water through high capacity gas or diesel-powered boilers. The steam itself acts merely as an efficient mechanism for delivering large quantities of energy (enthalpy) into the reservoir, which serves to reduce the viscosity of this tar-like crude and increase both production and recovery rates. Thermal EOR has proven to be an effective and often inexpensive mechanism to increase oil recovery factors, particularly in places with easy access to water and natural gas supplies. Widely used in Venezuela, Canada, California, and Oman, thermal EOR projects have shown rates of recovery well above 25% of original oil in place (OOIP). This has driven the technology to become broadly accepted when producing oil of 12°API and below.

Q: How has NorthPoint implemented its steam injection project in Samaria Luna?

A: Our biggest eachievement has been the development of well-completion systems for high-temperature thermal wells and the information network that supports activity management in the cyclic steam injection technique. Samaria Neogeno cyclic steam injection was designed in its early stages using similar projects in different countries as a technical foundation and operational reference guide. NorthPoint supplied the thermal completion tools requested by Pemex for the pilot wells and closely monitored their proper installation and performance. We later worked with personnel from the Samaria Luna asset to modify the initial completion designs with the objective of optimizing injection and production, as well as designing a tailored data-capturing and monitoring system that enables an in-depth efficiency analysis of the process. These completions and data acquisition technologies resulted in the sustained productivity of wells through long periods of time. The pilot project yielded positive results, proving that cyclic steam stimulation was a suitable method of production for extra-heavy oil in the Samaria field. After the encouraging initial results from the pilot project the process of commercial proliferation of cyclic steam began throughout the reservoir.

The specific geological characteristics of Samaria – including the challenging depths, high pressures, and high temperatures that characterize the field – led NorthPoint to develop custom-designed completion systems, operational procedures, and monitoring tools that are able to compensate for these atypical circumstances and drive heavy and extra-heavy oil production up. This is not achieved through a constant formula that can be applied anywhere. This open philosophy has been the main driver behind our rapid growth in diverse markets.

During the proliferation of cyclic steam injection in Samaria, starting in 2011, Pemex has been able to drill a large number of wells with innovative designs, which have included changes in artificial lift systems and the implementation of selective injection systems. This has been made possible by an in-depth understanding of each reservoir's specific requirements in combination with the use of new knowledge and technologies. The joint efforts of Pemex with integrated service companies allowed for the identification of opportunities to improve and the use of these pioneering technologies in the Samaria field.

INTEGRATED MONITORING SOLUTIONS

ADALBERTO PÉREZ
Oil & Gas Business Unit Manager at Endress & Hauser

Q: How has your business developed in 2012, and how will Pemex's eventual restructuring affect Endress & Hauser?
A: Our strategy has worked perfectly, even though it has been aimed towards private companies in the Mexican oil and gas industry rather than Pemex. While the restructuring of Pemex will make us rethink our strategy, our current and potential clients will still be there, regardless of the outcome. However, we have already thought of a revamp project to diversify our solutions, products, and services and identify new opportunities after the imminent energy reform and the restructuring of Pemex.

Our greatest success last year was the implementation of flow, pressure, temperature, well signal monitoring, and oil separation solutions in offshore and onshore settings. However, even though we greatly admire our successes of past years, we are already looking towards the future, where we are focusing on offering the same services with additional state-of-the-art wireless monitoring technology for offshore projects. Regarding onshore operations, we have focused on offering radiometric technology and energy level monitoring.

Q: Many companies are looking for integrated system monitoring solutions. What specific interactions have you had with IT providers to offer these solutions?
A: We have already entered into alliances with various companies in order to offer our clients integrated solutions to their monitoring needs. We tend to align ourselves with companies that complement our services and products because together we can offer a better package solution. Nonetheless, we definitely need to make more strategic alliances not only because it allows us to offer better products and services to our clients and add value to the Mexican oil and gas market.

Q. How successful have you been at introducing your monitoring technology in mature fields like Chicontepec?
A: Our most successful case was the first round of integrated service contracts at Chicontepec, where we were able to supply system, pressure, temperature, and flow monitors through ICA. Furthermore, in 2012 we were also able to supply 200 pressure and flow monitors in Poza Rica, Veracruz. Therefore, I would have to say we have been successful in some mature fields even though we are looking forward to the next rounds of contracts to provide more services in onshore mature fields.

For the next round of ISCs we are focusing on offering an integrated monitoring solution for remote fields. One of the greatest problems Pemex has in these remote areas is that, due to lack of pipeline infrastructure, the extracted crude must be stored in tanks before being transported by truck, which is a complex and difficult logistical operation. At Endress & Hauser we are trying to offer a comprehensive solution that will facilitate the logistics of this complicated process. For example, we offer a service that allows Pemex to know which storage tanks are empty, which tanks are at capacity, and which tanks have leaks or are being unloaded by unauthorized personnel.

Q: Pemex is currently trying to optimize control and safety in its production infrastructure, and update its storage and distribution infrastructure. What role could Endress & Hauser play in supporting these initiatives?
A: We are very interested in supporting Pemex to optimize control and safety in its production infrastructure, and have done so already in northern Mexico, where we installed pressure and level monitoring devices. Every time we install one of these monitors, we actually install two; one for supervision and a second one for safety purposes. We always do this in case one of the monitors fails; you always have a backup and can therefore prevent any potential hazardous situation.

Regarding storage and distribution infrastructure, Pemex is very interested in controlling and making sure its end products are safe. Therefore, we are focusing on offering storage and distribution solutions based on volume and level monitors to make sure Pemex always delivers the exact amount of its products. In the past, Pemex personnel would have to measure the volume of storage tanks and trucks, which caused various complications because of mistakes or slipups. However, with our state-of-the-art monitoring systems we avoid any of these mistakes and help improve Pemex's distribution and transmission network.

SCADA SYSTEMS AND CONTROL ROOM OPERATIONS

For over a decade, the OASyS SCADA (Supervisory Control and Data Acquisition) system has been the standard for Pemex's industrial control systems. A platform designed to be both secure and open, the OASyS system allows for multiple inputs from third party data collection and control systems. Introduced in 1997 as Pemex's gas and LPG pipeline control system, the project proved to be ground-breaking for Telvent, now the Smart Infrastructure business unit of Schneider Electric, the company behind the OASyS system. Luis Rancé, Public Affairs Senior Director at Schneider Electric Mexico, and former Chairman of Telvent Mexico, explains the trajectory of the system, the importance of Mexico as a showcase project for the company, and the history of the company after the project was completed.

"We had acquired the technology from a Canadian company, and the completion of the project in Mexico helped us become known around the world as leaders in SCADA systems. As a result of this successful project we established an international reputation that enabled us to start working on more SCADA installation projects around the world, and in 2004 the company was listed on the New York Stock Exchange."

Rancé explains that although there were other SCADA systems available on the market at the time, Pemex favoured OASyS because of its open architecture, and the fact that any technology could integrate easily into the system. He believes that the system has maintained its popularity over many iterations for this reason.

"Pemex is moving rapidly into the 21st century with regard to its monitoring and control systems, in both upstream and downstream activities"

Luis Rancé, Public Affairs Senior Director at Schneider Electric Mexico

The project for Pemex involved not only the installation of a SCADA system, but also the integration of all existing equipment on the field into the system. It was designed to monitor Pemex's gas and LPG pipelines, and to optimize their operation and security. The system integrates data from 13,000km of gas and LPG pipelines, and brings all the information back to a central control room in the Pemex tower in Mexico City. From this control room, Pemex has access not only to the SCADA system but also to all third party monitoring and control devices, which are integrated into the platform.

Schneider Electric still maintains and updates Pemex's SCADA system, and according to Rancé, the company's challenge today is keeping the NOC satisfied with the level of service that they can provide. As a result of doing this for a number of years, Pemex now directly assigns new SCADA contracts to Telvent, rather than putting it to a public tender, in much the same way that SAP is the enterprise resource planning platform of choice for many companies.

Indeed, in recent years, Schneider has been charged with implementing its OASyS SCADA system for other Pemex divisions beyond gas: for the last two years, the company has been working on a program to install the system for Pemex Refining, a project which is expected to be completed by the end of 2014. The project will include installation of the system across 12,000km of Pemex Refining's pipelines.

The company will also begin work soon on installing the system across the assets of Pemex Exploration & Production. Once the system has been installed across the upstream pipelines, it will be introduced at the division's compression and pumping stations, and also at production assets and crude storage units. "We have already started to automate Pemex's storage units," Rancé says. "We have installed OASyS at 30 of Pemex's 80 nationwide units, but this type of installation is much more complex than it is for a pipeline system: the system allows Pemex to monitor and control the volume of crude in each tank, the flow rate of the pipelines in and out of the unit, and the tankers delivering and collecting." At Pemex's production units, Schneider has started to install its SCADA systems on platforms at Ku-Maloob-Zaap, acting as systems integrator. Eventually, the system will be installed at all of Pemex's production sites.

"Pemex is moving rapidly into the 21st century with regard to its monitoring and control systems, in both upstream and downstream activities," says Rancé. "As this type of activity increases, we hope that the underlying architecture will continue to be our OASyS system."

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OFFSHORE FIRE SAFETY

HORACIO FÁJER
Director General at Kidde de México

Q: In the offshore oil and gas industry, what do you think is most important, to have a culture of safety or to create the right incentives for companies to comply?

A: This is a very risky industry, and I honestly cannot imagine that a company involved in this industry would not take the safety factor seriously. The first incentive is always self-driven. The oil and gas industry must be conscious of the risks that it takes – many of the accidents that happen in Mexico and around the world in the sector are completely preventable. Anyone who works in this industry, and even those that provide safety equipment and services to the sector, should remember at all times that their primary goal should be to prevent accidents.

A good example of what can happen when safety is not considered as a priority took place in Mexico a few years ago, when a habitation platform arrived from abroad and the instrumentation for fire protection was not in compliance with Pemex's internal rules. The system should have been installed properly before it was delivered, but it was not, and the result was that Pemex had to pay twice for the same system.

Around 1.3% of the total investment in an offshore production asset will be for fire protection. Many EPC companies consider this to be an area where they can make savings on a project. We often find, when providing maintenance services on an asset, that fire safety installations are not up to standard. In such a high-risk industry, you cannot afford to cut corners on fire safety.

Q: How could you disrupt the Mexican fire safety market to raise performance standards?

A: Mexico is relatively unregulated in terms of fire safety. For example, Kidde has estimated the Mexican fire extinguisher market to be worth US$200 million. A fully regulated market would be worth twice as much. However, the market as it stands is not properly regulated, and one of the side effects of this is the existence of faulty and counterfeit products. In a test we did at our Victoria facility, nine fire extinguishers out of ten from the stores of one of Mexico's largest retailers did not work.

Q: How much of Kidde's technology is sourced in Mexico, how much is brought from elsewhere, and what is your general policy regarding this?

A: I have created what I like to call a pyramid of fire protection, which starts with a base of 'first attack' products, many of which are sourced in Mexico – dry chemical powder and CO_2 fire extinguishers, fire hoses, and so on. As you climb the pyramid to the next block, the products are generally used less, but increase in complexity. The second block of the pyramid is detection and alert. Many of these detectors are being manufactured in the country, both for domestic use and export. At the top of the pyramid are highly complex systems that are used, for example, in the petrochemical field: this includes equipment such as controllers, computers, and high sensitivity detection devices for toxic and combustible gases, among others. Most of the equipment at this top level is sourced from outside Mexico.

Q: What opportunities do you see in Mexico for streamlining or growing Kidde's current range of services?

A: In the oil and gas industry, I believe our biggest opportunity will come from packaged control room solutions, which will allow us to drive better results through controlled environments. We also want to make our solutions more durable, to cope better with harsh environments such as marine and desert locations, and anywhere where salinity is high. In order to achieve our first aim, we will work with solution integrators, who are the companies making the decisions on how to solve each risk that a project will face.

Kidde, part of the UTC Climate, Controls & Security business of United Technologies, manufactures and distributes fire prevention, detection and suppression equipment, offering a wide range in products, security systems and services. For more than 90 years, its products specialize in early fire detection and suppression.

CHOCA

9

One of the keys to efficiency is to have a maintenance strategy in place that protects infrastructure and prevents downtime while also avoiding accidents. This chapter explores Pemex's track record for maintenance, the strategies the company is putting in place to improve infrastructure upkeep, and the technologies it is using to reduce downtime and improve safety.

Logistics is an often-overlooked aspect of the oil and gas industry: without companies providing logistics services, conducting exploration and production operations in offshore regions or remote locations onshore would be impossible. As well as examining the maintenance topic, this chapter also looks at logistics in depth, speaking to the service providers that enable Pemex to receive the products and services it needs, where it needs them, and when its needs them.

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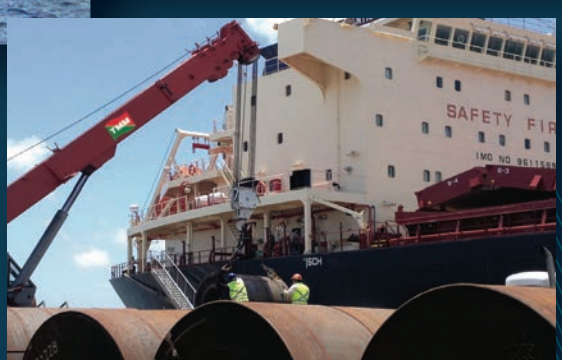

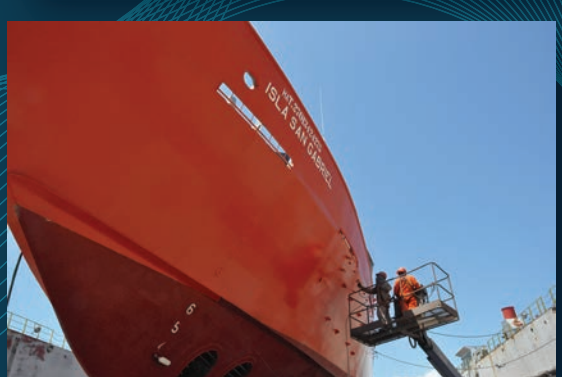

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CHAPTER 9: MAINTENANCE & LOGISTICS

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PEMEX'S MAINTENANCE STRATEGY

Pemex has gradually reoriented its maintenance strategy over the past few years, trying to move from a preventative to a corrective maintenance strategy. "Over the last few years, Pemex noticed that there were opportunities to optimize its approach to the maintenance activities that it should be performing," states Luis Vázquez Sentíes, President of Grupo Diavaz. The change of strategy was outlined in the Program to Increase the Operational Efficiency in Pemex and its Subsidiaries (PEO), which was published in 2008.

In this program, Pemex stresses the importance of maintaining equipment used in operations to minimize natural deterioration. The company notes the role of maintenance as a crucial factor for sustainability and the improvement of its operational efficiency. In the actions described by the program, Pemex denotes the need to perform an operational transformation in the way that maintenance activities are carried out. This action includes the development of an operational reliability system, which in turn would create a better control program to monitor the activities and costs of maintenance operations. Carlos Rafael Murrieta Cummings, Chief Operating Officer of Pemex, comments about the advancement towards achieving this objective during 2012 and the beginning of 2013. "In the first two months of 2013, Pemex has experienced a 60% reduction in problems with the reliability of its equipment compared to the previous year," he says, continuing that maintenance is the way to ensure the reliability of its equipment. "This year we are paying more attention to particular elements in our safety, health, and environmental protection program (SSPA) in order to reach a better level of infrastructure reliability and to keep a good safety track record."

Pemex's COO emphasizes that, for the program to work correctly, two different strategies should be implemented. First of all, every employee within Pemex has to keep performing their task in a more careful and judicious manner. "We are putting a lot of emphasis on the facilities with the biggest problems," Murrieta Cummings explains. "In order to take action and improve the reliability in these places, we have assembled a task force to visit those facilities, review and assess the conditions according to the SSPA guidelines, and present a proposal for what could be done to improve them."

Pemex is also developing a cross-analysis method where the employees of one business unit will evaluate another business unit's practices, and vice versa. "This would be done in order to develop a critical view of which areas of opportunity are present within each business unit, setting internal standards within the organization," Murrieta Cummings explains. "If one business unit realizes there is something to be improved within the unit they are evaluating, they make a recommendation. On the other hand, if they observed practices that could be learned from other business units, they should implement these themselves."

This cross-analysis strategy is aligned with the objective set by the 2008 PEO of helping Pemex personnel adjust to new labor and maintenance practices. Through the change of the maintenance culture within the organization and the critical assessment of the upkeep practices taking place in different business units, the NOC's personnel are able to correct bad habits and learn from good practices performed by their peers. However, Murrieta Cummings states that the development of better safety and maintenance practices not only depends on the improvement inside the organization, but also on the increase of strict regulations for the contractors that perform maintenance activities. In this regard, Grupo Diavaz has worked with Pemex in the upgrade of the maintenance contracts that Pemex E&P awards. "Pemex started giving out integrated service contracts related to maintenance called System 4 for five-year periods, System 1 and System 3 for 10-year periods," Vázquez Sentíes describes. "We had some problems when we started working under the System 1 contract, since the terms of the agreement did not allow contractors to work as partners. The contract was terminated and the terms were renegotiated into the System 1-B contract, which allowed better clauses for optimizing operations."

Murrieta Cummings agrees that, even though there have been efforts from Pemex to improve its maintenance strategy, it has not yet yielded the expected results. "We have evolved from corrective to preventative maintenance," he explains. "But now we have to evolve from preventative to predictive maintenance. This will allow us to know what to expect from our facilities and when to expect it. If you don't measure, analyze, and assess the conditions of infrastructure and predict what may happen and when based on that information, then it is impossible to have the right maintenance strategy."

"Maintenance conditions within Pemex are still below international standards," says Vázquez Sentíes. "Past incidents at the Pemex Tower and in Reynosa have encouraged both Pemex and contractors to develop a closer relationship and establish better maintenance practices."

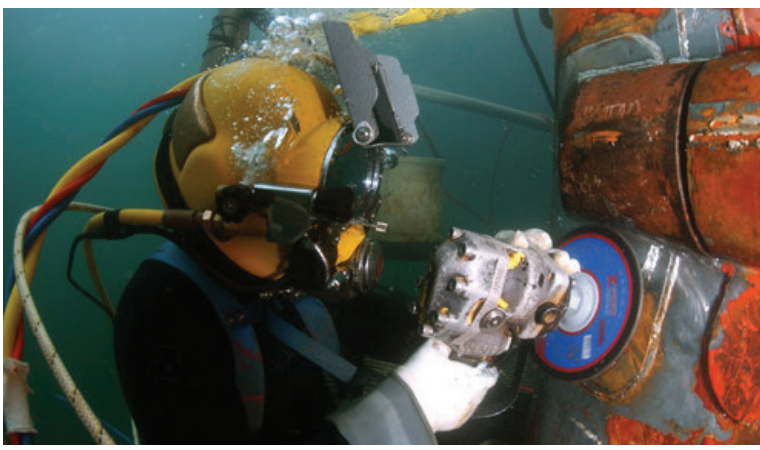
THE EVOLUTION OF OFFSHORE MAINTENANCE

More than 50 years ago, Hannes Keller, a 28-year old Swiss mathematician, was the first diver to ever get to a depth of 300m. At the time, it was widely believed that no human being could safely dive to depths beyond 90m, since several conditions start to affect the diver's health at those great depths. After Keller's achievements, oil companies such as Shell started sending divers routinely to depths of 300m for the maintainance of subsea infrastructure. The task was so demanding that it required divers aged 24-40 who could withstand the harsh conditions that diving to such depths implies.

The history of maintenance in the Mexican offshore oil and gas industry shares a similar beginning, when Pemex installed its first platforms to exploit the oilfields at Atún, Tiburón, and Arenque in 1961. Professional divers participated in the construction and maintenance of production infrastructure in the Gulf of Mexico since then, and some of today's leading service providers built their businesses on early diving activities. One of these companies is Grupo Diavaz , whose President Luis Vázquez Sentíes travelled to Tampico to promote drilling fluids when he became aware that a diving company had just turned down a contract with Pemex. As he investigated the situation, he decided to start a commercial diving company, with his cousin, Ricardo Vázquez Adame, a professional diver, and his brother, Óscar Vázquez Sentíes, who worked at the time for the Mexican Petroleum Institute. The company, then called Constructora Subacuática Diavaz, began operations in 1973 with the main objective of providing commercial diving and maintenance services for offshore platforms and infrastructure.

Today, thousands of technicians and laborers work on offshore platforms, and their performance and safety still depend greatly on the correct operation of the infrastructure and equipment they operate daily, which is the main responsibility of people executing adequate maintenance programs. Even though many of these tasks are today undertaken by automated technological tools, such as remotely operated vehicles (ROVs), there are still maintenance operations that need the specific skillset that a professional diver can bring.

The maintenance efforts that Pemex executes today include both corrective and preventative upkeep assignments, in order to optimize the safety and uptime of offshore operations. "Pemex has become stricter in terms of taking care of its installations," says Jorge Luis Díaz Reyes, head



of non-destructive testing at Binsmar, a diving company based on offshore hub Ciudad del Carmen. "They are handling maintenance operations under stricter guidelines and are more focused on preventative inspections and maintenance, reducing downtime, and maintenance costs." All of these offshore upkeep assignments that Pemex awards through maintenance contracts are intended to minimize the risk exposure of the people performing them: technology is playing an increasingly important role, both by replacing the need for human diving activities, and by reducing the total diving time based on technological advances that make subsea maintenance more time efficient.

Being the third-most-dangerous occupation in the US, commercial diving remains a dangerous job, not only as a result of the long term health risks that the profession could trigger, but also of the hazards of using heavy machinery in challenging underwater conditions. Through advancements in technology and the incorporation of preventative and predictive maintenance, the Mexican oil and gas industry is looking at reducing the time that divers need to spend underwater performing maintenance services, but the commercial diving is destined to remain a cornerstone of offshore maintenance activities, and remains the foundation of companies such as Grupo Diavaz.

A BRIEF HISTORY OF MEXICO'S SERVICE INDUSTRY

The first petroleum law in Mexico, published in 1901, allowed concessions within Mexican territory for oil exploitation. This encouraged foreign businesses to invest in Mexico with the interest of extracting hydrocarbons. The first to do so were led by Edward L. Doheny, of the Mexican Petroleum Company of California, and Weetman D. Pearson of El Águila Petroleum Company. Due to their capital, expertise, and advanced technologies, the companies constituted by the two foreign entrepreneurs dominated the market in the first years. They performed operations along the entire value chain, from exploration activities to downstream endeavors, commercializing the finished products in the open market. By 1921, the activities of these two international companies allowed Mexico to become the second largest oil producer in the world.

The success of these foreign businessmen in the Mexican market raised the interest of IOCs in the country, with the Standard Oil Company from New Jersey and Royal Dutch Shell coming to Tampico to establish operations. The IOCs bought the companies of Doheny and Pearson, taking over their operations. The two multinational groups owned

| VIEW FROM THE TOP

EVOLUTION OF PEMEX CONTRACTORS

LUIS VÁZQUEZ SENTÍES
President of Grupo Diavaz

Q: How has Pemex's relationship with its contractors evolved over the last decade?

A: Over the past decade, the relationship between Pemex and its contractors changed in nature after 30 years of close partnering. This has complicated relationships between the two sides. The perspective that should prevail in the Pemex-contractor relationship is of mutual benefit: to work jointly in order to improve the industry. At the moment we sign a contract, we should see each other as partners, and we have expectations that this government will help to foster this kind of relationship.

Q: How will Pemex's restructuring affect the relationship that the company has with its contractors?

A: I think Pemex will return to work under the same principles it was working 40 years ago, and this implies that the relationship will get better again. Partner consolidation should be a priority, and with the new attitude that Pemex has garnered during the past months, I think it will be easier to achieve. Grupo Diavaz will continue to offer its services for any project or contract that could be tendered, eager to participate in the development of the Mexican oil and gas industry. We are clear that a big opening of the sector will not necessarily take place, but we want to continue advancing the System 1 contracting model to support Pemex's maintenance performance.

Q: Grupo Diavaz has used the partnership model with national and international companies in order to grow. How has this played out in the Mexican context?

A: Our strategy at Grupo Diavaz has been based on partnerships with companies from different countries, such as China, Brazil, and the Netherlands. We have the expectation of continuing to participate with them in the multiple service contracts, for example at Burgos, an asset for which we hope Pemex will award integrated service contracts in the future.

We are currently working at two onshore fields, Cuervito and Fronterizo, with Petrobras and we are trying to change the contract into an integrated service contract. To move to this stage, we have studied the first six years of operations that we performed in Burgos, which were really beneficial both for our company and for Pemex, in terms of proving the reserves and optimizing the way oil and gas is produced to lower costs.

smaller companies within Mexican territory performing exploration, production, refining, and transportation activities. Oil production during this period had several peaks and troughs, driven specifically by the operational strategies of the IOCs: a field would be exploited until depletion and then the next prospective source would be explored.

With the 1938 oil expropriation, IOCs were banned from performing activities related to oil in Mexican fields. Pemex was then formed under strict regulation from the Mexican government. Exploration activities during this period constituted a problem, since IOCs took part of the geological information with them when they left the country. Because of this, the scuffle with the international companies was not settled until 1947, when the last agreement with El Águila was signed. The next 12 years were devoted to exploration activities. In 1958, the statutory law related to oil that stems from the 27th Article of the Mexican Constitution was decreed, enabling Pemex to award service contracts to any company under the restriction of a cash-only payment that did not involve sharing the oil produced. From 1959 to 1964, the focus changed towards production and maintenance. Risk contracts were then awarded to companies from different parts of the world to provide oil services related to these activities. From 1965 to 1975, exploration was once again emphasized, allowing for the great discoveries in southeast Mexico. But from López Portillo's presidency onwards, financial results were favored. This new approach drove the NOC's interest to strengthen the role of international service companies to foster competition and optimize results.

In terms of operation, it has been a profitability project for us. This opens the door to a production increase in the long-term since we know there is unconventional gas and condensates in those fields, and there might even be shale gas. The challenges related to producing this kind of resources has driven Pemex to migrate from multiple service contracts to integrated service contracts, and we believe that whoever does not adapt will get its contract terminated and substituted by Pemex.

Q: You were actively trying to participate in the ISC contracts last year. Why did Grupo Diavaz not win any of the blocks tendered?

A: We tried to be actively involved with some of the Villahermosa blocks, with Weatherford and Sinopec as partners, but we experienced a lot of problems amongst ourselves. First, Sinopec believed that the price at which we wanted to bid was not sufficiently attractive. The discussions started between us and, one week before the final offers were to be submitted, we decided to withdraw our bid. We believe that we should have submitted a bid ourselves and at the determined price without Sinopec. However, in retrospect, it was not such a bad idea to not bid, since our price of around US$12 per barrel was not competitive enough compared to the winners of the field who bid around US$7 per barrel.

Q: How did you translate these experiences into lessons and what would you advise the winners of the ISC, based on your experiences?

A: We consider the integrated service contracts to have two big problems: the low prices that the contracts ended up having, and the total rejection of oil companies by the local communities. One clear example of the problems with communities is happening at Carrizo. Companies have not been allowed to set foot there; they are completely blocked from accessing the place. Petrofac experiences some variation of the same problem. It is an international service company that does not have the know-how of Mexico and its circumstances, which will give them a rough start. That was the main setback we had with our seismic exploration company, and there was no way of fixing it: even after we talked with the relevant authorities and Senate representatives, we could not make any progress. This is a really difficult place to operate, where success depends a lot on the people.

Q: Are you interested in competing for contracts in the next ISC round through a partnership?

A: Of course. We are open to working through partnerships because it constitutes a win-win situation for all involved. We believe that we provide additional value for companies coming from abroad that lack the experience of working in the oil business in Mexico by being the only certified Mexican operators.

At the same time, our Ébano operation will continue to boost the local economy and generate new local employment. Our improved understanding of the operating environment at Ébano will also help us to figure out a better cost-benefit ratio that enables us to become one of the awarded operators at Chicontepec.

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CORRECTIVE MAINTENANCE

Corrective maintenance is maintenance performed after a problem emerges to identify, isolate, and rectify a fault, with the goal of restoring operability. Corrective maintenance cannot be avoided, since it sometimes has to happen due to extrinsic causes beyond anyone's control. Over the past decades, Pemex's limited investment budget, combined with external pressure to maximize oil production, resulted in a situation where investment in infrastructure upkeep drove the company to a corrective maintenance strategy. The company used to conduct minimal preventative maintenance, and would just wait until something broke down to perform maintenance tasks. This process would start by diagnosing why the failure appeared – either through physical inspection or other digital assessment tools – and then repairing or replacing the damaged parts, according to the diagnostic results. Once corrections are made, the system is tested to verify that the problem has been solved, and validate the continued use of the equipment.

For some older equipment, it may make more sense to rely on corrective maintenance, since other types of maintenance are expensive; it may be more cost effective to simply repair components as they grow weary or ineffective, as long as downtime is not detrimental to the company's bottom line. Downtime can be avoided, though, if regular inspections identify risk of failure in time for maintenance to be planned and scheduled.

PREVENTATIVE MAINTENANCE

Preventative maintenance is maintenance that is carried out to prevent equipment failing or wearing out by providing systematic inspection, detection and prevention of incipient failure. The preventative maintenance efforts are aimed at preserving the useful life of equipment and avoiding premature equipment failures, minimizing any impact on operational requirements, possible downtime, and even the frequency of corrective maintenance tasks.

The process works through scheduled maintenance programs where the equipment is cleaned, adjusted, lubricated, and tested to verify it is in full working order. Inspections are regularly carried out to identify impending problems and schedule planned repairs prior to equipment failure or decay. Preventative maintenance is usually carried out only on those items where failure would have expensive or unacceptable consequences, and it is recommended for new infrastructure to extend its lifetime and save money in the long-term by preventing as many failures as possible before they happen. The oil and gas business is filled with infrastructure where failure would have dangerous consequences, and this is why Pemex has adopted this type of maintenance over the past decade. Since its shift in maintenance focus, Pemex has gone from having an average of 90 days lost per million hours worked in the period from 2000-2005 to 27 days lost per million hours worked in the period from 2006-2011.

PREDICTIVE MAINTENANCE

Predictive maintenance consists of several techniques that help to determine the condition of equipment in order to predict when maintenance tasks should be performed. This approach helps to save money over preventative maintenance since tasks are performed only when they are justified. The main value of predictive maintenance is to schedule corrective maintenance that can, at the same time, prevent unexpected equipment failures. The key is to possess the right information at the right time, to avoid unnecessary downtime or routine maintenance tasks. This strategy of planning maintenance helps to increase the equipment lifetime and plant safety, while reducing accidents and environmental impact.

New monitoring and customizable parameter-setting technologies allow oil and gas companies to determine the exact time and measurement of their up-keeping necessities. Predictive maintenance keeps industry operators from incurring in unnecessary costs surrounding maintenance, especially when plants or platforms are located in remote areas, both onshore and offshore. Using predictive maintenance measures thus offers competitive advantage in the oil and gas industry, for it allows companies to reduce both operating and maintenance costs. Pemex is currently in the process of changing its culture to include predictive maintenance as its main approach towards its infrastructure upkeep program.

DEVELOPING NATIONAL CHAMPIONS

Under current regulations, Pemex is able to award service contracts to any company in the world that best serves its interests. This has led to a national discussion over whether Pemex should act like a business in the contract awarding process and choose the best partner, regardless of nationality, or whether it should prioritize awarding contracts to Mexican companies to foster the domestic economy. The answer, regardless of the option Pemex decides to take, is for Mexico to develop national champions that are the best choice for the NOC, even when facing international competition. This is the approach that Mexican service companies such as Grupo Diavaz, Comesa, Goimar, and Vallen have taken in providing highly competitive services in their different market segments.

GRUPO DIAVAZ

Grupo Diavaz started operations in 1973 as a diving company that provided maintenance services to the offshore hydrocarbon exploration and production industry. Since then, the company has expanded into three different divisions: maritime operations and other offshore services, oil and gas exploration and production services, and natural gas production and distribution. Throughout the years, Grupo Diavaz has become one of the most important players in the Mexican oil and gas industry, to the point of even having success where some of the most important and well-regarded international service companies have not. "We have been able to correctly manage the different community groups within Tamaulipas, Tampico, Reynosa, and Ébano," Luis Vázquez Sentíes, President of Grupo Diavaz, describes. This placed the company ahead of international service provider Schlumberger in production-related services at the Pánuco and Ébano fields for several years.

COMESA

Comesa has been a leading provider of exploration services in Mexico. By offering cutting-edge seismic technologies since its formation in 1968, Comesa has become one of Pemex's partners of choice in its exploration operations. Working side by side with Pemex and the IMP, Comesa is currently conducting the important geological research project for shale gas in the country. "We will be very active helping Pemex to acquire the seismic information that it will use in the development of the shale resources in Mexico," Adán Ernesto Oviedo Pérez, Director General of Comesa says. However, progress does not stop there for Comesa. The company is venturing into the US shale market, hoping to become an operator in the Eagle Ford area. This is a key step to develop additional expertise and knowledge on shale gas projects and build on them to exploit Mexico's potential.

GOIMAR

Goimar was founded in the early 2000s to provide services related to the leasing and operation of drilling rigs and vessels for the oil industry. Throughout its history, Goimar has dedicated itself to learning from international companies working in the sector, which has led the company to Denmark and China. By acquiring knowledge and experiences from Denmark-based Maersk and Chinese COSL, the company has built a portfolio of rigs and now operates these successfully in the Mexican market. The company's prospects for the future involve the continuing operation of rigs in the market, while introducing a new modular rig into Pemex's drilling plans. "We anticipated since 2009 that Pemex would like to increase the number of modular rigs in its fleet, since they are still drilling extensively in shallow waters under more difficult conditions," says Yann Kirsch, VP of Business Development & Strategic Planning for Goimar. "We came up with the conceptual engineering design of a brand new, self-erecting 3,000 HP modular rig, which we are now building to extend our portfolio and help Pemex in its endeavors."

VALLEN

The Kuri Con brothers established the company that came to be Vallen in 1985 with the idea of providing safety products that were still not in use in several markets. After its establishment, the company underwent several constitution changes through joint ventures and was later acquired by Vallen Safety Supply Company and ultimately by Sonepar. Throughout this process, Vallen was awarded service contracts by Pemex's drilling unit. "Carlos Razo, director of the at the time new drilling unit, explained the safety problem behind the low efficiency and productivity of his team and asked us for an integral solution," José Luis Kuri Con describes. "This implied not only providing the necessary protection equipment for its personnel, but also making sure that the correct equipment reached the right person at the time it was required, under the proper controls." This was how Vallen pioneered the concept of integrated safety solutions in Mexico and has become one of the market leaders in their provision.

The common denominator for all these companies is that they overcame the global competition to become partners for Pemex in different key areas within the oil and gas value chain. Whether it was through acquiring knowledge or technology from international companies, developing them through joint ventures or acquisitions, or developing their own solutions in-house, these Mexican champions have successfully worked their way into Pemex's list of trusted partners.

ENTREPRENEURS CHASING OPPORTUNITIES IN OIL AND GAS

"In the future, we expect to work with the same Pemex we started working with 40 years ago, but with an additional openness and better opportunities. At Grupo Diavaz, we offer our services for any project or contract tendered, eager to work and develop the Mexican oil industry. It is clear that a big opening will not necessarily be generated, but we want to continue advancing System 1 in order to ensure that Pemex's maintenance standards continue to improve. Our Ébano operation will continue to boost the local economy and generate new local employment sources. The experience gained at Ébano will also help us to figure out a better cost-benefit ratio that enables us to persevere as one of the awarded operators at Chicontepec."

Luis Vázquez Sentíes, President of Grupo Diavaz

"Our first operational experience was with the semisubmersible rig KanTan IV, a Sinopec-owned rig. The seed of our skilled experience was sown alongside Maersk Contractors, while managing the KanTan IV. Goimar now has highly qualified and certified personnel operating its fleet. We also provide human resources to privately-owned companies for their drilling and maintenance operations."

Yann Kirsch, VP of Business Development & Strategic Planning of Goimar

"We have the ambition to become an operator in 2014, but it is Pemex's decision to allow us to move into that scenario. Right now, we are providing new technologies such as VSD 3D seismic. We are preparing ourselves to eventually win a field and operate it, and to choose the right partners to do so. We have already selected a Canadian company to work with us on drilling and workovers."

Adán Oviedo Pérez, Director General of Comesa

"Organizations in the country nowadays are starting to view safety as an investment rather than a cost because it does not only protect expensive and modern infrastructure and processes, but also because it protects what Mexican companies have come to understand is their most valuable asset: their human capital. Due to the fact that there is always an opportunity to optimize safety in an industrial setting, Vallen will continue to grow and find opportunities in Mexico in the years to come."

José Luis Kuri Con, Commercial Director of Vallen

"We offer training in security and human development to our personnel and clients, as well as operational support for maintenance, drilling, and vessels in the oil and gas market. Our goal is to change people's emotional and mental wellbeing to increase their self-motivation and increase the capacity of Mexican workers."

Yina Muñoz Pineda, Director general of Match Personnel

"What President Peña Nieto must do is make the unions realize that by increasing productivity they could actually be increasing local content by around 20%, not to mention the value they would be generating for the Mexican oil and gas industry. However, it has to be a long-term plan; if we started now it would take around 10 years."

Luis Vielma Lobo, Director General of CBM Ingeniería Exploración y Producción

MAINTENANCE OF OFFSHORE STRUCTURES

Maintenance tasks are usually appointed to special task forces or service companies in the oil and gas industry. Nevertheless, the remoteness of offshore structures increase the probability of possible malfunctions within the equipment at sea developing into hazardous situations. In order to prevent the possible risks of downtime and injury, Fernando Araujo Castillo, General Manager of ARPO, believes that wireless technology should be implemented and knowledge should be shared within the people responsible for offshore infrastructure maintenance.

ARPO began making its way in the industry by approaching its clients with technology and modernization. "We became specialists in the area by garnering the necessary knowledge and combining it with our expertise in construction and maintenance services," says Araujo Castillo. "We provided companies with wireless tools that reduce the time consumed by maintenance operations." After specializing in the technological side of engineering for the oil and gas business, ARPO approached construction companies and proposed technology-based solutions. "It started as an integration process, where technology and automation were incorporated into the engineering designs of production equipment, and to promote the proper use of technology we gave training courses," explains Araujo Castillo. "The process also generated maintenance opportunities, since after ten years the systems would lose their guarantees and require reconfiguration. We were eager to provide our clients with that."

Usually, when companies provide new technologies, they create training programs for the clients' personnel so that they can take full advantage of them. What they often do not teach is how to react to possible risks or malfunctions with the technology. "We offer training courses to clients, not only to make the technology accessible, but also to get certified and organized," Araujo Castillo describes. "The client is not only interested in understanding the technology, but also in equipping its personnel with easier solutions to face possible risks and problems that stem from it."

An hour-long production loss due to system or equipment problems could turn out to be a great loss of money. Therefore, Pemex has supported the idea of minimizing the time spent on repairs by submitting its platform-based

NON-DESTRUCTIVE TESTING FOR OIL AND GAS INFRASTRUCTURE

Victor Manuel Rodríguez, CEO of RICCSSA

As a company focused on offering technical support, engineering, maintenance, and consulting services for the Mexican oil and gas industry, one of RICCSSA's main strengths is that its workforce is largely comprised of retired Pemex personnel. As a result, the company holds a great wealth of knowledge of the functioning, needs, and processes of the NOC, which enables RICCSSA to anticipate opportunities in various different fields at an early stage.

Besides offering consulting, maintenance, and technical support for the Mexican oil and gas industry, RICCSSA's main strength is non-destructive testing technology for maintenance and inspection of oil and gas infrastructure. The development of the company's non-destructive testing expertise and experience in implementing the associated technological solutions was initiated when RICCSSA was hired to solve storage tank issues at Puerto de Dos Bocas, Tabasco. "During our study on the storage tanks we searched for international best practices and technologies that offered the optimal solution for Dos Bocas and we eventually identified to most suitable technology in Germany and applied this at the port," recalls Víctor Manuel Rodríguez, CEO of RICCSSA. After acquiring the technology and adapting it for storage tanks, the company obtained a contract to inspect 60% of all 500,000 barrel storage tanks in Mexico, which made the company realize not only the potential of their discovery, but the impact it could have on the industry.

It was then that RICCSSA began applying non-destructive testing technology on pipelines and other oil and gas infrastructure. During the process of adjusting and optimizing the use of this technology for different types of infrastructure, the company's engineers and technicians – with the help of Mexican technicians, engineers, and

personnel to risk management and structure maintenance courses. “This way, if safety systems fail, the client’s personnel has the ability to react and present a solution to the problem, helping to prevent possible liabilities created by the failure and even save employees’ lives,” Araujo Castillo argues.

The innovative solution that ARPO provided helped Pemex correctly assess the different areas of expertise and maintenance skills within its workforce. “We offered to assess Pemex employees at all levels and classify them in different categories,” Araujo Castillo explains. “Training programs are then tailored for each different group and simulators are created for them to undergo practical, hands-on training and follow their progress through the evolution of the program.”

The biggest project that ARPO has undergone in the company’s history is the safety certification training for all employees at Cantarell. “70% of the systems installed at the complex were implemented by ARPO and are still updated through maintenance procedures. The significance of us being present at Cantarell is the fact that we still address different issues and technical questions that our personnel has,” says Araujo Castillo. “We share additional knowledge with employees at the complex to help them understand how the whole process works and what they can do when equipment stops working.”

university research centers – were able to not only improve the technology, but also succeeded in creating a methodology to reduce the cost of inspection and maintenance in the Mexican oil and gas industry.

As a result, RICCSSA was able to win multiple contracts with Pemex as well as both national and international private companies, which created the foundation for the company’s expansion into consulting services. Building on the innovative and entrepreneurial spirit of its founders, RICCSSA moved forward by entering into technological and consulting alliances with both British and Mexican companies, and currently offers consulting services such as pipeline risk analysis to reduce maintenance costs. “Many companies stayed behind in this respect, focusing on standalone challenges and required technologies rather than system solutions and an integral approach to pipeline maintenance, while we are consistently striving to develop and implement new technologies and solutions that enable us to offer Pemex 98% certainty that their installations and infrastructure are in good conditions,” Rodríguez adds.

The above mentioned strategy has not been the only pillar of RICCSSA’s expansion, the company also capitalized on the introduction of the integrated service contracts. These contracts have opened the Mexican market to private sector operators under a fee per barrel remuneration scheme that also attracted a new wave of international service providers that are today presenting serious competition for Mexico’s pool of domestic small to medium sized service companies. “Fortunately, we are in a position in which we can compete with any international company in Mexico because of all the opportunities available. Competition is not only driven by the knowledge and technology that international companies are introducing to Mexico and are sharing with their Mexican counterparts. Our extensive experience working in Mexico has allowed us to understand the operating environment, operational needs, and administrative and bureaucratic processes of Pemex, which is something international companies currently lack.”

To pursue further growth, RICCSSA is currently creating an alliance with a well-established Canadian oil and gas company which will open up the possibility of acquiring larger contracts, even to the point of being responsible for design, engineering, and construction of an offshore platform. “We expect to make this dream a reality over the coming decade,” concludes Víctor Manuel rodríguez.

EXPANDING OPPORTUNITIES FOR ASSET PROTECTION

"In the last ten years, Pemex has really ramped up its activities in pipeline integrity management," says Lorenzo Martínez Gómez, President of Corrosión y Protección. "Pemex recently introduced internal regulations for these activities based on those of the US Department of Transportation. These regulations include risk assessment methodologies, inspection methodologies, and require operator qualification. A total of 152 tasks, each separated into different groups, have now been internationally certified, across the pipeline system."

Despite Pemex's advancement in terms of pipeline integrity management, there are some areas where Martínez Gómez feels the company is lagging behind in terms of protecting its assets. "Although the pipeline system has been corrosion protected for many years, which has been particularly strongly enforced for the last five years, there are many Pemex systems that have not received the same attention. For example, Pemex does not use cathodic protection at its oil storage tanks. Without it, the bottom of a tank will last only two or three years before it needs to be replaced. Cathodic protection can vastly extend the life of these tanks, both above and below ground. Pemex has around 50,000 tanks across the country: if we can convince them to use cathodic protection on this type of infrastructure, it would present an enormous opportunity for us."

Another area where Martínez Gómez believes that Pemex should be looking to implement cathodic protection at well casings. "Studies have been conducted in both the US and Canada regarding the environmental and business impact of well casing deterioration. These studies all recommended that cathodic protection be applied at well casings in order to combat corrosion and prevent leaks and spills." Today, cathodic protection is applied at 100% of well casings in Canada, the US, Saudi Arabia, Brazil, and Argentina. However, Pemex has yet to be convinced that this should happen in Mexico. "This issue becomes even more pressing when the well casings are exposed to fracking chemicals at unconventional wells, because the corrosion rate increases dramatically," Martínez Gómez explains. "This is something that Pemex really needs to consider given the country's shale gas potential."

As well as looking for opportunities to provide additional services to Pemex, Corrosión y Protección is also looking to diversify its business: in 2012, 60% of the company's business came from the private sector. For example, one project that the company is working on is a corrosion inhibitor made from Mexican coconuts from Guerrero. The company recently developed a formula that will enable them to produce the inhibitor at scale, and sell it as a commodity in both Mexico and the region.

OFFSHORE SAFETY

Global Maritime has extensive experience with risk assessment for marine and offshore projects and implements international best practices to enhance safety and reduce risk. We are committed to enhancing safety performance in the Mexican oil and gas industry by offering risk identification and reduction strategies for projects from an early stage throughout the operation and including decommissioning.

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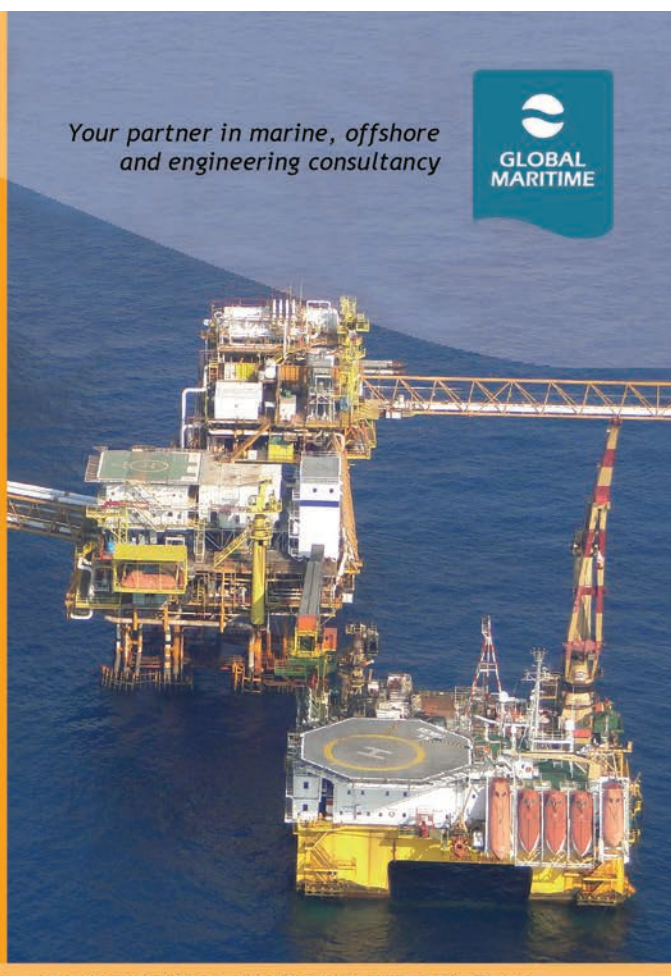

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CHARTING PEMEX'S MIDSTREAM INFRASTRUCTURE

To optimize its operating performance, Pemex has had to devise an outline of Mexican territory that indicates the different prospective and proven hydrocarbon resources, and a map of the transportation network needed to move this oil and gas around the country. In this cartographic work, technology has become a central component for improving accuracy. It has evolved from identifying the approximate location of assets to a point where real-time sites can be exactly scanned and traced for their specific conditions to be supervised. The effects of this progression have influenced operational efficiency: real-time control solutions have allowed Pemex to replace corrective maintenance with preventative equipment upkeep to maximize performance in its midstream facilities.

The focus of C&C Technologies in Mexico is to deliver survey services through different technologies and help companies to better understand the current state of their infrastructure. The oil and gas business has served as a key driver for the company's operations in Mexico. As a company with broad expertise in surveying, mapping, and inspection, C&C Technologies is well positioned to bring innovative offshore technologies to the onshore market, which has enabled the company to win an eight-year contract with Pemex in the South Region. With the philosophy of "no downtime" the company has dedicated itself to meeting Pemex's needs.

"Any offshore operation costs a great deal of money, so companies have to depend upon reliable technologies to plan their strategies correctly," states José Aguilar, Director General of C&C Technologies. "We recently developed a trustworthy third generation Global Positioning System (GPS), which reduces downtime significantly." The system is being used in Mexico to map out Pemex's facilities, with a special focus on old forgotten pipeline systems that might prove useful for the company in the future.

In the past, Pemex used to perform infrastructure surveys by hand: the mapping of possible fractures within the distribution network had to be analyzed in person. "The old formats and procedures that Pemex used in this kind of service were outdated," Aguilar says. The GPS technology that C&C Technologies provides has actually brought additional benefits than just positioning and infrastructure mapping. "We are automating Pemex's rights of way within its old pipeline system," Aguilar says. "By analyzing different sections of the pipeline network, we are able to deliver electronic maps of the infrastructure with enabled satellite views. The satellite overview that we provide enables Pemex to find leaks in its hydrocarbon distribution network within minutes."

Using its GPS mapping device, C&C Technologies has obtained data on approximately 6,000km of pipeline that had been all but abandoned. "We are acquiring information about the current shape of this distribution infrastructure, in order to provide a precise report on its condition," Aguilar comments. "This will enable Pemex to drastically reduce uncertainty and facilitate a faster response to possible leaks and illegal taps that these pipelines might encounter along their full extension."

Even though today Pemex uses cutting-edge surveying and built-in monitoring technologies to watch out for possible leaks in its AAA pipelines, there is infrastructure that the company is not yet assiduously monitoring. "These pipelines currently have no means of connecting with production centers and its control systems," Aguilar explains. To oversee and manage the country's old distribution network, Pemex has contracted C&C Technologies to chart a detailed infrastructure map, which delineates the location of the facilities and elaborates on their current state. "We were hired to install monitoring solutions at those old pipelines and fields to preserve them for further use," he adds.

The use of GPS technology to create a fully detailed diagram of Pemex's distribution system and its current capabilities is only the start of the possible applications for the technology. If the NOC were to invest in an in-depth diagnostic report of all its equipment and infrastructure, operational management and upkeep of the company's facilities would result in a decrease in downtime rates and a more proactive approach to maintenance tasks and production optimization.

The contract has been expanding gradually. "It started with a normal tendering process, where Pemex asked us for the provision of the technology," Aguilar describes. "From the start, the contract was divided into regions. We were first awarded one of those sections and once we delivered results, Pemex decided to continue investing in our service."

The company believes that this contract can expand into Pemex's development plans, with deepwater as a big target. "GPS solutions will continue to be our main business driver during 2013. We are executing the same services all around the world," Aguilar explains. "So even when the Mexican subsidiary has not applied this technology in deepwater, we can rely on the company's international experience and implement it in Mexico. This way, we have managed to build a successful business that could help Pemex in mapping deepwater infrastructure."

SOLUTIONS FOR FUEL THEFT

During the election year, some processes within the oil and gas industry experienced a slowdown. It is not unusual for the industry to reset itself, just as it occurs to services that are fundamental in ensuring the safety of the country's hydrocarbons, such as pipeline testing. Óscar Luis González Arias, Director for Latin American Operations at NDT Systems & Services, believes this is the main reason for the increase in oil theft in the country.

"The amount of inspection that Pemex does on a yearly basis dropped during 2012 due to the political timing," González Arias explains. This propelled the number of intentional and accidental leaks the industry has seen in the year. "Pemex Refining discontinued the Zero Wall program we implemented ten years ago, since the contract expired and they did not have the budget for a new one. With this program, Pemex had secured its pipelines. Now that it has stopped, illegal pipeline tapping has skyrocketed."

"NDT's operation is to find defects on the pipeline created by the environment or the materials used to build it. However, the company's system detects the illegal taps within the pipelines as a by-product," González Arias describes. "NDT's system is not perfect, since it can only detect the illegal taps in the moment it passes through the pipe. If the illegal tap is created one day after our detection system goes by, there is no way to tell." However, NDT has modified its contracts with Pemex to perform more detailed testing and inspection, and become part of the solution for the fuel theft problems in the country. "The company now conducts surprise inspections on a more frequent basis, and changes the schedule to return to already inspected pipelines. There, the NDT team focuses on finding things that have changed, instead of what they had already discovered."

González Arias suggests that the inspection service that NDT provides could very well complement real-time monitoring systems to eradicate security issues in pipelines. "Real-time monitoring systems let Pemex know when its pipelines have been hit, but do not give the necessary detail as to the exact location. By the time Pemex gets to the point where the pipeline has been tapped, a good amount of crude has been stolen," he details. "With a real-time monitoring and better inspection methods, we can provide faster reactions, and if paired with detection tools, a comprehensive system can be created to diminish fuel theft."

The next step for NDT is up since the contracting environment has improved from the moment President Enrique Peña Nieto appointed his team. "NDT was awarded three contracts by Pemex Gas last year, Pemex Refining is about to release interesting bids, and the company has already secured contracts with players in the private sector such as Gasoductos de Chihuahua, Sempra, and Mayacan," González Arias concludes. "This gives us a new customer, a new player in need of the same inspection requirements, under the same rules."

ZERO MAINTENANCE FLEXIBLE PIPELINES

Juan Ponce Saumel, CEO of Industrias de Tuberías Flexibles (ITF), was quick to respond to the opportunity to introduce a new technology to the Mexican oil and gas market six years ago. "One of the most valuable aspects of flexible steel piping is that maintenance is reduced to nearly zero, which is extremely attractive to the oil industry." After researching the different types of flexible pipe available, Ponce Saumel went with Flexsteel, a technology developed by British company Wellstream, which in 2009 was sold to Prime Natural Resources, a privately owned Houston company. ITF was given the license for marketing Flexsteel products in Mexico, and introducing the technology to the Mexican market has been its primary mission for the last six years.

"Six years ago, Flexsteel pipe was a fresh technology that still needed approval and acceptance from Pemex, but now we are ready to start gaining ground and market share here in Mexico"

Juan Ponce Saumel, CEO of ITF

Flexible steel pipe has a number of uses in the oil and gas industry. Combining a core of steel with corrosion resistance and innovative installation procedures, Flexsteel technology has been used in a number of situations in the country as an alternative to conventional steel pipe. Flexible steel pipe can be particularly useful in situations where saline fluids need to be transported through pipelines, as the PE liner of Flexsteel pipe offers corrosion resistance and therefore removes the need for cathodic protection that would be essential in a conventional steel pipe. However, Flexsteel pipes can be used between two sections of conventional pipe where cathodic protection is being employed, as the current can be transmitted through the steel sections of the pipe which are protected by the PE liner. The PE liner also means that the chance of contamination is reduced to almost zero: whereas gases can permeate conventional steel pipes, they are unable to escape from PE lined Flexsteel pipe, and can be run along the pipe and disposed of safely. This method can be used to securely dispose of H_2S, methane, and CO_2.

"One of the main advantages over conventional steel pipe is, predictably, its flexibility. Curves can be dealt with through the flexibility of the pipe: for example, a piece of 20cm diameter Flexsteel pipeline can be curved at a 90° angle using only 2m of pipe," explains Ponce Saumel. "Flexsteel is the only flexible pipe for onshore use certified with API 17J, which requires the manufacturer to produce pipes with a 20 year lifespan. Regression tests have shown, however, that they can last as long as 50 years with practically no wear."

Flexsteel pipe is an unbonded pipe, which gives it advantages over other flexible pipes in the market, which are usually constructed from fiberglass for this material is not as flexible as Flexsteel pipe and is thus subject to breakages. Whereas fiberglass pipes were designed with deepwater applications in mind, Flexsteel is used in onshore and in shallow water situations.

ITF's first break in the introduction of Flexsteel pipe to the Mexican oil and gas industry was in Villahermosa. Having decided to concentrate on getting Pemex to use the technology, it was an open-minded regional director that decided to test the pipe in a direct assignment contract, in an area where no other technology could be used. "The project was located in a protected region in the delta of the Usumacinta river, where entering to conduct maintenance work was extremely difficult," Ponce Saumel explains. "We used Flexsteel pipe within the existing steel pipe, which was condemned because of a lack of structural and mechanical integrity. This is not the only place where we have laid Flexsteel pipe within existing infrastructure." The rehabilitation solution means that right of way does not have to be renegotiated, which can often be a major headache for operators.

Flexsteel pipe ranges from 2 to 8 inches in diameter, but Ponce Samuel believes that it will soon be available in up to 12 inch diameters. The CEO of ITF has great expectations for the potential of Flexsteel pipe in the Mexican market. In addition to several onshore applications in the Burgos and Poza Rica areas, where Flexsteel pipe is used to transport frac water, oil, gas and condensates, ITF is also working on a technological test for Pemex to see the advantages of using Flexsteel pipe in shallow water. This pipe can be used in water depths up to 100m, and as most of Pemex's shallow water platforms are located in water depths of between 40m to 70m, Ponce Samuel believes that the pipe's introduction will be a revolution for the NOC in terms of reducing maintenance on offshore pipelines.

GROWING MARKET FOR PIPELINE TRENCHING SOLUTIONS

"In the next year there are 40 opportunities available for pipeline trenching solutions in Mexico, out of which we plan to sign at least 16 contracts, which is around 40% of the existing opportunities," José Luis Oviedo Acosta, Business Development Manager for the Americas at Ocean Engineering Systems (OES), says. However, OES is not the only company offering pipeline trenching solutions in Mexico; Reef Subsea, previously known as Rotech, already offers services to clients such as Technip, Swiber, Cal Dive, and Protexa, and is planning to increase revenue by 25% by participating in Pemex projects in 2013, according to Reef Subsea's Country Manager, Edgar Álvarez.

Currently, Reef Subsea is using T8000 equipment for pipeline trenching in Mexico, which generates a large column of water travelling vertically down to the seabed at a velocity of up to 10 meters per second. The effect of up to 8 cubic meters of water per second hitting the seabed at this speed creates a powerful excavation force capable of breaking up stiff clays. Reef Subsea also offers T2000 and T4000 equipment, which are mostly used in the US because of less demanding conditions. Oviedo Acosta, from OES, emphasizes that despite the fact that there are multiple technologies and equipment available for pipeline trenching solutions in Mexico, most of the trenching machines available are copies of machines designed by John Lincoln, the creator of OES. "OES pipeline trenching technology, in comparison to other technologies and because of its jetting nozzles at the bottom of the tool, allows you to dig trenches at the exact required depth, which prevents the tool from cutting more than what it is calibrated to," he adds.

However, one of the largest complications Reef Subsea is encountering in Mexico is establishing and importing all the necessary equipment. In the past the company brought equipment into the country for projects on a temporary basis, but now they are attempting to attack the Mexican oil and gas industry more aggressively. "We have to make proper arrangements to move the equipment from the US to Mexico to perform the service, to import and export the equipment, and deal with all the logistics issues of this process," Álvarez explains.

As Pemex focuses on more deepwater and shallow water exploration and development projects in the Gulf of Mexico and the Bay of Campeche, more opportunities will open up for subsea trenching solutions, and due to their innovative technology, experience, and growth strategy, OES and Reef Subsea are expecting to acquire more contracts with both private domestic and international companies as well as with Pemex.

CORROSION-EROSION MONITORS FOR SUBSEA PIPELINES

Corrosion-erosion monitors (CEM) for subsea pipelines keep operators informed on the level of sand that could cause any potential erosion and/or corrosion damage to pipelines. Pedro Ramírez Jurado, General Manager at Metromex, believes that this state-of-the-art technology is of vital importance to operators in the oil and gas industry. The technology, which is licensed to Metromex by Norwegian company ClampOn, estimates the rate at which corrosion and/or erosion is occurring in pipelines by the use of clamp-on sensors, preventing not only any potential damage to infrastructure, personnel, or the environment, but keeping pipelines functioning at their highest potential. CEMs work by transmitting ultrasonic signals that travel through pipelines and send real-time data back to the operators, informing them of any changes in wall thickness, originating from corrosion or erosion.

Currently, there are two different types of CEMs for subsea pipelines: an ROV-installable mechanism and a pre-installable solution that is installed before the structure is submerged. Both mechanisms offer the same solution and operate in the same manner, offering the same level of reliability and basically functioning on the same principles. The permanently installed CEMs have the advantage of monitoring the pipeline and always eliminating the weaknesses involved in manual ultrasonic thickness gauging. The corrosion-erosion monitor is comprised of eight small transducers, which convert signals in one form of energy to another form of energy, transferring the information to the head unit and generating data on the thickness of the wall of the pipeline.

The state-of-the-art CEMs are most commonly applied to pipelines, pipe components, storage tanks, and plate sections of refineries, chemical plants, power plants, and transport lines. Additionally, the CEMs have an ability to perform measurements on pipe diameters of 50mm upwards, measuring changes of wall thickness of as little as 1%, withstanding changes in surface temperature of -40 to 180°C, and operating in pipe temperatures of -40 to 150°C. Even though this is a proven and efficient technology, Ramírez Jurado finds that there is little interest from Pemex to implement it. However, he believes that it is just a matter of time until this situation changes due to the multiple advantages this technology offers, which includes a wide temperature range, operator independence, an ability to cover large pipeline areas, high sensitivity, easy to install, and most importantly, being designed for a lifetime of operation.

Over the coming years, more technologies like CEMs are expected to be implemented by Pemex in order to improve the monitoring and maintenance of its infrastructure. Besides helping operators monitor the status of pipelines and the effects corrosion or erosion might have on them and their performance, the CEM is also an effective tool in helping operators comply with newer standards and regulations regarding the need for condition monitoring of pipelines and other subsea infrastructure.

INDUSTRIAL OXYGEN SUPPLY AS A STEPPING STONE

Espartaco Acevedo, Head of Projects at Marine Pro-V

After starting as a construction firm in Campeche, Espartaco Acevedo, Head of Projects at MARINE PRO-V, explains that the move to serving the oil and gas industry came when the company moved to Ciudad del Carmen. Today, MARINE PRO-V is structured into four distinct business areas: industrial gases, commercial services, construction, and automotive maintenance and repairs.

Taking on the frontrunners in the industrial gases segment, MARINE PRO-V won a contract to supply industrial oxygen to Pemex, replacing one of the nationwide established leaders in the industrial gases market. “Cylinders are the main asset in the gas business; as a result, breaking into this market is very hard because the initial costs are high. Having a contract with Pemex solves this problem, as your assets are guaranteed, protected and insured,” explains Acevedo. The contract is for the supply of 14-15,000m^3 of oxygen to Pemex per month. It is mainly used in the construction and maintenance of marine infrastructure. Acevedo details that the company does have the intention of remaining an industrial gas provider in the long-term, but rather will take any opportunities that the company can find in the southeast region of the Gulf of Mexico, working in the oil and gas segment. “We believe one of the biggest potential opportunities in the future for MARINE PRO-V will be providing material and equipment to oil and gas companies using Ciudad del Carmen as our base of operations,” he reveals.

CLEAN POWER GENERATION DESTINED FOR EXPANSION

JUAN CARLOS HERNÁNDEZ NÁJERA
Director General of Industrias Energéticas

Q: What have been the main achievements and objectives of Industrias Energéticas since your company started working with Pemex in the Bay of Campeche in 2011?

A: Energy policies implemented by the Federal Government, in combination with Pemex's implementation of its safety, occupational health and environmental protection (SSPA) program, created an environment in which our company could pursue rapid growth. In order to take advantage of the opportunity to provide Pemex with microturbines that meet strict emissions requirements while offering continuous, reliable power in hazardous environments, we have made large investments in the training and certification of our people, adopted advanced industry standards, and are currently in the process of obtaining the ISO 9001:2008 quality management system certification to enhance customer satisfaction and optimize our overall performance.

The 46 Capstone microturbines with 30kW capacity that were initially installed for Pemex provide power to 27 offshore platforms, operating on sour gas and wellhead gas that flows through these offshore platforms, provide power for each platform's SCADA (Supervisory Control and Data Acquisition), fire and gas detection, emergency shutdown, communication, lighting, and auxiliary systems. While we can provide microturbines of 30kW, 65kW, and 200kW, at the moment 80-90% of the microturbines installed on platforms in Cantarell, Ku-Maloob-Zaap and Poza Rica-Altamira have a capacity of only 30kW. Our intention is to introduce more higher capacity microturbines, which can offer our customers more versatility and power, and therefore be used in offshore applications that are currently powered by diesel generators or conventional generators. Our goal is to enter that market and replace 100% of these generators.

We have already installed larger size microturbines in Cantarell, including two 65kW C65 microturbines on the Akal C production platform, and a 1.2MW configuration on the Ixtoc-Alpha platform. The latter platform is famous as it is the location of Mexico's worst oil spill following a blowout that resulted in 3.3 million bbl of oil being spilled into the Gulf of Mexico in 1979. To avoid problems with Mexico's federal environmental protection agency (Profepa) and the Ministry of Environment and Natural Resources (Semarnat), Ixtoc-Alpha has been a priority in Pemex's SSPA program. In consequence, Pemex selected a configuration of six C200 microturbines to power its drilling pumps there. We believe that the results of this project will have a profound impact on the decision making process for power generation infrastructure on other platforms, since microturbines do not only substantially reduce its maintenance costs (since our turbines only have one moving part, no gearbox or other mechanicals, and use no lubricants or hazardous materials), they also enhance flexibility as they can easily be relocated to another platform due to their lightweight and compact design. Besides the current offshore applications, microturbines can also be used for cogeneration and trigeneration in other locations, but the application of our technology depends on the needs of Pemex.

Q: How do you approach the challenge of introducing new power generation technology to Pemex?

A: The main reason why Pemex and its contractors are hesitating to change to microturbines is the initial purchase cost. However, this cost is balanced by the reduced maintenance costs throughout the lifecycle of a microturbine, which requires maintenance every 8,000 hours, while a diesel generator generally needs to be serviced every 700 hours. Based on our proactive monitoring system we are able to provide preventative maintenance during checks at 8,000, 20,000 and 40,000 hours to ensure that our microturbines reach their expected lifetime of 40,000 hours, after which the engine and several components need to be replaced.

To address the challenge posed by the initial purchasing price, Industrias Energéticas is working hard to become an integrated service provider. The main innovation lies in the way we provide our equipment to the customer. Rather than purchasing microturbines, we are offering Pemex the opportunity to rent clean power generation capacity from us. This would enable Pemex to minimize its investment in power generation equipment and reduce its carbon emissions. At the same time, this would facilitate the replacement of conventional generators by clean microturbines, and provide Industrias Energéticas with

access to a larger number of Pemex locations. For example, we are aiming to introduce microturbines for separation batteries in the onshore Poza Rica and Tabasco areas.

Q: What are the prospects of Pemex including a maximum CO_2 emission per kWh in its tenders for power generation equipment?

A: Mexico's General Law on Climate Change, which was published in the Official Gazette of the Federation on June 6, 2012, states that it is the obligation of any government entity to give priority to the procurement of equipment that minimizes pollution, offers added value, and applies advanced technology. We are still in the education phase, and Industrias Energéticas is actively participating in this process. Since the people in charge of drafting the public tenders for Mexico's government entities are not fully aware of the capabilities and performance of our equipment, the appropriate technical specifications do not necessarily appear in these tenders. Industrias Energéticas seeks to be part of the change that is taking place at the national level to protect our environment, not only by offering low emission power generation solutions, but also by helping Pemex and other stakeholders to change their way of thinking and move towards this new paradigm.

NEW BUSINESS MODEL FOR SEPARATION SERVICES

Created from the expertise and human resources of IFAMESA, part of the former Mexican industrial giant Bufete Industrial, Octopus Group had clear experience with Pemex in a number of industrial areas from day one of its creation. Two of IFAMESA's strongest areas in its business with Pemex were the production of pig launchers and separators. Today, both of these are strong areas for Octopus, but it is the separator business that the company has really developed in recent years to add move value to its offering. "Today, we have moved from simply providing separators to the market, to creating tailored products that include valves, instrumentation, and piping. These can also be places on skids, ready to plug in and go," explains José Pablo Mendoza Escalante, CEO of Octopus Group. Separators are used at the wellsite to divide well fluids into gases and liquids. Gravity is the normal method used to achieve separation in the units, where the heavy fluid sinks while the less dense fluid moves to the top of the separator.

"By using companies as separation service providers, Pemex would be able to pay a service provider for the amount of gas separated rather than paying for multiple separator units"

José Pablo Mendoza Escalante, CEO of Octopus Group

Mendoza Escalante is extremely optimistic for Octopus's separation business, and hopes that in the future, Pemex will approach separation in the same way that it currently approaches drilling. "Right now, Pemex contracts drilling services to third parties as a service – they do not buy the drills and drill themselves, particularly in complex areas. We hope that something similar will happen with separation. We just have to work with the operational side of Pemex to help them convince the executive levels of the company to try using companies like Octopus as their separation service providers, rather than just buying the equipment from us." Mendoza Escalante says. "This will have particular value in regions like Chicontepec, where wells have a relatively short life cycle, and Pemex would be able to pay a service provider for the amount of gas separated rather than paying for multiple separator units. Octopus can leverage its highly portable separator units to maximum advantage in a region like Chicontepec." Although separation activities are important for Pemex, Octopus's portable units have many different possible applications beyond separation, including lubrication, cooling and gas control units for power turbines, gas measurement, chemical injection units, dehydration and desalination units, as well as de-sanding activities, and produced water treatment, something that will grow in importance in Mexico once the country starts to produce more unconventional resources. Furthermore, Octopus Group is participating in Pemex's gas flaring reduction project, using the associated gases to produce electricity instead of burning them.

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EVOLUTION OF SAFETY SOLUTIONS

José Luis Kuri Con, Commercial Director of Vallen

"In the past, oil and gas companies believed safety was an unnecessary expense, but nowadays, due to a variety of reasons, it is seen as a vital investment," says José Luis Kuri Con, CEO of Vallen. This mentality shift has allowed Vallen to not only find new opportunities in the safety industry, but allowed the company to change its focus from being a safety equipment and services provider to offering integrated safety solutions.

Vallen began operations in 1985 with the buying and selling of safety equipment for the automotive, manufacturing, steel, and pharmaceutical industries, but after recognizing the potential opportunities the oil and gas industry offered in the city of Tampico, the company began providing polycarbonate safety equipment to Pemex. "Up until 1996 we functioned with many limitations and boundaries; we could only offer safety equipment, but with the appointment of Carlos Razo as director of Pemex's new drilling unit – which had as one of its main objectives the improvement of safety performance in upstream activities – we were able to adapt our strategy," Kuri Con recalls. There was a great opportunity for Vallen, since oil and gas related accidents in Mexico were 10 times higher than the international benchmark. After conducting various safety studies, the company started offering Pemex an integrated solution to its safety problems. "We had an epiphany and decided to change the core of our service," he adds.

Vallen was very familiar with the safety equipment Pemex needed for exploration and production, but had never been involved in the end product: preventing accidents to Pemex personnel and infrastructure. Vallen created an integrated solution based on software with the ability to organize the necessary equipment by size, condition, area, and quantity. "With this specific software we were able to establish the needs of each worker in each area, understand the risk they encountered in their daily jobs, create a distribution network based on the information acquired, and minimize the safety risks Pemex personnel faced," details Kuri Con. He explains that by mapping all wells and drilling equipment, interviewing over 8,000 Pemex personnel, and analyzing the information using a statistical package with experts in various fields – including industrial security, psychology, statistics, and environmental safety – they were able to identify and reduce the risk posed to the infrastructure and human resources of Pemex and other companies in the oil and gas industry. Once the risk study was completed, Vallen hired a group of specialists to develop guidelines, manuals, and procedures regarding safety, and created a training group in charge of educating workers. The goal was to help Pemex's drilling and well maintenance unit reduce accidents to international benchmarks in five years. "We are extremely proud of achieving the goal in less than two and a half years, which also speaks of Pemex's commitment to safety and security," says Kuri Con. "When we began working with Pemex, the accident rate was 24 accidents per million man hours worked and we managed to reduce this rate to 2.8 by controlling the supply of the correct equipment in combination with consulting and capacity building courses.

"Vallen's new philosophy of offering integrated solutions worked perfectly; instead of selling products to fulfill the equipment needs of our clients, we sell equipment and solutions to diminish risk and avoid accidents," states Kuri Con. However, Kuri Con believes there is more work to be done, since political issues and bureaucratic processes at Pemex have led to the rupture of this positive trend and many companies that have been awarded contracts are not performing at the required safety levels. Nonetheless, Kuri Con is a firm believer in Mexico's ability to reach international benchmark safety standards because there is a continuous desire from Pemex to improve safety and security, but also due to the level of standardization of safety processes worldwide. "Safety standards, with the help of globalization, have been homogenized. Every free trade agreement or economic cooperation includes them, as well as regulations with regard to the environment, infrastructure, financial, and human resources," he emphasizes. Additionally, the presence in Mexico of international companies with the highest levels of safety and security – such as Dupont, Schlumberger, and Halliburton – serve as a reference and inspiration for Mexican companies to strive for both success and safety.

"Vallen is currently a diversified company, where oil and gas constitutes 22% of our sales, automotive 32%, mining 11%, and the remaining 35% is divided between the petrochemical, pharmaceutical, and telecommunications industries, successfully protecting over 95,000 Mexican workers" says Kuri Con. Furthermore, Vallen is expecting to continue growing in the future because of a continuing mentality change in Mexico. "Organizations in the country nowadays view safety as an investment because it does not only protect infrastructure and processes, but also because it protects what Mexican companies have come to understand is their most valuable asset: their human capital," he adds.

THE CONSTRUCTION OF EXPERTISE OFFSHORE

Partnering with a local company is a frequently used strategy by foreign companies to enter the Mexican oil and gas industry, enabling them to shortcut the lengthy process of understanding the way that the local markets operates. In return, the local company gains access to international technologies and best practices. Mexican company AlmaCid has built this concept deeply into its business strategy, to the extent that without it, they would not be able to come close to achieving their goals for growth.

In the course of its 23-year history, AlmaCid has expanded its construction business to new areas such as off-road construction, civil work, infrastructure, equipment, and most recently offshore infrastructure development. "The offshore business is the newest division of the company; it has only been operating for two years," explains Alejandro Gutiérrez Cortés, Director General of AlmaCid. He recognizes that the only way for AlmaCid to fully develop this new business activity is with the help of experienced international partners.

"AlmaCid shares its expertise of working with Pemex in exchange for the knowledge that international companies provide"

Alejandro Gutiérrez Cortéz, Director General of AlmaCid

Gutiérrez Cortés describes the process by which AlmaCid approaches the challenge of entering a new sector and making the business as attractive as possible for finding international partners. "Whenever the company sets out to open a new division, the process before startup includes a research stage to strengthen our knowledge in the field. We look for assistance and advice from industry experts to get the necessary understanding that will allow our new division to hold its own in the market and grow," Gutiérrez Cortés details. "With the oil and gas construction market only being served by a modest number of main players, we believe that as the company accumulates the necessary knowledge to serve as an anchor for its future partners, opportunities will come."

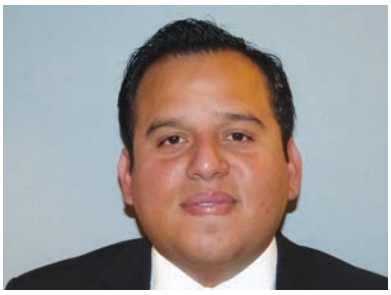
For AlmaCid, the planning stage before launching the division is crucial. "Our objective is to become specialists in every sector we work in. We are focused on technological growth in order to excel at our role as partner to international companies, and provide the added value that they need to reassure themselves," Gutiérrez Cortés states. "After two years, we now have the knowledge of how Pemex operates internally, and the administrative, safety, and environmental standards required to successfully work with them." With knowledge in both the construction sector and the way Pemex operates, AlmaCid is now looking to manage local operations for international partners. There are a number of opportunities in offshore infrastructure development, including dismantling existing platforms, transporting them to land, and adjusting them to international specifications.

The last component that aids AlmaCid in its role as partner to international companies is its approach to the promotion of innovation. Technology is a major component in the growth equation for the Mexican industry, and the country is currently at a transition stage where it needs to import international best practices and leading edge technologies from other countries. Mediators such as AlmaCid play the role of identifying the technology gaps, identifying the technologies that are best positioned to meet the particular challenges facing the industry, bringing these technologies to the country, helping Pemex to overcome its operational challenges, generating knowledge spill-overs for domestic companies, and developing additional national content.

"We bring technological development through our joint ventures with partners from international backgrounds," Gutiérrez Cortés says. By providing Pemex with useful technologies from foreign companies, while facilitating their contact with the NOC, the country matures in its technical knowledge. "AlmaCid shares its expertise of working with Pemex in exchange for the knowledge that international companies provide," he explains.

AlmaCid's role tries to capitalize on the international interest in the Mexican oil and gas industry, and helps Pemex to gain access to international technologies and best practices at the same time. Building such bridges between Pemex and foreign companies is destined to be a critical success factors for the sustainable development of the industry.

THE PORT OF ISLA DEL CARMEN



"The Port of Isla del Carmen is not only one of the main oil and gas ports in Mexico, but also the busiest port in the country with over 16,000 arrivals per year"

David Uribe Haydar, Administrator of the Integrated Port Administration of Campeche

"Even though Isla del Carmen is already an important port for Mexico, the Governor of the State of Campeche is aiming to further develop this oil and gas hub, says David Uribe Haydar, current Administrator of the Integrated Port Administration of Campeche (APICAM). "He is devoted to improving and developing port infrastructure at Isla del Carmen, with a specific emphasis on building infrastructure that will help consolidate Campeche as a logistical, administrative, and service center for the oil and gas industry."

The Port of Isla del Carmen, located at the entrance of the Términos Lagoon in the Gulf of Mexico, was originally created for fishing and commercial activities; nevertheless, over the years it has been modified and adapted to incorporate logistical services for all type of vessels supporting Pemex's offshore activities. Currently, the Port of Isla del Carmen has 157,627m^2 of land and 209, 871m^2 of water surface, 48 water-front office spaces for rent, 35 interior offices for rent with storage rooms, restaurants, shops, and more office space, 184 supply vessels and passenger boats, 1,230 arrivals on average per month, and a passenger terminal with an ability to hold 1,800 to 2000 people.

Besides being a strategic port for all oil and gas operations for Pemex's Southeast Marine Region, the Port of Isla del Carmen has made Ciudad del Carmen one of the most important economic centers in Mexico because of all the jobs, infrastructure, schools, restaurants, and hotels that the oil and gas business has brought to the city. "Besides its economic growth, Ciudad del Carmen has had an educational boom in the last five to 10 years," asserts Armando Rodríguez García, Director General of the Mexican Chamber of Marine Transportation Industries (Cameintram). Today, the University of Ciudad del Carmen is offering undergraduate and graduate studies in fields such as petroleum engineering and marine affairs, and the city's school system has been greatly improved to meet the rising demand of Mexican and international workers who moved to Ciudad del Carmen to participate in the development of its oil and gas industry.

Even though the Port of Isla del Carmen currently receives the highest number of vessels in Mexico, if it wants to compete with larger federal ports such as Dos Bocas and Coatzacoalcos, it must improve its current infrastructure and construct new buildings. Although Ciudad del Carmen has the competitive edge of being the closest port to Mexico's main offshore fields Cantarell and Ku-Maloob-Zaap, this will not be a simple task, according to Uribe Haydar, because the current financial situation of the state of Campeche is fragile and there is not enough money to invest in state-of-the-art port installations. "Nonetheless, with the help of Pemex, the federal government, and Apicam, Campeche could potentially find the resources to modernize the port of Isla del Carmen and compete at a national level," argues Rodríguez García.

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FUTURE OF THE MEXICAN SHIPBUILDING AND MAINTENANCE INDUSTRY

LUIS OCEJO RODRÍGUEZ
Senior Managing Director of Maritime Transportation at Grupo TMM

Q: What were the highlights of 2012 for Grupo TMM?

A: The project where we achieved the most progress is the shipyard in Tampico. Our goal was to increase the capacity of the yard and expand into other areas such as construction and maintenance for larger vessels. It was a difficult year, but we were successful in advancing our maintenance capabilities for offshore vessels, we delivered a rescue and salvage vessel for Pemex, we also successfully modified our DP2 and FIFI2 vessels, and got our rescue and salvage certification. We are very proud of all these achievements because they were accomplished at our Tampico shipyard using Mexican labor, which proves Mexico's ability to move forward and create a competitive shipbuilding industry.

Q: If Mexico has strong shipbuilding capacity, why is Pemex awarding contracts to foreign companies?

A: Pemex is awarding shipbuilding contracts to foreign companies because the Mexican shipbuilding industry does not have enough experience, but since the industry is consolidating through the Mexican Chamber of Industrial Shipping (Camin), I feel we are moving in the right direction. Mexico has not been building vessels for a long time, so it was an easy decision for Pemex to go to Spain for the production of its ships. We feel we have the capacity to build vessels that meet Pemex's needs, so it is only a matter of time before they start awarding contracts to Mexican shipyards. Based on my shipbuilding experience as a naval architect, I believe that we have enough specialized people and the capacity to succeed in the shipbuilding industry; we just need an opportunity to prove ourselves.

Q: What are the main competitive advantages Mexican shipyards could have over international shipbuilders?

A: Right now we do not have many advantages. International shipbuilders have much more experience and knowledge in shipbuilding. Our only advantages are that the new government will be interested in creating jobs and obtaining taxes from the industry, which will create work for us. The second advantage is that we have been working with Pemex for years, so we know exactly what they want and what they need with regard to equipment, technology, and safety requirements.

Q: What role will the creation of Camin play in reviving and strengthening the Mexican shipbuilding industry?

A: The most important thing is to unite the industry and have one voice: to work as a single group. If we succeed in this, it will be a great step forward for the Mexican shipbuilding industry. Regarding the main points of the Camin agenda, we are trying to find out what shipyards exist in Mexico and what production capacity they have. Secondly, we have to work on finding financial support for the industry. It is very hard for Mexican shipyards to get any type of funding because the industry is just starting to take off, but if we sign contracts with Pemex we would definitely find the necessary financial support. This matter is being discussed in order to prepare the industry for future opportunities, since it will be hard to get any contracts without finance, and vice versa. There have been some changes in the law that have already increased the amount of money banks can guarantee, and they seem to be less skeptical about the shipbuilding industry, since they are apparently more willing to finance our shipyard activities.

Q: What would be the impact of this revival for the Mexican economy? And what areas would benefit the most?

A: We do not have any data on the exact number of jobs that could be created, but we are working on that to produce a report. The regions that will benefit the most are those on the Gulf of Mexico, more specifically Tampico, Veracruz, and probably Coatzacoalcos. On the Pacific coast I think the main port that will profit is Mazatlán and maybe Ensenada, but the Gulf Coast will benefit the most, since moving ships from the Pacific to the Gulf is very expensive.

Q: What will be the role of Grupo TMM in bringing new technologies and further developing national content?

A: First of all, the knowledge we acquire from Pemex will play an extremely important role. Also, our dealings with companies abroad, the reputation we have in Mexico, and the fact that we are financially stable allows us to be at the forefront of Mexico's shipbuilding development. I strongly believe that 2013 will be a prosperous year for Mexico, for shipyards and for Grupo TMM; we are extremely excited about all the opportunities coming our way.

PEMEX PLANS TO ACQUIRE A SPANISH SHIPYARD

In the beginning of May 2013, Pemex sent a letter of intent to shipyard Hijos de J. Barreras (HJB), a shipyard on the Atlantic Ocean in Galicia, Spain, to acquire 51% of the company's stock. According to the letter signed by Pemex directors, the main goal behind the acquisition of the Spanish shipyard is to "transfer the technological knowledge of Hijos de J. Barreras shipyard to meet Pemex's growing demand for specialized vessels, and in the near future, offer Mexican shipyards the capability and technological knowledge to meet such demand."

It is being argued that Pemex should be focusing on fostering the Mexican shipbuilding industry by investing at home instead of investing in foreign shipyards. Despite the fact that Pemex claims the investment in the Spanish shipyard is meant to foster the Mexican shipbuilding industry through technology and knowledge sharing, many people seem skeptical about this. During the administration of President Felipe Calderón (2006-2012), Pemex awarded Hijos de J. Barreras shipyard a contract to build a floating hotel – or flotel – worth US$190 million; however, due to the financial problems of the shipyard, the construction of the vessel has been jeopardized. People seem to question Pemex's investment for a variety of reasons. Pemex is not only seen to be awarding contracts to companies without the financial capability to see them through, but its strategy might appear to run contrary to the anticipated renaissance of the Mexican shipbuilding industry: instead of providing jobs, raising local and federal taxes, fostering economic growth, and rebuilding an industry that has been virtually inexistent since the 1980s, Pemex is planning to invest in a foreign shipyard that is in the process of exiting bankruptcy proceedings.

Pemex and the HJB shareholders would provide the company with sufficient working capital to resume operations. Pemex claims this is an advantageous move for the NOC and for Mexico because they are acquiring a highly technological and capable shipyard that will allow Mexican shipyards to learn from their Spanish counterpart while at the same time providing Pemex with its much needed vessels.

VESSEL DESIGN FOR INDUSTRY REBIRTH

Since the 1980's, Mexico's shipbuilding industry has been virtually inexistent. However, Pemex's recent announcement that it will acquire 21 Mexican built vessels for its offshore operations, has brought about talk of a renaissance of the country's shipbuilding industry. In addition to the big players in this industry, smaller companies such as Seamac Marine Solutions are eager to be at the forefront of the industry's rebirth. The company, located in Mazatlán, Sinaloa, specializes in providing maritime solutions for the Mexican and international markets. In the past years, they have been involved in the production of two X-52 meter aluminum offshore crew vessels that service the Gulf of Mexico's oil and gas industry and two X-35 meter steel buoy laying vessels. "These modern designs are just in time to assist the local market in its march forward", commented Colin McDonnell, Director of Seamac Marine Solutions. "We have received a flurry of inquiries about our services and these designs in the wake of a recent announcement made by Pemex." The availability and timing of these designs has kindled the flame of interest amongst Mexican shipyards whose ambitions are in line with Pemex's new fleet construction project. According to Seamac Marine's

Director, "we have an ability to provide professional services to shipyards, operators, and vessels of all shapes and sizes and we have experienced maritime professionals and an extensive international supply network with the necessary experience, expertise, and resources to offer a cost effective solution to ensure budgets are maintained and productivity levels are maximized."

"It is such an exciting time to be in the naval industry here in Mexico, since so much is happening and it all starts with a design, which we can provide," says Marketing Manager of Seamac Marine Solutions, Nicholas Kinzie.

LOOKING FOR SHIPPING OPPORTUNITIES IN THE OIL AND GAS SECTOR

RUDOLF HESS
President and CEO of RH Shipping

Q: What are the origins of RH Shipping, and what role do you aspire to play in the Mexican shipping industry?

A: RH Shipping was founded in 1996. The company was created to be an international shipbroker serving the steel industry. In 1999, we were even active in steel trading, when we sold more than 100,000 tonnes of steel billets from the Ukraine to one of our clients; however, we were too focused on Mexico and the steel industry, so when the Asian financial crisis came in the late 1990s and Korean steel flooded the market at extremely low prices, our business almost disappeared, because Mexican steel exports collapsed. At that moment, we decided to diversify our ship brokerage activities to include clients that handle heavy-lift and industrial projects, and general break bulk and bulk cargos.

After successfully implementing our initial diversification strategy, we continued to expand and diversify our activities to include non-vessel operating common carrier (NVOCC) and international freight forwarding services to be able to attend the project forwarding business and handle goods through all transportations methods: air, sea, land, and multimodal transportation. Today, our activities include those already mentioned, plus customs brokerage services, cargo insurance consultancy, packing, supply chain, and warehousing.

Q: How did the diversification strategy facilitate your entry into the oil and gas industry?

A: In 2010, we decided to open a company in Houston to be closer to the oil and gas industry. Today we are ready and have the expertise to further develop our oil and gas portfolio to not only include the transportation of goods, but to also participate in supplying vessels for the offshore activities of Pemex and their service providers in the Gulf of Mexico.

Q: Which type of major projects have you executed for the oil and gas sector in Mexico?

A: We transported almost 20,000m³ of dismantled LPG spheres on a modern multipurpose cargo vessel for Zeta Gas from France to their terminal at Ensenada in 2010. We have also transported land-based oil rigs from the US to Mexico on a port-to-door basis. We have not been very much involved with Pemex, though. We have tried to acquire contracts from Pemex Refining to charter 40,000 tdwt tankers for their costal trade needs, but we were not successful.

Q: What specific services are you planning to offer the oil and gas industry going forward?

A: Apart from transporting goods and offering industry-related services to oil and gas companies, our idea is to further diversify our activities and begin participating in Pemex tenders to charter fast crew boats, platform supply vessels, anchor handlers, and other equipment needed for the offshore and drilling business. We would also like to participate in supplying goods to the platforms, such as diesel, barite, fresh water, spare parts, cranes, food catering, and so on.

Q: Do you have any, or are thinking of obtaining, quality or safety certifications?

A: Today, we do not have any safety or quality certifications because we have never needed them. However, we would not have any trouble obtaining them if necessary, since we are more than qualified and prepared in every respect. Nevertheless, we are somewhat skeptical about the benefits of certifications, since we have seen that companies have become more bureaucratic and less flexible as a result of meeting the administrative conditions required for certification. Before pursuing certification we would have to analyze the negative and positive impact this could potentially have on our company and go from there.

Q: Why are you so optimistic about your opportunities in the Mexican oil and gas industry?

A: We believe that the people who are currently working at Pemex will bring positive change and development. Emilio Lozoya has a different approach to past Pemex CEOs. He wants to make a lot of changes and is in favor of further energy reform. With his kind of leadership Pemex will be more flexible and this will lead to more business opportunities for the private sector. He represents a new generation that wants to clean up shop and do the right thing for Pemex and the country.

PORT OF DOS BOCAS: THE CHALLENGE OF LOGISTICS

Roberto de la Garza Licón, Director of Port Authority of Dos Bocas

In February 2013, the port of Dos Bocas reached a milestone in its operational history by welcoming Elegant Sky, the biggest merchant vessel to ever dock at its piers. The vessel had a cargo of 3,900 tonnes of pipe for a rig that is under construction by Grupo Evya, at its specialized terminal. "It makes us proud that the Elegant Sky, a vessel of such dimensions, can now dock at Dos Bocas," states Roberto de la Garza Licón, Director of Port Authority of Dos Bocas. "It means we are opening ourselves to a new market. Before, vessels of such dimensions would have to go to Altamira, one of the biggest ports in Mexico, to unload their cargo, which would then have to be transported by land." Reaching such a milestone has brought new goals and challenges. "We cannot stall, we have to keep growing; the Elegant Sky, being 189.94m long, is at the size limit that the port can accommodate. We have to develop additional infrastructure to be able to receive bigger vessels and open Dos Bocas to a whole different market. Our target right now to expand our capacity to be able to accommodate vessels of up to 200-210m in length," De la Garza Licón explains.

Last year, the port experienced vertiginous growth, mostly due to the completion of its multipurpose dock. Before its conclusion, the port was saturated with about 98% occupancy, but the new dock lowered this to around 65%. De la Garza Licón believes it still is not an optimal situation – which would be 45-55% – but it is an achievement. The second pier enabled the Port Authority of Dos Bocas to diversify operations and cargo, and now it is planning a third pier. The port's core business is still the oil and gas industry, but the multipurpose dock has enabled it to diversify its commercial activities. Dos Bocas has become a commercial outlet for other Tabasco products, such as sugar exports.

The first phase of the 70 hectare oil-related industrial park was finished last year, which involved the multipurpose dock. Currently, the second phase is underway. It involves the completion of a 5MW electrical substation – with a federal government investment of US$3.015 million (MX$40 million) – that will guarantee energy access for the companies in the industrial park. However, the biggest challenge is connectivity between the industrial park and the port. "Distance is not an issue," De la Garza Licón explains. "Our aim is to connect both through a railway that does not have weight or volume limitations. This is where the synergy between both projects dwells. The companies that do not use the dock intensively, or that support related activities, can be located in the industrial park and, at the same time, be self-sufficient and have access to all services. This strategy will expand activities and help us avoid saturation in both the terminal and the land around it."

De la Garza Licón believes 2013 will be a complicated year in terms of the port's internal logistics due to the number of operations, clients they are currently serving, and prospective customers. A good example is Grupo Evya, a port concessionaire who is building rigs and is employing an average of 1,000 workers. The logistics needed to satisfy their needs are quite a challenge in terms of operations, personnel transportation, and management. "We have to be efficient with our infrastructure to avoid hurting our clients' competitive advantages," he adds. Seabed stabilization is also an important issue. So far the port has moved 300,000 tonnes of mud, but it still is a work in progress.

De la Garza Licón has a long-term vision about the work being done at the Port of Dos Bocas: "We have created and developed new infrastructure. However, it is not just about growth, but about growing in an orderly fashion. Today, we are planting the seed for the future," he emphasizes. "It is not a job for the next two years but for decades and generations to come. We have to be careful and not replicate the mistakes made in older Mexican ports, which, due to lack of planning and a long-term vision, were encased by the service providers, making further expansion impossible. Our goal is to work together in constructing and planning for future needs and challenges." The port's main concern is accommodating its clients and organizing all the port activities to optimize efficiency and competitiveness. "Our competitiveness lies in effective logistics, which in turn, will make our clients more competitive and efficient. We owe them that because they bet on us when they decided to become our partners," de la Garza Licón concludes.

MEXICO'S PETROLEUM MERCHANT NAVY

ARMANDO RODRÍGUEZ GARCÍA
Director General of Mexican Chamber of the Marine Transportation Industry (Cameintram)

Q: What are the highlights in the history of the marine transportation sector in Mexico?

A: There have been two merchant navies in the history of our country. The first, dating from José López Portillo's presidential term (1976-1982), had a primary focus on cargo transportation of Mexican origin. The long-term contracts issued during this time allowed shipyards to build different kinds of vessels – bulk ships and mineral ships, among others – and also gave maritime transportation companies a sense of economic security. When most of these state-owned companies disappeared, the old merchant navy evolved into a petroleum merchant navy, as 97% of its business is oil-related.

Q: What is the role that Cameintram and its members play in the Mexican marine transportation industry?

A: Not everyone is worried about the development of the Mexican merchant navy, and this is why some people have tagged the chamber as an exclusive club of sorts. However, companies are starting to worry about the future of the industry, not due to the emergence of a particular problem, but as proactive companies looking for the growth opportunities for the marine transportation industry. This is one of the main objectives that Cameintram is constantly lobbying for by meeting with our members and key stakeholders in the industry. We are talking about proactive people who look for the association and its members to achieve their objectives while focusing on improving the industry. Cameintram has stopped acting just as a representative and has expanded its functions to bigger purposes with the aim of creating a better merchant navy. Cameintram divides its membership into three different categories: ship owners, operators, and service providers.

Q: How does Cameintram help its members to further develop their business relationships with Pemex?

A: Cameintram acts as the intermediary for our members in the general issues they have with Pemex. Our main function is to create a link with the different Pemex contracting areas to help make the bidding process more transparent. Pemex E&P usually consults Cameintram, and submits an application requesting the specific maritime equipment it will require. The association's role is to then obtain information about the equipment that our members possess and how these can satisfy Pemex's requirements. This way, Pemex gets a list of Mexican alternatives to fulfill their contract requirements. Besides this, Cameintram also bolsters activity within the industry, ensuring that there are always Mexican vessels available for the industry's needs. The association anticipates Pemex's needs and publishes them periodically so that different companies can be proactive in fulfilling equipment requirements for the future.

Q: How successful has Cameintram been in developing the correct operationing environment for its members?

A: Cameintram promotes, protects, participates in and anticipates Pemex E&P's needs to ensure that Mexican shipping companies can take part in every bid. We also ensure that basic regulation of the maritime industry is adhered to. Mexico's maritime sector has its own version of the Jones Act, with the main difference being that coastal shipping can be done by foreign vessels: a 49% share is allowed for foreign companies under the regulations. The chamber works as a mirror to reflect compliance with the sector's regulations, enabling the Mexican market to compete against international competitors. As a Mexican chamber, though, we will always have the aim of giving domestic companies an advantage on all bids. When there are no Mexican alternatives, however, we encourage Pemex to find a foreign company to fulfill its requirements.

Q: How is Cameintram contributing to optimizing safety performance in the maritime transportation industry?

A: Mexico complies with all international safety standards, and often goes well beyond international norms. All maritime safety treaties and protocols are met, and we intercede through the safety experts on our technical committee. Cameintram has been collaborating with Pemex E&P for 23 years on safety-related topics so there is consistency in the safety checks they perform. We have learned that safety at sea is of the utmost importance: the protection of human life is the best investment there can be made. Fortunately, Mexican operators have invested greatly in safety, and in personnel training.

CATERING FOR THE MEXICAN OIL AND GAS INDUSTRY

Although hiring and retaining well-trained personnel is widely recognized as an important success factor, the importance of keeping employees satisfied and able-bodied might be overlooked at times. Increasingly, the choice of a healthy diet is considered an untapped opportunity to secure additional productivity from the workforce. A lack of nutrients can result in people working at a fraction of their capacity and reduce output on the job, while concentration lapses can in turn affect safety performance. In the long term, poor dietary choices not only lead to reduced functionality but also are a primary source of weight gain and related health problems, which in turn results in inefficient circulation that ultimately causes increased fatigue and affects productivity.

Mexican companies in the oil and gas industry are gradually moving from hiring catering services simply to meet their workers' daily calorie needs, to providing a balanced diet for their employees in order to optimize productivity. "The main challenge is to look for healthy and nutritious diets at a reasonably low cost; the same cost at which fast food might be acquired," Fausto Muñíz Patiño, President of Grupo PAE, the umbrella company for Contempo. "It is all about bringing quality food to the place where employees operate, taking care of their productivity and economy."

"We are convinced that good nutrition has a big influence on the global performance of oil and gas companies"

The provision of healthy diets has become a trend in the industry to keep operational downtime referring to employees' wellness to a minimum. The requirements have to be in line with food industry regulations regarding health and safety practices. "Today, food has to be ready on time, with good flavor and presentation, as well as with certain nutritional requirements," Muñíz Patiño describes. "Food quality is primarily dependent on the production and packaging processes, and logistics," adds Marcelino González Yáñez, CEO of Catering & Hospitality Services Mexico (CHS). "Using the correct infrastructure for storage and transportation is crucial to prolong the expiration date of provisions and keep food fresh. The challenge, however, lies in managing the chain from the product acquisition, its careful preparation, the correct packaging process, and the hygienic delivery to remote locations with altered conditions," González Yáñez says. "Currently, we are working on acquiring equipment where we can transport and prepare all types of food so the consumer has varied choices at each meal. The aim is to offer a variety of juices, salads, and hot meals with an expiration date of 5 to 10 days so they stay fresh without conservatives, because the products are not frozen."

However, logistics are not the only challenge catering companies are facing. Improving employee health through dietary improvements requires cultural adjustments to address widespread unhealthy eating habits that – according to the Organization for Economic Cooperation and Development (OECD) – has caused 69.5% of the Mexican population aged 15 or older to be overweight or obese. "We are using color schemes to help consumers control their daily caloric intake," González Yáñez emphasizes. "With this, each employee will be able to select a personal menu based on color quotas for calories, and be able to combine different type of foods without exceeding daily calorie intake, according to body type, age, and physical exercise. To facilitate a healthy lifestyle for those seeking to improve their eating habits, we also provide other educational tools, such as software programs, that our client's employees can use to achieve their nutrition targets. We can summarize it as a training program, and that is the added value we provide to our costumers."

Contempo has also specialized infrastructure to provide their services in remote locations, meeting time, cost, and form requirements. "Our company has the expertise to generate alternative menus that contribute to labor productivity through smart, balanced diets that meet the necessary requirements of each operation," Muñíz Patiño explains. "We always use local produce, and useful mobile kitchen equipment to reach remote locations, while keeping the food clean and fresh." The operation, which can be carried all around the Mexican territory, usually begins by locating the specific zones where the food will be prepared and installing the equipment to clean and cook food. "Local cooks are hired to tropicalize flavors to the regional preferences and the company's nutritionists organize diets to fill requirements on a 24-hour-a-day basis," Muñíz Patiño points out.

CHS also offers nutritionists on a weekly or monthly basis to enhance a healthy diet culture. "Our company focuses on a top-down approach, since people in the top positions usually make the diet decisions," González Yáñez remarks. "We provide the necessary tools to help companies supply a good diet for their workforce and maximize their operational uptime and productivity."

HEALTHY NUTRITION FOR A PRODUCTIVE INDUSTRY

MARCELINO GONZÁLEZ YÁÑEZ
CEO of Catering & Hospitality Services Mexico (CHS)

Q: How has the role of catering services in the oil and gas industry evolved in recent years?

A: The catering industry originally had little to no importance: in an attempt to save money, companies would just buy supplies at the supermarket, and transport them to the location where the operation takes place, and ask managers to organize the preparation of the food. Companies do not usually attribute the necessary importance to feeding their employees in a healthy, hygienic way, and often lack the infrastructure, processes or expertise to do so. They often prioritize cost over employees' well-being, since they are unaware of the risks that a poor diet can cause for their workforces. We created CHS to help companies make healthy food choices that nourish employees and increase productivity levels, while reducing possible productivity loss due to illnesses. CHS works under the highest quality and hygiene standards, both in food preparation and presentation, and takes pride in the quality certifications that guarantee our work.

Q: What have been the highlights in the development of CHS as a company?

A: CHS started out by supplying medicines, fruits, and vegetables, based on the needs of the industry. During the presidency of Vicente Fox Quesada, the company won its first tender to supply a children development center of Pemex in the Northeast Marine Region. At the same time, CHS won the contract for Pemex's hospitals in the southern region, where we provided supplies under a diet-based nutrition service. We were awarded the Mesozoic project from 2004 to 2006, which was based on completely different logistic: the food was to be produced at a basecamp and distributed to the locations where diverse workforces were executing their operation. In 2007, CHS started to work with contractors, first with Halliburton and currently with Schlumberger. To the latter, we have been providing movable kitchens for on-site food production instead of cooking in a central location and then distributing the food to different sites. We have developed exclusive infrastructure for Pemex contractors that complies with all the quality, hygiene, and health regulations necessary for a healthy diet. As part of our quest to innovate, we have established an integrated operations center from which we support on-site service, providing goods and personnel services. We also have a training center, as well as an area dedicated to nutrition where we develop healthy menus. Based on the latest researches on nutrition for field workers, we create our menus with the appropriate caloric intake that, in turn, will contribute to increase personnel productivity. After two decades of experience in the oil and gas industry, we have created a unique method based on flexibility and swiftness to adapt to the particular needs of each client and provide a tailor-made service.

Q: Which differences have you found in the catering services that Pemex requires from those that international companies such as Halliburton or Schlumberger require?

A: The menu is as diverse as the nationalities working for our clients. To serve an international community such as the oil and gas industry, we offer a wide range of menus since tastes and local cuisines vary between regions and nationalities. The larger the number of diners that we have to serve, the more standard the menu has to be; at the same time, the smaller the operation is, the more tailored the menu can be – even boutique-style. We are convinced that good nutrition has a big influence on the global performance of oil and gas companies.

Q: What are you doing to create awareness of the positive correlation that exists between workers' performance and healthy diet?

A: Clients should know that the main responsibility they have is to search for facts and trust the information we provide, since that is the first step towards a healthy diet. CHS provides weekly or monthly diet courses through our nutritionists to create a healthy food culture. A clear example of our influence is in the gradual disappearance of the "tortilla and Coke" diet within Pemex. In the end, food consumption decisions are made by company directors. It is their responsibility to transfer a healthy diet culture to all different levels of the organization. Our contribution and ever continuing challenge is to provide the necessary information about the benefits of healthy food and the rationale behind investing in greater quality and better processes food products, while lowering costs, to help these decisions become easier for companies.

10

To reach its 3 million b/d production target, Pemex does not just have to explore and produce more; it has to operate smarter. Pemex is constantly looking at ways to introduce new technologies and techniques to optimize its performance and streamline its processes.

New software architecture means that Pemex can more quickly access and analyze exploration and production data, leading to improved results. Real-time monitoring of production means that projects can be followed more closely, and timely adjustments can be made to boost productivity. Advances in automation technology boost efficiency, and help Pemex to produce in a smarter way.

This chapter is dedicated to looking at those technologies that Pemex has already introduced, investigating those that Pemex might be interested in for the future, and looking at the different philosophies and methodologies of technology providers in the oil and gas industry.

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CHAPTER 10: INNOVATION

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INTRODUCING NEW TECHNOLOGY IS AN OPPORTUNITY

PEDRO SILVA
Subdirector of Technical Resources Management for Pemex E&P

Q: What has been the role of technology or the lack of access to the right technology in Mexico's declining oil production since 2004?

A: For the last few years, production has been more stable, and that is not necessarily because of a certain technology, but because of a combination of technologies and the knowledge and dedication of people in understanding reservoir behavior and controlling the decline. However, technology is going to play a major role in our future oil production because, as can be seen in Cantarell, we are already in the mature stage of production at many of our fields. As a result, we are looking at new ways to stimulate well productivity, understand and control reservoir behavior, and implement secondary and enhanced oil recovery (EOR) techniques. This is going to be really challenging because many of our reservoirs are composed of naturally fractured carbonates, and Pemex does not have much experience with this type of reservoir and the technology associated with it. New technologies for drilling and well completions will also play a major role, as well as technologies to understand the position of water and gas content in reservoirs, and to better exploit oil windows. Technology is going to play an essential role in Mexico as never seen before, because reservoirs are inevitably going to mature and there is a lot of oil still available.

Q: In which ways is Pemex planning to cooperate with the private sector and research institutions to pursue technological innovation that works for Mexico?

A: There is a great opportunity for Pemex to learn from the private sector and exchange expertise; in the end it is going to be a team effort. We are looking for the opportunity to cooperate, learn, review technology proposals, try them, adapt them, and eventually use them for the advancement of Pemex and the Mexican oil and gas industry. Pemex today is very open to proposals from companies, and technology cooperation might work quite well as long as Pemex does not interfere too much in the work of its private partners. We have great expertise and technological capabilities in areas such as shallow water, but we are lacking experience in areas such as deepwater and mature fields. To close these technology gaps, we are launching a number of projects where private sector technology providers are working together with research institutions and Pemex, through the Conacyt-Sener Hydrocarbons fund and integrated service contracts, to identify and develop integrated solutions.

Q: What are the main technology gaps that Pemex will try to close via the smart procurement of technology in the coming years?

A: We have pinpointed close to 80 technical challenges in exploitation, and are in the process of prioritizing those challenges. Well productivity, field productivity, mature fields, extra heavy oil, deepwater, and EOR are the areas that we should be concentrating on in the short to medium term.

Q: What do you see as the ideal balance between being technologically autonomous and using external experience and proven technologies in deepwater?

A: The way to go is to acquire the technology from the companies that have the practical experience, and perhaps eventually, if possible, go beyond and establish intelligent alliances with operators that could help us to become technologically independent. I do not think that right now Pemex should be working to develop a particular deepwater technology. The most important decisions to be made today are selecting the right technology partners, and ensuring that all the legal and contracting mechanisms are in place to cooperate efficiently. Perhaps along the way we might find that some technologies need to be developed, but for the time being there are more than enough proven technologies out there to accomplish our deepwater goals.

Q: Does the current available innovation budget reflect the ambitions you have?

A: Pemex has been given an increasing budget to tackle the growing technological challenges, but to meet Pemex's immense technological needs we also have the Conacyt-Sener Hydrocarbons fund at our disposal. Additionally, Carlos Morales Gil is promoting technology by pressuring field administrators to measure the relationship between the innovations they are including in their programs and the budget they are assigning to each technology.

Q: What needs to be done to create an innovation focused culture?

A: We need to develop a technology innovation culture in the industry, but also in the country. The Mexican oil and gas industry has been successful for decades because of the natural productivity of the country's reservoirs. We are trying to increase the participation of Mexican universities in these projects through the the different programs fostered by Conacyt and the Energy Ministry projects, but it is important to note this is a nationwide problem, not one unique to Pemex. If we can make this shift and become champions of innovation, we could set an example for the country.

Q: Some people in the industry might question the fact that Pemex is determined to become a technology leader. What would you say to these people?

A: Give us a chance to try. We have the need, the desire, and the will to do it, and we have lots of oil still remaining. The average recovery factor at Mexico's fields is still below 20%, which is extremely low in comparison to industry standards, so we need to do something and we need to do it now. We are working with companies in order to develop research projects to innovate and develop technologies, to create a technology innovation culture in Mexico, and become the main engine of development for the country.

THE IMPORTANCE OF KNOWLEDGE CREATION AND KNOWLEDGE SHARING

"The Mexican oil and gas industry has been successful for so long because of the natural productivity of the country's reservoirs, rather than the participation of Mexico's universities in these projects," explain Pedro Silva, Subdirector of Technical Resources Management for Pemex Exploration and Production. However, since Cantarell started declining and other important fields such as Ku-Maloob-Zaap are expected to decline soon, the need to involve academic institutions in the development of technologies and the education of petroleum engineers in order to strengthen the technological capabilities in the Mexican oil and gas industry has become more urgent.

"Besides the pressing need to modernize the Mexican oil and gas industry, one of the greatest challenges that Pemex is facing is that its petroleum engineers are starting to retire," explains Fluvio Ruiz Alarcón, Pemex Professional Board Member. He argues that Pemex must find a way to institutionalize and accelerate the transmission of knowledge to the next generation because a large part of the knowledge of the current workforce is held at the individual rather than the organizational level. To counter the wave of retirement of knowledgeable petroleum engineers, Ruiz Alarcón argues that there is a strong need to finalize and open a Pemex University, "which would basically facilitate and accelerate knowledge transmission that could potentially be lost with the retirement of 1970s and 1980s Pemex engineers."

Mexico is still behind in the education of petroleum engineers and Pemex must adapt to compete. "This is a public policy issue that needs to be solved by implementing new mechanisms to foster vocation for earth sciences and engineering," says Ruiz Alarcón. Due to the gap between recruitment policies and the attractiveness of job opportunities on offer, many students that graduate with petroleum engineering degrees end up working for companies in the private sector. In order to reduce this brain drain towards the private sector, "the federal government, in conjunction with private and public universities, must create programs where students are introduced to Pemex, its different divisions, and the attractiveness of its career opportunities, and where they are allowed to compete for internship opportunities," explains Ruiz Alarcón.

Pemex and the federal government have an opportunity to work hand in hand to expand the availability of oil and gas related study programs at universities in regions where the oil and gas industry has a strong presence. "For example, in Mexico City the UNAM and the Instituto Politécnico Nacional (IPN) have been offering petroleum engineering for years; however, the Universidad Veracruzana has only recently graduated its first class of engineers in Coatzacoalcos, even though Veracruz is one of the leading Mexican states with regard to oil operations," Ruiz Alarcón details. The creation of universities offering a range of oil and gas focused programs should be a joint effort, involving not only Pemex and federal and local governments, but also the private sector. "Increasing the number of petroleum engineers in Mexico is beneficial for everyone, because it would attract more foreign investment, further develop and modernize the oil and gas industry, institutionalize oil and gas knowledge, and it could accelerate the creation of new technologies in Mexico. Therefore, everyone should be involved in fostering the opening of the Pemex University and support other oil focused universities in places like Tabasco, Tamaulipas, Campeche, and Veracruz," states Ruiz Alarcón.

BRINGING INNOVATION TO PEMEX TO INCREASE PRODUCTION

HÉCTOR MOREIRA RODRÍGUEZ
Professional Board Member of Pemex

Q: The level of technological prowess is a critical success factor for any oil and gas producer. What has been done in order to bring further innovation to Pemex?

A: Last year, Pemex approved its Strategic Technology Plan and some of the first projects are already in progress. For example, we have prioritized shale gas, making the largest investment in one project in Pemex's history, and we are starting to see the results of this investment. However, its outcome will all depend fully on the energy reform, because if shale gas is opened to private investment, then the entire technology plan for shale gas will have to be revaluated. For this reason we are currently trying to predict how the new energy reform will eventually unfold, even though these predictions are difficult to impossible to make, in order to allocate the necessary economic resources for the technologies needed in each field.

I believe Pemex has done a great job in its naturally fractured reservoirs, becoming world leaders in this area. Nonetheless, in non-fractured onshore fields like Chicontepec – where we have invested a lot of money, resources, and time – we have not been as successful. Regarding shale gas, since we are just beginning to enter into this field, we still have to decide the where, when, what, and how, but due to its potential, I truly believe shale gas can be the future of Mexico.

Q: What is the role of the field development division in the innovation process within Pemex?

A: The structural change and the creation of the development division are extremely important, but it is at the end of the chain. What has changed the most at Pemex is the perception of the importance of technology, what it can offer, and the value it brings to the company. In the past, Pemex would sign a contract with a private company and would only be concerned with the end result, such as well depth or number of pumps installed. However, Pemex has evolved to become more involved in what technologies will be used, always specifying in the contracts the different expectations the company has for each technology and the importance of training Pemex personnel.

Q: How does Pemex make sure that new technologies introduced in Mexico result in knowledge and technology spillovers that create additional value for the company?

A: If we change the incentives we will be attracting different types of companies. In the end it has to do with your contracting scheme and the incentives you give companies to come and work in Mexico. Regarding technology spillover, we have to make sure that technology is not simply a means to an end, but rather, a means to educate and train Mexicans, so that in the future we will not depend solely on private companies for high-end technological projects.

Q: How can the recent change in Pemex's purchasing scheme, and the introduction of framework agreements, potentially improve access to technology for Pemex?

A: The change is already there, but it has taken people some time to understand the importance of this change in the purchasing scheme, which will truly help Pemex in acquiring new technologies, by making the purchasing process more transparent and the technology transfers smoother.

In the past, Pemex was very limited in terms of gaining access to new technologies, but Pemex is currently using a purchasing system based on incentives, which is a more sophisticated system that allows us to acquire the best technologies while rewarding companies appropriately. Essentially, through this new purchasing scheme we are incentivizing the return on investment for companies offering technology.

Q: How can Pemex use the integrated service contracts to attract new technology and increase production?

A: We have to create competition by attracting more companies to compete for contracts. If instead of having three companies bidding for a contract we had 10, we would be creating more competition, lowering prices, and creating additional value for Pemex and the Mexican oil and gas industry, which is the aim of the third round of integrated service contracts. Besides, even though these integrated service contracts have limitations, they still offer great opportunities based on incentives.

MEXICO'S HYDROCARBON FUND

Pemex uses its Strategic Technology Plan as a roadmap for the development of innovative technologies that can help address current and future challenges across its exploration, development, production, refining, and petrochemical activities. "All projects developed for Pemex must be aligned with the Strategic Technology Plan," explains Francisco Gabelich, Director General of Ciateq, one of Mexico's basic research institutes with extensive oil and gas industry related capabilities.

In order to achieve the objectives set forth in the Strategic Technology Plan, Pemex can utilize the financial resources of a sectorial research fund, the Conacyt-Sener-Hydrocarbons fund, which was created jointly by Conacyt and Mexico's Energy Ministry, to facilitate new technology development through investments outside the budget allocated to Pemex by the Federal Government. "Technology and innovation projects are published and tendered in packages, and companies and institutions submit their project proposals, which are then reviewed by a committee formed by the Energy Ministry, Conacyt, and Pemex representatives," Gabelich explains.

The beginnings of the Conacyt-Sener-Hydrocarbons fund date back to October 2007, when Conacyt and Pemex started collaborating to create a framework for new technology development to face the modern challenges of the industry, under the governing taxation policies of the Finance Ministry and the Federal Administration. It was established that 0.65% of the fiscal proceeds from Pemex E&P would be made available for technology and scientific research projects. From that allotment, 63% would be directed to create, and further replenish, a fund dedicated to addressing the research needs of the hydrocarbons industry. The available financial resources are expected to increase each year, in line with the revenue of Pemex E&P.

The fund, which currently has more than US$700 million in its coffers, was established to finance technology development with the assistance of universities, research centers and laboratories, and public and private companies. Since the fund is aligned to Pemex's Strategic Technology Plan, it is focusing its research funding strategy on the technological requirements for deepwater activities and shale gas and oil exploration. "Deepwater and shale gas are issues of great relevance for the Mexican oil and gas industry," states Gabelich. "Mexico is getting ready to conduct several projects in these areas, and the Conacyt-Sener-Hydrocarbons fund will play an important role in financing these activities." Pemex, Mexican Petroleum Institute (IMP), and Comesa are already cooperating to acquire seismic information for areas where prospective shale resources are expected to be found.

Pemex has identified a prospective shale gas area of 43,000 km^2 and is considering conducting seismic surveys in an area of 10,320 km^2. To speed up the evaluation of resources in key prospective blocks in Galaxia, Burgos, Limonaria, and Tampico-Misantla basins, the Conacyt-Sener-Hydrocarbons fund is financing a project for the acquisition and analysis of seismic data covering 2,700 km^2. This project, called "Assimilation and Technology Development in Design, Acquisition, Processing and Interpretation of 3D Seismic Data with a Focus on Shale Oil and Gas Plays in Mexico" was approved during October 2012, and is coordinated by the IMP.

Ciateq's Director General believes that Mexico is still in learning stages of developing an adequate research environment for the industry, but he is convinced that the introduction of the fund has certainly improved the outlook for research, development, and innovation projects in the oil and gas industry. "Through the Conacyt-Sener-Hydrocarbons fund, the government has made important strides in persuading Mexican companies to invest in innovation and technology development," Gabelich comments.

Now that the financial resources are in place, the focus is shifting to correctly managing those resources. "The legal reforms in Mexico in 2006 and 2008 encouraged the allocation of prominent investments to research and development," states Vinicio Suro Pérez, Director General of IMP. "What we need today is to form new research groups to address the industry's current challenges and problems and complement Mexico's current scientific capacity. It is not only an issue of money; it is the focus given to that money and the way it is managed to address the right problems at the right time and with the right people." Strengthening Pemex's ability to prevent brain drain, bring talents back to the country and provide them with challenging tasks that can help foster the development of the national oil and gas industry will be an important success factor in this process. "We have over 100 people studying postgraduate specialties abroad," says Fluvio Ruiz Alarcón, one of Pemex's Professional Board Members. "The issue is bringing them back and assigning them responsibilities that can keep them motivated, and encouraging them to improve the country's technological and operational expertise."

"If you measure the budget allocated to exploration and engineering activities in nominal terms, the investment in research and development has been growing, helped by the additional resources provided by the hydrocarbon fund," Ruiz Alarcón explains. "The fund's contribution is still in its early stages, but it has started to yield clear results."

PI Server 2012

EL PODER DE LOS DATOS

OSIsoft, proveedor del PI System y líder en infraestructura de eventos y datos en tiempo real, anunció el 29 de noviembre pasado el lanzamiento de PI Server 2012 en vCampus Live, en San Francisco, California.

Diseñado y construido para satisfacer las crecientes demandas de su empresa, el PI Server 2012 garantiza que los datos que usted requiera estén ahí; cuando, como y donde los necesite. El PI Server 2012 le permite lograr el "Poder de los datos":

- Aumento o disminución y ejecución a la velocidad de su negocio, su capacidad se puede aumentar o disminuir para recolectar y almacenar el volumen de datos, poniéndolos a disposición de los usuarios finales.

- Todos sus datos históricos, al alcance de sus manos en todo momento, busca y recupera muchos años de datos de manera rápida, manteniéndolos en línea, para ayuda en la toma de decisiones.

- Ponga sus datos y eventos donde pertenecen; PI Server 2012 tiene características de backfiling (rellenado), únicas que permiten incorporar datos desde varios sistemas en un solo almacenamiento de datos, simplificando el mantenimiento.

- Asegura sus datos de manera segura y protegida, está optimizado para mayor resistencia en redes lentas o no confiables; se recupera de forma automática de cortes de electricidad, tiene capacidades de recuperación automática.

- Tenga visibilidad de sus datos donde y cuando lo necesite; combinado con las nuevas versiones de productos de PI, podrá analizar datos de manera móvil desde su iPad. Listo para operaciones de misión críticas, únase al Centro de Operaciones de Redes (NOC) y a cientos de usuarios de PI System, usando el PI Server 2012 para mantener sus negocios funcionando las 24 horas del día, 7 días a la semana.

Acerca de OSIsoft: Es una empresa privada fundada en 1980, con sede en San Leandro, California, con operaciones en todo el mundo, proporciona el PI System, el estándar de la industria en infraestructura empresarial para la gestión de datos y eventos en tiempo real. Con instalaciones en 110 países por todo el mundo, el PI System se utiliza en las industrias de fabricación, energía, materias primas, servicios públicos, ciencias biológicas, centros de datos, instalaciones e industrias de proceso. Esta base global instalada confía en el PI System para salvaguardar sus datos y proporcionar visibilidad en toda la empresa sobre los datos de funcionamiento, fabricación y empresariales. El PI System permite a los usuarios gestionar recursos, minimizar riesgos, cumplir con la normatividad, mejorar procesos, impulsar innovaciones, tomar decisiones empresariales en tiempo real e identificar oportunidades de negocio y mercado competitivas.

www.osisoft.com

THE VALUE OF REAL-TIME DATA INTEGRATION AND AVAILABILITY

Information is paramount in any decision-making process, and having the ability to compare real-time operating information with historical data stored in a large database provides a valuable tool that facilitates decision-making and helps companies to learn from their past experiences. OSIsoft not only delivers the resources to do this, but enhances the results by providing real-time solutions that allow the people in charge of operations to react to contingencies in a timely fashion. The company's Mexico Country Manager, Silverio Cavazos, feels fortunate to have helped develop a flexible strategy to satisfy the needs that have arisen during this year for different customers.

"OSIsoft's benefit for the oil and gas industry is that it enables horizontal integration through the value chain"

Silverio Cavazos, Country Manager of OSIsoft Mexico

Cavazos believes that the oil and gas industry is experiencing an expansion period. "During 2012, we looked at a rapid growth in the private sector in Colombia, Brazil, and the Andean region. We are also looking at the possibility of an expansion in the private sector in Mexico, depending on the pending energy reform." The agnosticism that the OSIsoft's PI Systems infrastructure provides makes it easier to interact with the different sectors of the Latin American oil and gas industry. "It helps to have a common layer of information on a real-time basis, for both the private and public sectors."

Cavazos believes there is a trend for corporations to successfully standardize their operational and information processes. OSIsoft is helping Pemex in its execution strategy of integrating the four subsidiaries under one data infrastructure. "Pemex is only using part of the potential they can obtain from our portfolio of solutions. We are having long-term conversations with them to develop a scheme that incorporates the information flow and information sharing between its four subsidiaries. Our PI System is already implemented in the four divisions, and has shown the added-value OSIsoft provides. We are now looking to extend that service by interconnecting the information flow between the divisions."

One way of convincing Pemex of the benefits of this total integration might be showing them what has been done for other companies around the world. "The Hungarian oil and gas company, MOL, managed to optimize its operations and production metrics after a really short time of implementing OSIsoft's full solutions. We have also had this type of successful stories coming from Italy, Brazil, the US, among many other countries," Cavazos recounts. "Results are starting to be delivered and noticed very quickly after the implementation: due to its complete visibility of the company's information, key performance indicators (KPIs) can be attained almost immediately."

Cavazos explains that the technology can add different key indicators to the standard ones, and the software can be adapted to each specific operation that Pemex performs.

"OSIsoft offers the flexibility of implementing different KPIs, with the opportunity to create them at three different levels: the operational level, the management level, and the strategic level. Customization is really easy for our clients, due to the openness of our software." This all comes together by helping clients to strengthen communication and teamwork between their employees, enabling people in charge of observing the system to react on time to any challenge. "OSIsoft keeps at the forefront with its training programs because it believes in the importance of having great human resources at hand," Cavazos says.

The company's favoring for open communication tools does not stop at the training level. "One of the most important functions of the PI Systems solution has to do with notifications," Cavazos explains. "Whenever a significant event is registered by the software, it immediately sends an automated e-mail to everyone involved, so they can react in time." In the end, companies can have all the necessary information available, since data recording and storage is included inside their operations, but if people do not know how to take advantage of this access to relevant information, then opportunities to improve performance and avoid incidents are being squandered. "OSIsoft's benefit for the oil and gas industry is that it enables horizontal integration through the value chain," Cavazos adds. "We have seen examples, even within Pemex, where areas that were not foreseen as part of the company's original analysis to optimize its operations, end up being included in the real-time platform."

A PRODUCT-BASED INNOVATION STRATEGY

OWEN GOLDEN
Vicepresident, Global Energy Segment at National Instruments

Q: What characterizes National Instruments' position in the industry as a provider of products rather than integrated solutions and systems?

A: National Instruments works with many of the companies that develop solutions by integrating our products into the devices and solutions they create. Those service providers use our equipment because it allows them to innovate more quickly, and today this is necessary for their survival. There is strong competition out there with Halliburton, Schlumberger, and Baker Hughes and all the other global oilfield service providers, but we are unique in the sense that we provide an open system, and the people who can really take advantage of that are the research arms of these companies. There are also research institutes in Mexico that use our products extensively, because of our open system, measurement platform, and instrumentation background.

Therefore, it is hard to separate National Instruments from closed-box service providers, because a lot of our technology is inside those closed boxes. They have realized that they cannot dedicate time to building the technology from the ground upwards, because they would fall behind very quickly if they tried. If they develop a board from scratch, it gives them exactly what they need at the time, but two years from now, they don't have a team that is there to keep evolving it in the same way that National Instruments does. Increasingly, these companies are looking for commercial, off-the-shelf equipment that is very configurable, and then they invest in the software as their intellectual property, which is where they add value. Also, they have a long history of being able to package products in a way that ensures survival in particularly brutal environments.

Q: Which role does the oil and gas industry play in your development strategy?

A: In Mexico, National Instruments is focused on a dual strategy: working with the global players that come to Mexico for manufacturing and sales, while also developing relationships with the country's main players. Obviously, energy is a crucial market in this second area. We have strong relationships with companies operating in this industry, and they can guide us to make sure we are making the right products for their needs. We are going after the energy sector and we are going to develop products that make it easier to solve the industry's problems.

Q: What are the challenges of increasing awareness of the contribution that National Instruments' products can make to its customers' product development processes?

A: From a sales perspective, this is always a challenge, and our strategy is to keep moving up the organization, with the end goal of reaching the managers that matter. National Instruments has always been an engineer-to-engineer company: when we meet with this type of people we do a great job, because we talk technology, and all the great things we can do from an engineering perspective, but that is not necessarily the person making the final purchase decision. In research areas, researchers often have the ability to make purchase decisions, but when you want to deploy large volumes of equipment, you have to move up the chain within the organization and make sure that management is comfortable with choosing our company. As we progress, we continue to grow our investment in R&D. With over US$1 billion in revenues, we invest US$200 million per year in research and development. Increasingly, our business is focused on the oil and gas sector, particularly on hydraulic fracturing, where I would estimate that our technology is present in 25% of fracking operations in the US.

Q: In the oil and gas world, what are your strategies for getting your product to market?

A: Our products provide professionals, such as petroleum and mechanical engineers, who have the ability to see what technological solutions are needed in the oil and gas industry, with the tools to innovate themselves. By cutting out the bottleneck of sending requirements to a programming team and waiting for them to come back, and also removing the possibility that the solution does not match the requirements correctly, we can be of great use to the industry.

PLATFORM TO BOOST INNOVATION AND PRODUCTIVITY

Mexican culture is full of inventiveness and wit; nevertheless, many oil and gas companies have yet to excel at capitalizing on these characteristics of the Mexican workforce. For Invensys, exploiting these innovative qualities has become a cornerstone in its process to develop new solutions for the Mexican market. The idea, according to Matías Adam, Invensys' Managing Director for Mexico & Central America, is to capture the oil workers' experience in its software solutions, and implement these to further boost innovation in the industry.

One of the biggest opportunities to be exploited in this area, according to Adam, is to enhance operational excellence through dynamic simulation models, captured in the software that the company provides, and implement these in downstream infrastructure to advance standardization and boost reliability, innovation and productivity.

"The incorporation of the workers' ideas raises awareness of their importance in the process, and motivates them to perform beyond their job descriptions"

Matías Adam, Invensys' Managing Director of Mexico & Central America

"The basic premise behind our value proposition is connecting our solution-based applications to the already installed systems in the client's facilities to provide the client's workforce with additional information that enable them to become decision-makers," Adam explains. "The incorporation of the workers' ideas raises awareness of their importance in the process, and motivates them to perform beyond their job descriptions. This helps the client to optimize its operations from within, and at the same time gives Invensys insights on new features to add to its oil and gas applications." To achieve this purpose, Invensys implements Dynamic Simulation along the project lifecycle. The first part involves the validation of the process design. "Based on a thorough review of the existing configuration, we test and validate before committing capital to a project. We analyze operability for highly integrated plants, reassert controls, reduce equipment cost through minimizing overdesign, verify relief safety and flare systems, and eliminate programming errors and unaffordable downtime for testing," Adam describes. "After obtaining firsthand intelligence on the specifics of the operation from petroleum engineers and plant workers, we divide the process into different areas. Then, we study each employee's role in the process and brainstorm with them about the tools that would help them to create value for the company."

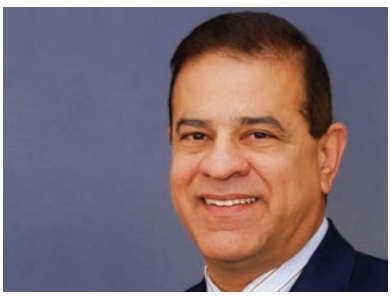
Once the features described are integrated into the software, the next step consists of using simulation software to provide personnel with a thorough understanding of their tasks, identify potential points of improvement, and outline the relevance of their tasks in the whole process. "By using the Operator Training Simulator (OTS), our company looks to help the client become an expert in the process, empowering personnel to improve performance" Adam says. This system lets the operator walk through all the areas of the facility and run different equipment using an immerse interactive augmented reality environment to obtain an in-depth understanding of what happens at each stage of the process and give him a firsthand insight in the role of each action in the value chain.

The last stage of this solution is an Integrated Training Simulator (ITS), a comprehensive training system including a control room and field operators for different processes and plants. "Through web-based access to a Learning Management System (LMS), the ITS provides the possibility to launch the OTS, enabling the trainee to interact with the training simulator while scores are recorded and stored in the LMS," Adam explains.

Through these training solutions, Invensys looks to capitalize on the innovative nature of the Mexican engineer, by giving them the power to make decisions within their operative environment and understand the full impact of these choices within the company. In the end, this is destined to result in a win-win situation for all the parties involved.

Invensys is a global technology company active in over 180 countries that works to design and supply advanced technologies for industrial and commercial customers. Its technology and software enables customers to monitor and automate their products and processes, maximizing safety, efficiency, reliability, and profitability.

DATA MANAGEMENT TO BRIDGE THE GENERATION GAP



BARRY IRANI
President and CEO of iStore

Q: Which role does information play in improving asset performance and maximizing profits for oil companies?

A: Information is critical to the effective functioning of an operation and is the lifeblood of any organization. Examining existing workflows and streamlining the relevant information leads to better, timely decisions that ultimately impact the bottom line. For example, consider a company bidding for an integrated service contract (ISC), where the participating organizations are provided the same basic data on each block available in the bidding round. Each participant has developed its own methodology to review and analyze the data, building on its knowledge and experience in different fields and reservoirs, in order to make a better-informed bid. The combination of data with the company's knowledge is very powerful, and companies rely on this combination to give themselves a competitive edge since two companies might look at the same data but come to different conclusions.

Q: What are the main challenges for oil and gas companies to gather data and develop it into information, and how have these challenges evolved over time?

A: Data collection is a continuous activity in the oil and gas industry: a 70-year-old field should have 70 years of data. Information begins with data, which resides within companies in many forms. One of the problems globally, not just in the energy industry, is the evolution of the way data is collected, stored, and applied over time. Following various waves of technological change, we are left with data in different locations and applications. The ability to collect and organize data for use in decision-making processes has become an enormous challenge.

In the oil industry, you have a wide range of basic operational data. Contextualizing this data by assembling and presenting related data sets together in meaningful ways leads to information, which when combined with people's knowledge, or know-how as they interpret, analyze and apply reasoning, leads to better informed decisions. The focus of modern information technology companies must be to bring disparate and dispersed data together from wherever it resides and convert it into information, so people can work with it using their knowledge. All of iStore's effort, technology, software, and processes are concentrated on streamlining this task.

Q: How can the evolution of technology help in solving these challenges?

A: There are two key factors in the evolution of data. The first is the development of new technologies, such as the Internet, that enable connectivity and encourage information sharing. The second is that newer generations are more open to sharing information since they are raised in a connected world where immediacy and sharing is becoming more common. For example, continuously updated online publications and newsfeeds are supplementing or even replacing traditional daily newspapers and weekly magazines. Forums, blogs and instant messaging are providing means to have two-way communications. News and events are increasingly being reported by normal people carrying smartphones. We are witnessing the power of harnessing collective thinking. What we need to do is pick out the best practices from this rapid evolution and apply them in our industry, with appropriate information governance, to help us become more efficient and effective. The combination of technology and connectivity is therefore creating tremendous opportunities for progress in information sharing.

Q: While newer generations might be open to using new technologies, how do you convince the older generations to accept these technological changes?

A: Having worked in the oil industry for 40 years, I am seeing how this generation gap is being closed. Company executives and management realize and understand that they need a blend between older generations that are more cautious and analytical using their knowledge and experience, and newer generations that want to respond faster and build up knowledge heuristically.

The executives that form part of the older generation are the ones promoting the use of new technologies, as they see the value it provides. Technology is forming the bridge by which older and newer generations can communicate. Talking face-to-face does not always work, because new generations think old generations are old-fashioned and

outdated, while old generations think new generations are impulsive and reactive. Technology can connect them, bringing youth and enthusiasm together with experience and knowledge. Our software's goal is to bring information together through a shared context, and when both generations look at the same data, input their thoughts by making decisions and interacting through the system; it is serving as a bridge to harness the power that resides in people within the company.

Q: With the 'digital oilfield' already in place, what are the main challenges that iStore faces to advance this integration?

Each passing day, more data is being accumulated. As oil wells continue to produce, they create more data. The complexity arises from the amount of information and the different formats and systems in which it naturally resides. Trying to connect to that information and bring it to the users in the form they need it, is the objective. With technologies evolving so quickly, we constantly refresh our software to make it faster, cheaper, more effective, and more efficient. Our challenge is to keep the software in line with the evolving technologies, so that our clients can harness its benefits. When major technology providers such as Oracle, Microsoft, or Google come up with newer versions of their technologies, or a new offering such as cloud computing comes along, we update our software to work with those new platforms.

The wonderful thing is that people are accepting these updates, as they see improvements in tasks they normally do, and become faster and easier. Tablets, for example, are introducing new levels of portability and instant-on convenience to oilfield workers. Knowledge workers, young and old, are welcoming and embracing these new changes.

THE CHICONPAD

The Chiconpad, a mobile software application for tablets based on the experiences of engineers in the field, delivers real-time information of all the oil wells in Chicontepec, one of Mexico's most challenging oil fields. The area of operation is divided into eight different operating units, called *chicos*. Within each *chico*, there are 20 to 100 multi-well drilling pads, each of which contains dozens of producing wells. These *chicos* are operated independently by separate engineering teams that focus on maximizing production for different areas of Chicontepec where reservoir and/or fluid characteristics define subsurface boundaries. The Chiconpad was originally created to provide timely reports on the production information to each of the teams working at Chicontepec, collectively providing an overview of the reservoir's total production behavior. This information is displayed within the application through real-time indicators, allowing users to select the data sections they want to investigate. The indicators work as traffic lights: a green indicator symbolizes that performance is equal to or better than expected targets, yellow means that performance is within expected limits, and a red indicator shows that performance is below the set standard.

The Chiconpad is connected directly to the production system, which means that updated information appears whenever a user logs in, turning the application into a valuable real-time information resource. Once logged in, the user can navigate through the application's interface to get details of the production of a specific *chico* or multi-well drilling pad, or review the performance of each independent well. Besides providing real-time access to the performance of each different section through indicators, the application also has the ability to access the historical database of each well. This yields a more comprehensive view for asset managers and engineers of how the reservoir has evolved, while allowing for comparisons and contrasting of different wells within different periods of the fields' life cycle.

The ease of access it provides to real-time core data makes the Chiconpad a useful tool for Chicontepec's asset managers and engineers: it allows them to see which wells are working as expected, and which are not, and gives them the opportunity to respond to production delays immediately. It also provides the ability to tailor the information displayed in the application. While the asset managers worked with iStore to specify the original indicators displayed in the software, the system has been designed so it can be easily updated and modified as new standards are set or as different types of data are required. This way, the software stays up to date, providing important pieces of information vital to the decision-making process. While the key performance indicators currently displayed on the Chiconpad include data from field operations, production and well history, in the future it will also show cost information and other financial indicators, which will give a more complete overview of the operations at Chicontepec.

CROSS-INNOVATION AND TECHNOLOGY DEVELOPMENT

"Technology is part of the DNA of our company: everything we do is at least in part related to innovation and development of technology," says João Geraldo Ferreira Ferrera, Vice President of GE Oil & Gas Latin America. The company has a specific focus on developing technologies that are customized to the unique challenges in certain regions. For example, the technologies needed to explore pre-salt developments in Brazil are different to the technologies needed for shallow water exploration in the Gulf of Mexico, which in turn are different to the technologies needed to explore shale gas in Argentina; therefore, "at GE we are focused on not only developing technology for the oil and gas industry as a whole, but for specific niches that make the oil and gas industry more competitive and more efficient," says Geraldo Ferreira.

As a means of developing technology for the oil and gas industry, GE has a unique and creative innovation strategy that transcends industry boundaries. "Since technological innovations in one industry could potentially help to overcome challenges in other industries, we always try to cross-innovate and leverage technologies used in one industry, virtually with no adaptation or customization, to address problems in another industry," he explains. Furthermore, "the intersection of expertise, PhDs, engineers, scientists, doctors, specialists in aviation, transportation, and oil and gas is extremely rich, which makes us one of the very few companies in the world that can really bring that strength of R&D and technology into any industry," explains Gabriela Hernández, President and Director General of GE Mexico. For example, GE has used healthcare technology to analyze and understand x-rays and seizures as a means to explore and understand a variety of different problems and challenges at oil and gas wells.

In order to be successful in this strategy of cross-innovation, GE has four global research centers in China, India, Germany, and the US, and recently announced the opening of a fifth center in Rio de Janeiro, Brazil. However, even though GE does not have a global research center in Mexico, the company opened a Center of Excellence in Queretaro as the core center for technology innovation dedicated to specific Mexican technological needs. "Basically, it is an opportunity for us to develop and innovate technologies specific to the Mexican oil and gas industry that hopefully – in the future – will be implemented in the region and eventually across the globe," says Geraldo Ferreira.

The opening of this engineering center in Queretaro has a lot to do with Mexico's economic prospects and the imminent energy reform. Depending on the outcome of the energy reform, GE will assess the level of commitment and resources it will invest in its Queretaro engineering center. However, even if the energy reform does not pass, there is still space for growth, "but if the reform does pass you are talking about really modernizing the industry, bringing a lot of resources, and creating wealth for the country and the company, which is a win-win for everyone," explains Hernández.

Gabriela Hernández, President and Director General of GE Mexico

João Geraldo Ferreira Ferreira, Vice President of GE Oil & Gas Latin America

Besides focusing on technology innovation and development, GE's major areas of business are healthcare, transportation, and aviation, but the energy sector – which includes power and water, energy management, and oil and gas – is fostering GE's growth in Mexico. "Of the three, oil and gas is the second largest division. However, we are planning for it to become the largest, or at least as important as the power and water business," says Hernández.

The future looks bright for GE's activities in the oil and gas industry, and Geraldo Ferreira believes Mexico's main potential lies in offshore exploration, development, and production. Nonetheless, in order for this potential to turn into real opportunities for growth, he believes: "After the regulatory framework is updated, Pemex will have an interesting opportunity for a new market strategy, technology understanding, and how to establish partnerships for offshore joint ventures, and seriously go to the Gulf of Mexico and explore and develop – just like the US is doing."

Despite being criticized for not venturing into deepwater earlier, Pemex's strategy has been extremely successful, since the company has the advantage of having technology agreements with international oil companies such as Petrobras, which allow the company to exchange education, technology, and knowledge. However, even though Mexico is lagging behind countries like the US and Brazil with regard to deepwater exploration and production, Geraldo Ferreira strongly advises not to forget Mexico is still producing more oil than Brazil, Colombia, or any other country in Latin America. "We have to put this into perspective, because it is really hard; we cannot ignore the fact that Mexico is the top producer in the region," explains Hernández.

ARTIFICIAL NEURAL NETWORK TO OPTIMIZE PRODUCTION

Created in 2009 by Harvard and The Anáhuac Mayab University graduates, Share Oil & Services Consulting Group was founded with the intention of playing a role in the advancement of Mexico as a technological center for the national and international oil and gas industry. Understanding the present need to encourage technological advancements in Mexico, and that technology innovation and production are key factors in measuring the value and success of oil companies in the world, Share Oil & Services recently opened a new research center in Mérida, Yucatán, in order to advance the company's potential to contribute to the development of the oil and gas sector in Mexico.

"Share Oil & Services is about more than just the development and production of technology; it brings together people with innovative ideas to create partnerships"

Jaime Gallegos Rosado, CEO of Share Oil & Services

The research center, known as Oficina de Desarollo e Investigación de Mérida (ODIM), is a state-of-the-art facility designed to produce high-end technology. A recent example of the solutions created at the center is a liquid sealant that solidifies when a crack or fissure is detected in a well or pipeline. This technology has been proven in other industries such as automotive, but was adapted for the oil industry by the company and has improved Pemex's ability to prevent oil and gas leaks. Showing the diversity of the projects being handled at the research center, one of their most impressive technological innovations is the creation of an artificial neural network that functions as a brain, and allows the user to simulate different scenarios based on the opinions of various experts. Share Oil & Services adapted this technology for Pemex, which uses the software for well management as a way to analyze and take faster decisions on the various different scenarios and options for optimizing the production of a well. This technology, known inside Pemex as 'Smart Tablets', uses algorithms to recreate different opinions and trends utilizing the expertise of past and present Pemex employees and, according to Share Oil & Services' CEO, Jaime Gallegos Rosado, "helps combat brain drain and allows the optimization of resources, technology, and oil production." Pemex has been testing these 'Smart Tablets' and their respective technological attachments. "Pemex has successfully utilized the technology in the intervention and monitoring of wells in the field of Abkatún, among others," Gallegos Rosado explains.

"Our tablets have been so successful because not only do they monitor the performance of each well on a daily basis, but they create a digital diagram that allows Pemex to have all the information on one oil field or well stored in a database than can be analyzed for drilling, oil extraction, and production," says Gallegos Rosado. This artificial neural network is a great technological advancement since it saves Pemex time and money due to the fact that it monitors the performance and/or problems of each well and gives an assessment of the productivity and potential of each field. According to Gallegos Rosado, "Pemex field directors no longer need to meet every Monday to review the performance of and problems at each well; they only have to review the wells or fields that the smart tablet indicates." As part of Share Oil & Services' ambitious growth strategy, CEO Gallegos Rosado plans to attract young talent but hopes to always maintain his policy of having an 88% Mexican workforce. "Mexican engineers are very capable but lack opportunities," he says. Moreover, as a way to foster the development of both Mexican engineers and the Mexican oil and gas market as a whole, Gallegos Rosado is opening a university where he plans to recruit students from the best universities and offer a Master's degree in Oil Production. His plan is to "prepare people in Mexico and Latin America and give them the necessary resources to eventually work at Share Oil & Services or other Mexican companies." This plan will not only provided his company with much needed Mexican human capital, but will help him achieve his goal of making Mexico one of the leading technology hubs in the oil and gas industry. Even though Share Oil Services has mostly focused on the creation of Mexican technology for the country's oil and gas sector, Gallegos Rosado explains that "Share Oil & Services is about more than just the development and production of technology; it brings together people with innovative ideas to create partnerships." This strategy, originating from the entrepreneurial spirit of its founder and CEO, has led to discussions with five Norwegian companies, with the goal of creating a partnership as a means to learn from the Mexican oil market, approach Pemex, and eventually win contracts.

SHARE OIL & SERVICES
CONSULTING GROUP

-POSL

(Production Optimization Services Line)

Estudios de Aseguramiento de Flujo

Tradicionalmente, el análisis de los sistemas de producción se ha dividido en:

Yacimientos
Caracterización y simulación de yacimientos (Eclipse, Petrel, MBAL, Nexus, etc.)

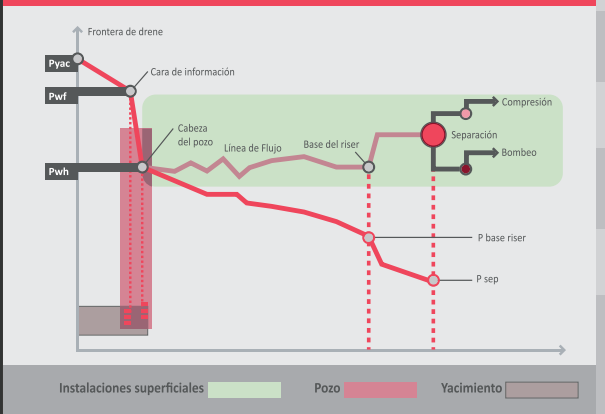
Pozos
Evaluación, diseño y optimización de pozos en régimen estacionario (Prosper, WellFlow, Pipephase, Pipesim, etc.)

Instalaciones
Evaluación, diseño y optimización de procesos y redes de transporte en régimen estacionario (Aspen Hysys, Pro/II, Pipephase, GAP, Reo, Pipesim, etc.) y transitorio (OLGA)

La evaluación, diseño y optimización de los sistemas de producción exige un análisis integral a fin de enfrentar los retos del aseguramiento de flujo.

A). Hidratos de gas
B). Parafinas y Asfaltenos
C). Arenas
D). Incrustaciones
E). Corrosión
F). Emulsiones y espumas
G). Bacheo

Esquema del sistema integral de producción:
Yacimientos - Pozos - Instalaciones



Esquema del sistema integral de producción:
- Yacimientos
- Pozos
- Instalaciones

Análisis termo-hidráulicos de líneas de transporte

Análisis de bacheo en pozos y líneas

Análisis de paros y arranques en pozos y líneas

Análisis de sistemas integrales de producción

Análisis de corridas de diablos

Teléfonos/Phone:
+52 (938) 111 0352 / (938) 111 1576

Dirección/Address:
Calle José María Morelos y Pavon #26
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Col. Francisco y Madero, C.p. 24190.
Ciudad del Carmen, Campeche, México

Las problemáticas asociadas al aseguramiento de flujo se deben principalmente a:

Las caídas de presión en pozos y líneas de transporte

Las características del suelo marino o terrestre

El perfil de temperatura del lecho marino o medio ambiente

El perfil del terreno en el lecho marino o terrestre

Los cambios del flujo en las líneas de transporte

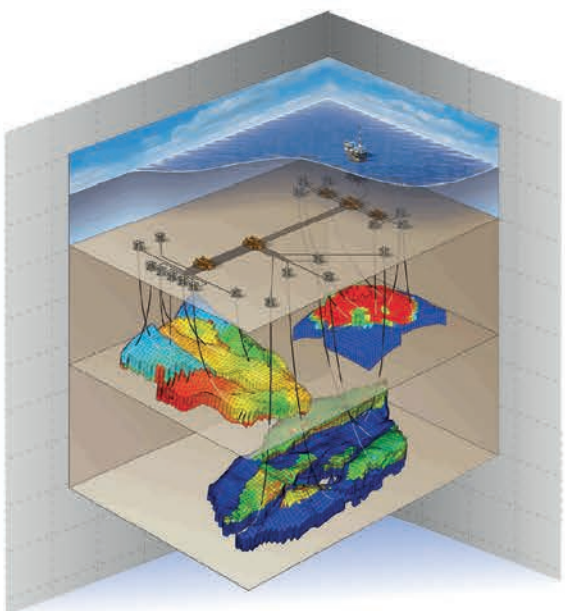
Los cambios en las propiedades del fluido (RGA, corte de agua, presión estática, etc.)

La compatibilidad de químicos introducidos en la corriente de productos

Para un estudio adecuado de las problemáticas se requiere:

Entender el comportamiento de los fluidos producidos

Modelar el flujo de hidrocarburos desde el yacimiento hasta las instalaciones de acondicionamiento.



Asistencia técnica en la operación de instalaciones de producción

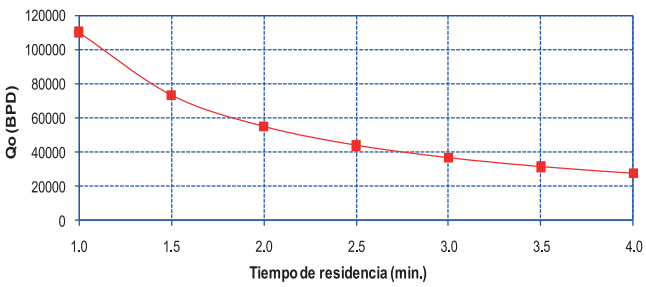
Caracterización de mezclas de hidrocarburos
La caracterización nos permite obtener una composición representativa de las corrientes de hidrocarburos analizadas mediante simuladores de proceso como Hysys®, Pro/II® o PVTsi®.

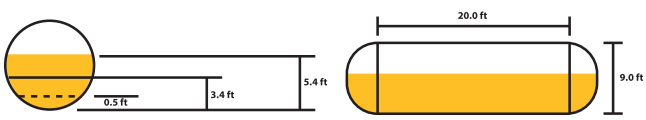
Sus objetivos principales son:
Ajustar las propiedades del fluido analizado a las propiedades reales reportadas en el análisis PVT.
Reducir el número de pseudocomponentes pesados a un mínimo práctico.

Simulaciones de proceso en estado estacionario

Las simulaciones de proceso mediante simuladores como Aspen Hysys®, Pro/II® nos permiten determinar las propiedades fisicoquímicas de cualquier corriente implicada en la recolección, separación, bombeo, compresión, tratamiento y transporte de los hidrocarburos.

En la medida que contamos con modelos de simulación de proceso representativos de nuestro sistema podemos predecir, anticipar o eliminar problemas en el manejo de la producción.





Efectuada la caracterización y la simulación de procesos es posible el desarrollo de los análisis hidráulicos, la selección y dimensionamiento óptimo de líneas y equipos de proceso como separadores, bombas, compresores y válvulas.

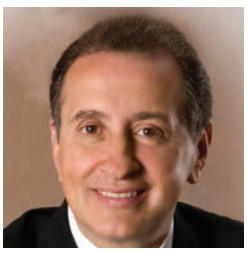
- Dimensionamiento de separadores de producción, slug-catchers, rectificadores, etc.
- Análisis hidráulicos de sistemas de procesamiento de mezcla, aceite y gas
- Selección y dimensionamiento de bombas, compresores y válvulas
- Comportamiento de afluencia de pozos

$$Q_o = J\left(P_{ws} - P_{wf}\right)$$ ← Índice de productividad

$$\frac{Q_o}{Q_{o,máx}} = 1 - 0.2\left[\frac{P_{wf}}{P_{ws}}\right] - 0.8\left[\frac{P_{wf}}{P_{ws}}\right]^2$$ ← Modelo de Vogel

$$F_I = P_{ws} - P_{wf}$$ ← Fuerza impulsora

PARTNERSHIP APPROACH TO INDUSTRIAL AUTOMATION



Rafael Stifano, Director General of Mexico and Central America at Rockwell Automation

Two years ago, the International Energy Agency (IEA) finally presented its position on a discussion that had been looming over the oil industry for decades. In its World Energy Outlook 2010, the IEA concluded after comprehensive analysis that peak oil, the point where conventional worldwide crude oil production reaches its peak, had already occurred around 2006. However, the IEA predicted in that same publication that the world's liquid energy resources would continue to rise at a modest rate, at least until 2035, thanks to technological advancement and increased production of natural gas, unconventional oil and gas, and crude oil from fields yet to be discovered or developed. These projections reflect the notion that, even if the age of easy oil is over, technological developments in the oil and gas sector will allow companies to discover and exploit increasingly complicated hydrocarbon resources. Given that a large proportion of the unconventional supply that is crucial to meet future global oil demand will come from extra-heavy crude and bitumen, Mexico's relatively less complicated oil resources imply that the country's future production challenges will be manageable, provided that the correct technologies are applied.

Automation is one of the solutions that are making an increasingly important contribution to the technical and economic viability of oil and gas production around the world. On one hand, higher production cost has led oil and gas companies to rely on automation in order to increase productivity and reduce costs by investing in automation solutions that reduce downtime, increase control, and optimize performance. On the other hand, stricter health, safety, and environmental regulations and requirements have pushed hydrocarbon producers to improve their performance in these areas through automation of their processes.

Rafael Stifano, Director General of Mexico and Central America at Rockwell Automation, mentions that this is also the case for Pemex. "We see that Pemex has evolved. In the past, Pemex was using a relay-based program controller, which was wired and thus required a lot of maintenance while its reliability left room for improvement. Years ago, Pemex decided to switch to an electronic-based system that allowed the company to increase the productivity and reliability of its operations and made plants safer. Pemex is investing a lot, because the company has the long-term objectives of raising oil production and increasing its occupational safety and environmental sustainability performance. In order to achieve these goals, Pemex needs to invest in automation equipment," he says.

Rockwell Automation has responded to Pemex's growing automation requirements by basing its solution delivery model on developments made in conjunction with other partners. "For example, we have very strong knowledge about compressors, but since our expertise concerning pipelines it not at the same level, we approach partners who have the knowledge that we need in this area and thus jointly develop the most advanced project possible for Pemex," Stifano explains. This model stems from Rockwell's acknowledgement that, even if the company is one of the world leaders in the industrial automation arena, the oil and gas industry demands a very high level of technical performance, which often no single company can deliver on its own. "By working together with our seven to nine partners, we believe we can create additional value for the customer. This enables us to provide the best service and fill any potential technology or expertise gap, setting us apart from competitors that are operating independently," he points out. The company's constant cooperation with specialized partners has indeed increased its capacity to innovate. "Rockwell is considered a leader in the safety and program controller systems, while we still have a way to go on motor systems, which we are investing in right now. For the first time, there is just one company that is integrating what is happening on the power and control sides. Now the motor and the controller are integrated into a single architecture and platform, so customers don't need to invest in two separate systems. This product integration also provides additional input, facilitating early diagnosis and allowing customers to greatly reduce downtime."

Thanks to its emphasis on technical support and solution delivery model, up to 150 of Pemex's platforms currently use equipment from Rockwell or the company's brands, Allen Bradley and Triplex. At a global scale, this focus has translated into the creation of an Automation University, located in the US and directed by Rockwell and its partners. "Our employees go there for one or two years to learn or update their expertise in technology and services, from how to diagnose to highly complex and specific skills. When they come back, they are better able to serve the customer," says Stiffano. In addition to these training facilities, Rockwell coordinates its global strategy for the oil and gas industry from Houston, where it has a specialized team. The coordination between the company's offices all over the world strengthens the capacity of its Mexico subsidiary to take on increasingly complex challenges, such as Pemex's deepwater projects.

CREATING AN APPLIED RESEARCH CULTURE IN MEXICO

"Ciateq has been working for Pemex for over 15 years in maintenance, technical evaluation of technologies, certification, engineering, and training projects," says Francisco Gabelich, Director of Ciateq. He explains that these projects have contributed to making Pemex a more competitive and valuable company, since the results of the projects have led to better training of Pemex personnel, more reliable operation of Pemex's infrastructure, and fulfillment of international standards and regulations. However, besides working in the past on various downstream and midstream projects with Pemex Refining and Pemex Gas and Basic Petrochemicals, Ciateq is currently engaged in a strategic evolution, focusing on upstream projects with Pemex Exploration and Production.

"Countries with highly trained workers invest at least 1% of GDP in research and development and therefore in local talent"

Francisco Anton Gabelich, Director of Ciateq

Mexico's 27 research institutes, spread throughout the country and operating under the National Council for Science and Technology (Conacyt), are divided into three large branches: Social Sciences, Basic Research, and Technology. Even though Ciateq is capable of tackling projects independently, Gabelich explains that the research institute also works with other basic research and technology institutions. "We work with other organizations because, sometimes, finding the best solution for our customers requires a combination of Ciateq's strengths and the capabilities of other centers that belong to the Conacyt system."

Currently, Ciateq is involved in multiple projects with Pemex E&P, focusing mainly on increasing oil production at mature fields. "We are working in an alliance with a Mexican company to manufacture oil production equipment in Mexico with the help of a Canadian technology company," Gabelich details. Furthermore, Ciateq is also working on the remanufacturing of machine tools, a turbo machinery overhaul project, the evaluation and redesign of measurement systems, training for certification of welders for Pemex Refining, and various other engineering projects for Pemex E&P.

Gabelich recognizes that one of the handicaps that Mexican companies, including Pemex, is their dependence on external parties to improve their processes. "If companies cannot adequately define all their technology needs, even though they have a lot of experience in day-to-day operations, they become one hundred percent dependent on suppliers. Ciateq's strategy is to offer a master's degree, using Conacyt financing for scholarships, for employees," he emphasizes. "The key issue is that the master's degree final project must be related to the company they work for, to bring benefits back. Through this strategy, Ciateq strives to create a win-win situation for all parties involved: the company will gain advantage from the project and employees will be better trained. Moreover, for Ciateq each scholarship represents a potential new client," says Gabelich.

Gabelich points out that countries with highly trained workers invest at least 1% of GDP in research and development and therefore in local talent. "In Mexico, we do not have the type of companies that incubate engineering or equipment manufacturing; we incubate commercial systems and spend a lot of money on basic scientific research, even though we do have public research centers devoted to this," he says.

Ciateq has aligned its processes with Pemex's Strategic Technology Plan, which identifies and prioritized the technology needs of the Mexican oil and gas industry. The execution of this strategic plan is supported by the Conacyt-Sener-Hydrocarbons fund, which allows organizations such as Ciateq to advance the technological capabilities of Pemex and the Mexican oil and gas industry.

Gabelich believes that compared to more developed economies, Mexico is still in the early stages of becoming a technology and innovation hub. "There are many capable companies in the country, but the most developed countries mainly see Mexico as a country specialized in light manufacturing. However, the federal government is increasingly encouraging Mexican companies to invest in innovation and technology development, which is why funds such as this one are quite important. The country's attitude towards technology development and innovation is changing, and surely the best years for researchers and institutions are ahead of us as an applied research culture is gradually implemented by Pemex and private companies," emphasizes Gabelich.

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AGUASCALIENTES ESTADO DE MÉXICO HIDALGO QUERÉTARO SAN LUIS POTOSÍ TABASCO VERACRUZ

PEOPLE-FOCUSED SAFETY CONSULTING

Some might be surprised that DuPont, a company known predominantly for its work in the chemical industry, is also a world leader in safety consulting. Mexico is one of DuPont's biggest markets for these services, with Pemex being one of the consultancy business's largest clients. Pedro Fernández, Vice President of DuPont Sustainable Solutions Latin America, explains how the company got into the business of providing advice on safety: "As a company, DuPont shifts and changes its portfolio fairly frequently. Around 12 years ago, our current CEO suggested that we should capitalize on our success in safety, health and environment, and start a consultancy where we could share our knowledge for profit. Today, this is the only consulting business in the DuPont portfolio." The consultancy focuses on a number of key areas in industrial safety, including occupational health, mechanical integrity, sustainability and environmental issues, and clean technology.

"In 2011, Pemex Exploration & Production was number one in a safety record ranking of all the E&P companies in the world"

Pedro Fernández, Vice President of DuPont,Sustainable Solutions Latin America

DuPont has created its team of safety consultants by bringing in those with extensive experience to teach and consult, making consultancy a career change that occurs later in someone's professional life at DuPont. DuPont drew on Spanish-speaking experts when it formed its partnership with Pemex, including experts that had worked with Repsol, PDVSA, and Ecopetrol. Fernández stresses that rather than being technology focused, DuPont's safety strategy centers on people, and creating behavioural changes in companies in order to help them stay safe. "We create the proper processes, systems and infrastructure to make sure that people can operate in a disciplined manner according to their procedures. There are other companies complementing what we do, like the owners of the technological packages that help improve safety, but once these improvements are made, we get into the actors."

DuPont's collaboration with Pemex began in 2000 after the explosion at the Cactus gas terminal in Tabasco. From this initial point of contact, DuPont expanded its collaboration to work with all four Pemex subsidiaries, as well as at the corporate level. Today, the company's major contracts are with Pemex E&P and Pemex Refining. The work involves creating a safety curriculum for the company, for training of safety personnel. DuPont believes the best way to do this is through creating a Pemex 'academy' for safety training.

While DuPont's cooperation with Pemex started with safety, it has now been extended to creating unique solutions for the NOC in terms of employee safety, learning and development, which includes defining how to train people and developing their capabilities around these safety concepts. "One of our key areas of focus here has been in environmental sustainability and occupational health, which is not something that DuPont does a lot of worldwide. However, it has proven to be very successful here. We have worked hard in this area to transfer some of our knowledge and experience of plant operation, the role of the medical community and HR, to create a safe environment not only in terms of both safety and wellness. These two concepts create a virtuous circle that elevates employees' levels of commitment and focus on safety."

After achieving impressive success in the field of exploration and production, Pemex is now concentrating on refining as its priority area for safety improvements. DuPont is helping the company to face challenges in this area.

"As recent events have shown, Pemex Refining has a problem with its maintenance strategy and its attitude to safety," Fernández says. "Our strategy is to help Pemex create a system of safety of which employees feel a large degree of ownership. Hopefully, this will not only improve the safety of refining units, but will also increase productivity, by increasing uptime and addressing concerns over mechanical integrity."

The relationship between safety and efficiency is what Fernández refers to as a journey: "efficiency is related to equipment running up to speed and potential, and for that it needs to be well maintained, according to the correct standards, and this cannot be achieved without good process safety. With safe employees, downtime can be reduced because accidents will occur with less frequency, and this in turn leads to increases in productivity. This is what we will be focusing on as we start to help Pemex improve its refinery processes."

SMART SOLUTIONS TO MANAGE COMMUNITY RELATIONS

Environmental and social issues have become an increasing concern for companies developing projects in the Mexican oil and gas industry. The successful execution of such is partially dependent on the operator's ability to execute the work while respecting the traditions and customs that affect the communities around the area of the project. Local communities in the country are sometimes reluctant to allow companies to operate in their backyards. Companies are often compelled to negotiate certain commitments in order to gain access to fields, and companies such as Boréalis help their clients keep track of those commitments and deliver on the promises made to communities.

"Things are changing in the industry: Boréalis would not have existed 15 years ago, since demand for this kind of services did not exist"

Jules Paquette, CEO of Boréalis

The idea to create Boréalis came to Jules Paquette and Patrick Grégoire in 1999, when they were developing a 1,000km pipeline project for ExxonMobil in Chad, Central Africa. The project represented a big challenge for the oil major, since it involved negotiating land access rights and giving several other concessions to local communities within the region. When the company finished tracing the route for the pipeline, people at ExxonMobil realized that they had left a trail of promises. Fulfilling those obligations became a difficult and time-consuming task. Both Paquette and Grégoire noticed the importance of improving the way large energy companies face these commitments.

Boréalis' goal is to assist in managing both social and environmental responsibilities that large oil companies engage in. "We provide a solution that follows the lifecycle of a project, keeping track of the relationships the company has with the communities and the commitments made to them," says Jules Paquette, founder and CEO of the company. "Through several detailed metrics, we measure the level of compliance of those commitments and trace them to completion, even when the asset or site changes hands over time. Our software helps support auditing and corruption management processes within social investment."

Companies have begun to understand the benefits coming from this detailed management of community relationships. "Corporations from all around the world have instituted a new position within their structures in charge of going out to the field, talk to people in the community, and build a link with them," Paquette says. Boréalis' CSR software serves the purpose of supervising that link through management of sustainability goals and key performance indicators (KPIs), while also measuring the efficiency and impact of the project.

Pemex has also realized the importance of this activity, especially after the problems that companies have had with local communities in Tabasco and at Chicontepec. The NOC is cooperating with Boréalis to ensure better community relationships at its different undergoing projects. "We are focusing on a specific project in Chicontepec, emphasizing social investment and providing the necessary capabilities to reinforce it," explains Paquette. "We will work both with Pemex and its contractors on their commitment to social responsibility with the communities, with Pemex overseeing the whole process." Social investment strategies will be reviewed directly by Pemex in the system. Possessing that information can assist the company in its decision-making process. "The software could provide Pemex with real-time information that allows it to adjust its social investment strategy based on recent developments and the fulfillment of KPIs," Paquette says. The establishment of precise metrics to get a more clear understanding of where the social investment is allocated will aid Pemex in the definition of its social responsibility strategy. "Through the software, Pemex will have access to more up-to-date information that will empower them to make more conscious decisions, under increased transparency, that will ensure that all investment plans are made in conjunction with local communities."

A great part of streamlining decision-making is ensuring that information is available at all times, even in remote locations that are out of the usual broadband range. Readily available information at any moment allows decision-makers to react quickly to risk materialization or failure to comply with best practices. "The idea is to make as much information as possible available in order to enhance field performance," Paquette details. "We have developed offline solutions to make information around social impact management available for mobile equipment

through satellite connections. The system has been made as light as possible, so even with very limited connectivity people can access it."

The underlying concept of Boréalis' solutions is ensuring that communities get the additional benefits that encourage them to allow oil companies operating in their region. "We do not want to provide a competitive advantage to one company or two," Paquette explains. "We want all companies to use our software, so that welfare flows directly to local communities. And while the solution right now focuses on large-scale projects at later stages of development, we have the proactive challenge to provide an additional solution for entry-level companies that will give them the opportunity to collect data from day one and effectively generate welfare." By building long-term relationships with communities, companies do not only manage to avoid protests, delays, or halts at their projects, but they also acquire the community's assistance in protecting the project's interests. "If the community buys in, they will defend the project," Boréalis' CEO adds.

Another advantage that strong community relations offers is the improved access to project financing. "If companies are able to prove that they have a superior understanding of the community and a controlled management of social and environmental risks, financial institutions will have greater security in financing those projects." Paquette explains. Boréalis' solution provides information about social and environmental indicators, such as land access

and management, social investment management, local business development, environment monitoring, and carbon footprint management, among others. All these data could provide financial institutions with the necessary confidence on the project's success to grant additional investment.

Regulations to manage social and environmental impacts in Mexico are not yet fully in place; however the increasing attention that both topics have garnered in the country are expected to give them a more prominent place on the energy agenda in the future. Evidences on the government's ambitions to better regulate these matters in the near future include the Climate Change Law and the annexes on sustainability added on the latest tenders issued by Pemex. "Things are changing in the industry: Boréalis would not have existed 15 years ago, since demand for this kind of services did not exist," Paquette says.

DEEPWATER SOLUTIONS

Over the next decade, Mexico is facing the challenge of exploring and producing in ever deeper waters as shallow water production enters into long term decline. Global Maritime is committed to supporting deepwater operators, drilling contractors, and service providers to minimize risk and increase operational efficiency as the Mexican oil and gas industry enters the deepwater era.

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LNG RIVERS

11

Natural gas is an interesting riddle; at the right price, gas projects can be lucrative, but when exploration and production budgets have to be shared with oil activities at current prices, the latter is clearly the more attractive option.

Pemex has the potential to ramp up gas production in the years to come, through non-associated conventional gas reservoirs and its shale gas resources, which are estimated to be some of the largest in Latin America. In this chapter, we investigate the pros and cons of conventional and shale gas production, the potential for Mexico to strengthen its energy independence by reducing its dependence on natural gas imports, and will also look at the most liberalized segment of the country's oil and gas industry: the transmission, distribution and storage of natural gas, which is open to third parties.

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CHAPTER 11: NATURAL GAS

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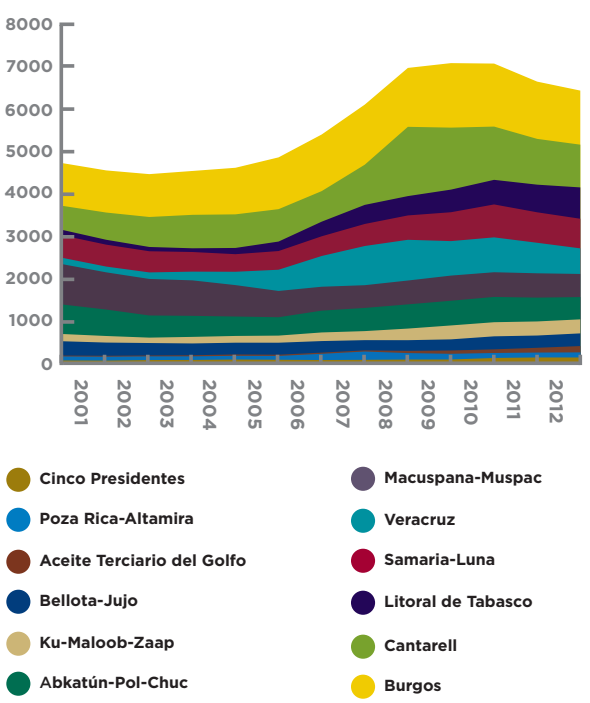
PEMEX'S NATURAL GAS STRATEGY

In 2012, the average wellhead price for natural gas in the United States was US$2.66, down from the 2011 price of US$3.95, and the 2008 high of US$7.97. This has had a serious impact on the natural gas strategy of companies around the world, including Pemex. Mexico is also experiencing a period of increasing demand for natural gas, as the country makes the transition to gas-fired power generation, and reduces its dependence on fuel oil as a power source. Pemex expects that demand will continue to rise in the mid-term, as a result of the country's industrial growth.

In 2011, Pemex produced an average of 6.59 bcf/d of natural gas, and in 2012, this figure actually dropped to 6.39 bcf/d; however, imports increased from 790.8 mcf/d in 2011 to 1.09 bcf/d in 2012. In the first months of 2013, this average had already risen to 1.22 bcf/d, showing a continuing growth trend in natural gas imports. In the last months of 2012, and even as recently as March 2012, Pemex issued critical alerts to industrial zones in central and eastern Mexico, warning that there was not enough gas in the system to meet demand.

As a result of these conditions, Pemex's natural gas strategy is currently focused on filling the gaps between supply and demand with a new round of infrastructure projects, designed to connect Mexico's industrial zones to gas supply from the US, and ramping up imports. In October 2012, Sempra Energy was awarded the contract to build a pipeline that would run from Arizona to Guayamas, in northwestern Mexico. In November, two pipeline contracts were awarded to Transcanada, to build the El-Encino to Topolobampo pipeline and the El Oro to Mazatlan pipeline.

GAS PRODUCTION



Source: Pemex

Pemex Exploration and Production assigned substantial investment to non-associated gas projects in 2012. According to figures from the National Hydrocarbons Commission (CNH), Pemex spent US$5.18 billion on non-associated gas projects for the year, 24.05% of Pemex E&P's total annual project investment budget. This represents a 0.05% increase in investment in this area between 2011 and 2012, albeit a 13.05% drop in comparison to the amount spent during 2010. For 2013, there is an assigned budget of only US$2.14 billion for non-associated gas programs, according to the CNH, which represents a 60% drop in Pemex E&P's investment in gas projects.

Of the US$2.14 billion assigned to non-associated gas projects in 2013, US$563 million, or 26%, was designated for exploration projects, US$702 million, or 33%, was allotted to development, and 40%, or US$944 million, was designated for investment in production. The remaining US$26.2 million was earmarked for general research and development in the area of non-associated gas during the current year.

Pemex E&Ps two main non-associated gas regions are the Burgos basin and the Veracruz asset. In total, Pemex plans to invest US$927.6 million in the Burgos asset, with 6% allocated to exploration, 52% to development and 41% to production. At Veracruz, 19% of the asset's budget will be allocated to exploration, 28% of the investment budget is set aside for development, and50% to production. The remaining 3% is reserved for research and development. Pemex has also allocated funds for non-associated gas exploration in deepwater in the Holok area, as well as development and production investments in Lakach. The former will receive US$410.9 million, while the latter will draw US$279.6 million from the planned budged for 2013. The remaining gas assets are grouped together in what Pemex calls its Strategic Gas Program. The fields included in this classification will receive US$23.9 million, which equates to 1.12% of Pemex E&P's total budget for non-associated gas projects

The current low price of gas has reduced the NOC's incentive to increase natural gas production since the economics of investment in oil production are more attractive than the return on investment in natural gas. As a result, natural gas production fell 6% in 2011 and 4% in 2012. Critical alerts issued because of natural gas shortages, and the resulting power shortages have cost the Mexican economy billions of dollars. The increasing pressure to solve this problem has pushed Pemex to expand its natural gas imports. Furthermore, the NOC is currently developing its gas pipeline infrastructure in order to be able to import more cheap gas from the US.

EVOLUTION OF MEXICO'S GAS RESERVES					
Region / Asset	Original gas in place (3P) Gas (bcf)	Accumulated gas Production	Remaining Gas Reserves		
			1P	2P	3P
Northeast Marine Region	27,939	9,025	2,849	3,792	4,439
Cantarell	17,911	7,327	1,301	1,790	2,082
Ku-Maloob-Zaap	10,028	1,698	1,548	2,002	2,357
Southwest Marine Region	45,224	7,974	4,080	7,846	14,616
Abkatún-Pol-Chuc	16,777	6,354	834	1,619	1,709
Litoral de Tabasco	28,447	1,620	3,247	6,227	12,907
North	110,049	23,210	3,858	15,388	33,958
Aceite Terciario del Golfo	37,866	370	881	11,192	28,397
Burgos	22,985	12,127	1,877	2,690	3,760
Poza Rica-Altamira	43,213	7,508	362	620	751
Veracruz	5,984	3,205	738	886	1,049
South	74,271	29,046	6,437	7,812	8,629
Bellota-Jujo	18,525	4,752	1,783	2,262	2,428
Cinco Presidentes	6,674	2,221	324	359	470
Macuspana-Muspac	29,518	15,555	1,466	1,857	2,299
Samaria-Luna	19,553	6,519	2,865	3,335	3,432
National Total	257,484	69,255	17,225	34,837	61,642

EXPLORATION ACTIVITIES IN 2012

The fast pace at which oil and gas exploration projects have developed has led to a wide array of natural gas discoveries. In 2012, four exploration wells drilled at the Burgos asset confirmed natural gas production potential, a large wet gas basin was discovered in the Litoral de Tabasco area, and gas and condensates were discovered in the Macuspana-Muspac asset – is a token of the gas production potential in the Southwestern Marine Region of the Gulf of Mexico. The Energy Ministry expects that this region will become the source of 27% of Pemex E&P's natural gas production by 2026. Gas and condensates were found in four wells located in the Southeastern Basin: Jolote-101, Sunuapa-401, Teotleco-101 and Navegante-1. In addition, the Gasifero-1 well, located in the Veracruz basin, reported an initial production of 0.3 mcf/d at the end of last year. In the Burgos asset a discovery was made at the Arbolero-1 well, which is part of a series of wells that Pemex drilled in this asset's Late Jurassic formation during 2012, in the hopes of developing shale gas production in the future.

Shale gas was one of the company's main finds during 2012. Pemex announced that it found shale gas in several exploration wells on the Mexican side of the Eagle Ford region, which is one of Mexico's five geological provinces with large shale gas potential. Pemex estimated that the country's prospective shale gas resources could represent up to seven times the conventional 3P gas reserves that Mexico currently has. Even if Pemex's gas strategy currently prioritizes imports, further exploration projects will be carried out in the coming years in order to define the country's shale gas potential. In addition to the exploration project at the Mexican extension of Eagle Ford, Pemex also embarked on the quest for shale gas in the northwestern region of the Gulf of Mexico, near Tampico. Together, these two exploration projects entailed investment of over US$200 million in 2012. This year, Pemex's management will continue the aforementioned trend; in March 2013, Pemex E&P signed an agreement worth US$244 million for shale gas exploration in Coahuila and Veracruz.

MSCS DRIVE DIVERSIFICATION RATHER THAN GAS PRODUCTION

Part of Grupo Industrial Monclova (GIMSA), GPA Energy began working in the Burgos basin in 2007, at the Monclova block, under a multiple service contract (MSC) for Pemex. Over the course of the contract, the company worked hard to develop its expertise in the various segments surrounding gas production: from drilling and operating wells to planning and constructing gas pipelines to link the production infrastructure to Pemex's natural gas network. However, according to Jesús Gil Benavides, COO of GIMSA, the project has not proven to be as successful as the group might have hoped, due to external factors: "Because of the current price of natural gas in Mexico, investment in expanding natural gas production in the Burgos basin has stopped. It is simply not profitable for Pemex to drill for dry gas, which is what we have in the Monclova block. Currently, the NOC is focusing on finding oil and condensates in the basin. As a result, our activities today are solely focused on maintaining the gas wells that we have in the block."

GPA Energy was created as a joint venture between three companies, and served as a vehicle for GIMSA to gain the necessary expertise to become an operator for Pemex under the multiple service contracting system, which was put in place before the 2008 Energy Reform allowed for the introduction of integrated service contracts. Gil Benavides reveals that the company was formed after encouragement from Pemex to establish the first 100% Mexican company operating under the multiple services contracting scheme in the Burgos Basin. "This is a turnkey project for us," Gil Benavides says. "We drill wells and connect production to the pipeline network. We have 10 wells in operation, which reach a maximum of 100 mcf per month of production."

Although the project has not met the commercial expectations, some positive results have come from the experience. As well as gaining drilling expertise, the company has also branched out into pipeline laying, and has been participating in tenders for the laying of various pipelines of up to 16" (40.64cm) in diameter. "The core competence for GIMSA is in manufacturing: we started building structures, offshore platforms, and then we got into the gas business, which directed us to gas pipelines," Gil Benavides says. With one of the largest pipeline trenching vehicles in the country, GPA is capable of laying as much as 1km of pipe per day. Also, the combination of the drilling experience in the Burgos Basin, and the group's long track record in the construction of large steel structures, encouraged GIMSA to take a gamble on the construction of land rigs. "The first land rig that we were going to build was destined for GPA, but drilling activities were shut down in the Monclova block as a result of the low natural gas prices. However, we are still looking to start that project," says Gil Benavides.

CONTRACTING AT BURGOS

The annual investment budget for the Burgos project is US$1.3 billion, creating attractive business opportunities for companies that have expertise in the development of non-associated gas fields. Field development for Burgos has allowed the participation of different private companies through the tender of several multiple service contracts (MSCs) for different blocks: with the Reynosa-Monterrey, Misión, Cuervito, Fronterizo, and Olmos blocks being awarded in the first round; the Pandura-Anáhuac and Pirineo blocks awarded in the second round in 2006; and the Nejo and Monclova blocks awarded in the third round in 2007. An important part of Burgos' total production is currently yielded by the blocks awarded in these contracts. Even though Burgos has already produced around 12 tcf of natural gas, there is still much gas to be extracted from the area. Its remaining 1P reserves amount to 1.88 tcf of natural gas, while its 3P reserves total 3.76 tcf. The continuing evolution of the project will depend on the constant analysis of the field and the implementation of new technologies and procedures that could help to optimize production in years to come. In this respect, Luis Vázquez Sentíes, President of Grupo Diavaz – one of the companies currently working at Burgos – believes that the next step for field development at the asset is to change the MSCs that are currently being used there to integrated service contracts (ISCs). "We are currently working at two of the fields at Burgos where Petrobras is the leader of our consortium, and we are lobbying for the contracts there to develop into ISCs," he says.

ROUND	BLOCK	COMPANY AWARDED
1st Round MSC	Reynosa-Monterrey	Repsol
	Misión	Techint Consortium (Tecpetrol, IPC, and Techint)
	Cuervito	Petrobras Consortium (Petrobras, Grupo Diavaz, and Teikoku)
	Fronterizo	Petrobras Consortium (Petrobras, Grupo Diavaz, and Teikoku)
	Olmos	Lewis Energy
2nd Round MSC	Pandura-Anáhuac	IPC Consortium (IPC and Compañía de Desarrollo de Servicios Petroleros, S.A. de C.V.)
	Pirineo	MPG Consortium (Monclova Gas Pirineos and Cobra)
3rd Round MSC	Nejo	MPG Consortium (Monclova Gas Pirineos and Cobra)
	Monclova	MPG Consortium (Monclova Gas Pirineos and Cobra)

THE NETBACK PRICING MODEL FOR NATURAL GAS

Since the 1990s, CIDE has been helping CRE to create a pricing system for the natural gas market in Mexico. During the research and analysis period, CIDE and its economists considered several models that could serve as a foundation for the model. Juan Rosellón Díaz, current Professor of Economics at CIDE, and one of the economists that led the analysis, explains the process of establishing the current model and the reasons it works in the Mexican market.

Changes in the regulation of natural gas in Mexico have been underway since the natural gas transportation and distribution market was first opened up to the private sector. "The CRE has tried several ways to open up competition in the natural gas market, so that prices could be optimized through market forces," Rosellón Díaz explains. "Institutional and political constraints, as well as the fact that Pemex operates as a monopoly, have slowed those regulations from being fully effective. The privilege that Pemex has to control the entrance of new players, and establish where to allow competition, makes a free-market pricing model impossible. Supply and demand would not work as a price-setting strategy within the current configuration of the natural gas market in the country."

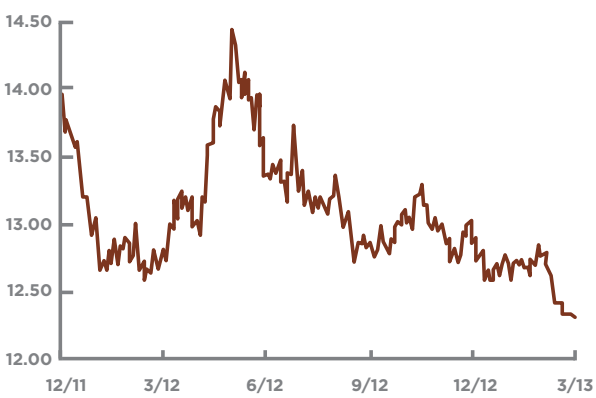
"The fact that the monopolistic market allows Pemex to be both a player and a regulator in terms of price-setting created several loopholes within the structure that the CRE wanted to put in place," Rosellón Díaz explains. "Competition is essential to develop the natural gas market in Mexico and introduce a market based price-setting mechanism." Since the current configuration of the industry does not allow a free-market structure to set the prices, the CRE started looking for a different pricing model.

In order to develop an optimal pricing structure for the market, CIDE had to learn how the market worked in detail. "First of all, it is important to understand that there are three different types of markets for natural gas in Mexico: the commercial market, the industrial market, and the residential market," Rosellón Díaz explains. Each market has to be analyzed separately to be understood completely, and then compiled into a unique model that would regulate the price of natural gas.

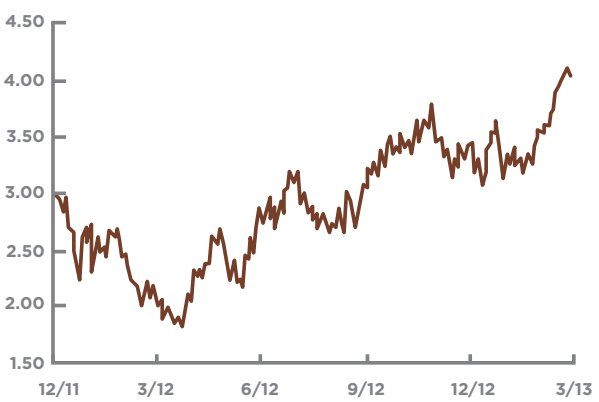
In terms of residential and commercial consumption, the main competitor for natural gas is liquid propane gas (LPG). "This product is very well established in the Mexican market," says Rosellón Díaz. "Although natural gas is considered a substitute for LPG, the distribution and price advantage of LPG allows it to maintain a dominant position in Mexico's residential market. CIDE and CRE together have conducted several studies on the prospects of natural gas replacing LPG in the residential market, which seems unlikely to happen in the short-term since LPG has a competitive advantage over natural gas." In power generation activities in the industrial market, there are several other substitutes for natural gas. "Fuel oil is the most frequently used, however, the high level of emissions that it produces and the environmental regulations in place have pushed companies in the power generation market to use natural gas instead," says Rosellón Díaz. "The analysis made by CIDE and the CRE indicates that the market will keep increasing its use of natural gas in the future instead of other alternatives."

Once CIDE's analysts fully understood the way the Mexican natural gas market works, they started analyzing possible

EXCHANGE RATE MX$/US$



NATURAL GAS PRICE US$/MMBTU



Mexico's natural gas imports from the US increased by 24% to 1.69 bcf/d in 2012, and now account for 30% Mexico's natural gas use. Over the past 5 years, Mexico's natural gas consumption increased by 4% annually while production went up by only 1.2% per year.

Source: Pemex

alternatives for price regulation. “The first alternative analyzed was setting the price through the Noble Prize winning economic theory of netback pricing,” Rosellón Díaz explains. “The netback pricing model would allow us to establish a fixed benchmark price. This structure would not allow Pemex to determine or strategically influence the price, making the NOC a price-taker.”

The first options evaluated were similar energy sources in Mexico that could be used as substitutes: diesel, fuel oil, or LPG. “Both diesel and fuel oil were influenced directly or indirectly by the oil extraction process, which works under very different economic conditions, so they were ruled out of the feasible set of pricing benchmarks,” says Rosellón Díaz. “LPG was further analyzed, since its price was established through a benchmark process similar to the netback pricing model. However, the transportation of LPG does not really compare to the transportation of natural gas, which made the alternative a non-optimal one.”

Rosellón Díaz explains that the netback pricing model was the best alternative after the free market approach, since it would allow a relevant market to establish a benchmark price, and add transportation costs from the central node to the rest of the nodes in the system. The problem then was to determine which market would be the most relevant for the country’s natural gas sector. After analyzing several alternatives, CIDE suggested that the benchmark price could be established based on the Houston Ship Channel Index. “The alternative we suggested was to use the price at the Houston Ship Channel Index as the benchmark price and add the net transportation costs, which would depend on where the arbitration point – or central node – would be located,” Rosellón Díaz explains. “It made a lot of sense, since none of the substitutes in Mexico was really viable as a standard and the market has three different types of consumers, which made it difficult to compare the natural gas market to other markets working under different conditions. The market in South Texas was also the most reasonable to use, since US supply and demand of gas directly affect the market in Mexico.” The arbitration point was set in Los Ramones, Nuevo León, since it is a central location from which gas flowing from the US and the north of the country could meet with gas coming from southern Mexico. “The fact that most of the gas production took place in the country’s southeastern regions, and production efforts were ongoing in Burgos, Tampico, and Veracruz, made Los Ramones the best location to obtain an balanced assessment of transportation costs,” Rosellón Díaz describes. “The arbitration point needed to be dynamic, central, and balanced, since any change in its location would affect prices and could make the whole operation’s profitability go down.” The netback pricing formula was set: the price would be set based on the Houston Ship Channel Index price to which transportation costs from Houston to Los Ramones would be added, and transportation cost from Los Ramones to distribution nodes, such as Ciudad Pemex, would be subtracted.

There is still one problem with this pricing model, which is not economic in nature, but relates to the regulatory framework under which the industry operates. “Currently, Pemex has the possibility of changing the location of the arbitration point in the company’s best interest,” Rosellón Díaz remarks. “They can change the location of the central node upwards or downwards to balance out the financial side of its projects. This is the reasonable choice to make for rational economic agents.”

“A way of undermining the risk of Pemex having the temptation to change the arbitration point would be to grant regulators such as the CRE additional power to control Pemex’s investment strategies, encourage it to produce more natural gas within the country and keep the arbitration point where it will optimize the country’s energy welfare, instead of the profits that could come from natural gas marketing,” Rosellón Díaz concludes. “If the regulator is given the power to set strategies focused on maximizing the country’s energy welfare, the pricing model will continue to optimize the market conditions.”

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BALANCING NATURAL GAS DEMAND AND SUPPLY

Mexico's natural gas production is not keeping up with the country's demand, and the low price for imported gas due to the recent North American shale gas boom does not provide the required incentive to drive sufficient increase in investment for the exploration and production of domestic natural gas. The lack of supply has led to critical alerts, which mean the suspension of supplies to major consumers due to insufficient natural gas pressure in the pipeline system. These alerts were repeatedly issued by Pemex in 2012, influencing production and bottom line for large industrial companies. José Luis Gutiérrez-Azpe and Claudio Rodríguez-Galán, partners at the law firm Capín, Calderón, Ramírez y Gutiérrez-Azpe S.C., believe that actions should be taken to avoid this situation in the years to come.

"CFE and Pemex are compelled by the Pemex Law to be efficient and execute the most profitable projects," Rodríguez-Galán explains. "So, if there are no incentives that make natural gas investment profitable, then they are not going to do it." Even though both state-owned companies are the main consumers of gas in the country, Pemex has not been able to grow its production levels. When private companies had to reduce their natural gas consumption during critical alerts in 2012, concerns emerged that Pemex and CFE had preferential treatment. "In theory, CFE and Pemex are just like any other client," details Rodríguez-Galán. "However, when supply issues arise, they probably have favorable considerations, since they are the main Mexican utility providers." To solve the problem, efforts are being made within the CRE to provide a new ruling on the issue. "One of the possible arrangements that could be made is to prioritize by consumption level," Rodríguez-Galán describes. "By ranking natural gas consumers by the amount of gas they use, and how critical it is for their activities, the CRE could create hierarchies for gas distribution."

Another solution that could be examined is the take-or-pay contracting model that already exists in the power generation industry. "It could work for Pemex, but I don't see it happening in the gas industry, since it would not benefit the CFE," Rodríguez-Galán clarifies, while stating that it could even go the wrong way for the industry. "Sometimes, Pemex would not even be able to provide the level of gas forecasted at the beginning of the period." To ensure that business can continue uninterrupted, the private sector lobbied for an agreement with CFE and Pemex to import more gas. With the Confederation of Industrial Chamber (Concamin) as intermediary in the discussions, the three parties came to a compromise on importing gas from Peru at US$2.50/MMBtu to ensure gas supply until 2015.

Despite this, longer-term constraints need to be addressed, provided that the gas market stays the same. "Other countries use subsidies and other incentives to make natural gas extraction more profitable," Rodríguez-Galán describes. "This is not the answer for Pemex," Gutiérrez-Azpe clarifies. "Temporary solutions might be reached, but the government understands that the final solution will be to invest more in gas production and transportation infrastructure; it all starts with infrastructure."

"First of all, additional infrastructure needs to be created at the border to increase natural gas import capacity" says Rodríguez-Galán. The main concerns with building the necessary infrastructure revolve around security issues in Mexico's northern region. "The security problem cannot be ignored," Gutiérrez-Azpe asserts. "Under Calderón's Administration, the war on drugs has an extremely negative impact on the energy industry," Rodríguez-Galán adds. "Several pipeline construction projects, as well as other infrastructure projects had to be stopped because of security issues and concerns. Some of our clients that work over there have also suffered from these security and safety hurdles."

Private investment plays, and will continue to play, a central role in ensuring the supply of natural gas meets Mexico's energy needs. "The market is already open to private investment in distribution, transport, and storage, according to the Constitution," Rodríguez-Galán explains. "Private companies can transport gas for Pemex and for private entities, as long as they build the necessary infrastructure to do so: maritime ports, storage facilities, and pipelines. The Manzanillo port infrastructure is a clear example of this. But Mexico needs to have more cases like this to accomplish the infrastructure challenge."

"The market is already open to private investment in distribution, transport, and storage, according to the Constitution"

Apart from the current efforts that Pemex and the private sector are making to balance supply and demand in the natural gas market, additional efforts have to be made. "We still have to work with the current regulations and continue creating new rules that allow more flexibility within the boundaries of the Constitution's main principles," Rodríguez-Galán adds.

IS THE NATURAL GAS MARKET IN MEXICO TRULY OPEN?

"It would be nice to say the gas market is completely open, but the private sector is only allowed to invest in the distribution and transportation of gas, and even though 23 different companies have invested around US$5 billion in gas infrastructure, further market opening would create more opportunities to expand the natural gas industry in Mexico," says Agustín Humann Adame, Executive President of the Mexican Natural Gas Association (AMGN).

Since AMGN was created in 1988 to promote the interests of the Mexican natural gas industry, it comes as no surprise that the AMGN played a key role in the liberalization of the country's gas market. "We worked with the CRE to establish all the necessary regulations. Before the liberalization there were only a few Pemex companies distributing natural gas in Mexico; one was in Mexico City and the others were in Queretaro, Piedras Negras, Ciudad Juarez, and Monterrey. However, after the liberalization the CRE opened participation not only for the distribution of gas, but for transportation as well, which led to the awarding of 24 distribution and transportation contracts," explains Humann Adame. Most of the contracts were awarded to foreign companies. This happened, says Humann Adame, because of the lack of Mexican bids for the contracts and because the CRE was more focused on increasing the much-needed natural gas distribution capacity rather than fostering the growth and expansion of Mexican gas transportation and distribution companies.

The need for pipeline infrastructure is not the only challenge to the growth of the industry; the subsidies for LPG gas offered by the federal government are hampering the growth and expansion of the conventional gas market. "The AMGN is constantly lobbying against the subsidy LPG currently receives from the federal government, since it is not good for competition. However, we are confident and have high expectations that the new government will change these outdated practices," explains Humann Adame.

Besides lobbying and attempting to reduce or eliminate the federal subsidy on LPG gas, Humann Adame states that the AMGN is constantly working to promote the benefits of natural gas to the general public through local campaigns and via radio, television, and printed material. "The first and most important benefit is safety, since natural gas is never stored in compressed tanks; and the second is that you pay your bill post-usage, so you have vast gas availability that you can use at your own discretion, without ever having to worry about storage levels because it flows continuously through pipes," explains Humann Adame.

Even though LPG gas and the eventual production of shale gas in Mexico might affect natural gas prices, Humann Adame believes the natural gas market is going to grow because companies are finding alternatives to their dependence on pipeline infrastructure and starting to find their own transportation solutions, such as transporting by truck. "In Mexico we currently have two new companies that are transporting natural gas in trucks; one in Morelos and one in the north, which is a great short-term solution to the lack of pipeline infrastructure."

"I truly believe security is not a problem in the construction of pipelines in Mexico"

Agustín Humann Adame, Executive President of the Mexican Natural Gas Association

Currently, most gas transportation and distribution activity occurs in northern and central Mexico. "This is the case because on the entire Pacific coast there are no pipelines. Four pipelines that were awarded to Sempra Energy and Transcanada, are currently under construction in this region," explains Humann Adame.

Due to security reasons, many companies have been reluctant to work in certain parts of the country. Humann Adame believes that "those companies that are awarded contracts by the CRE and will not fulfill them or postpone them for security reasons, should allow others to seize the opportunity because I truly believe security is not a problem in the construction of pipelines in Mexico."

AMGN's Executive President understands this is just a short-term solution and that in order to fully address Mexico's transportation and distribution problems there needs to be more market openness: "We feel the intense interest of foreign and domestic investors in the Mexican natural gas transportation, distribution, and storage business, which could result in various benefits for the country, such as more jobs, an increase of natural gas production, and a decrease in natural gas prices."

FROM PIPELINE TO PROJECT OPERATOR

FERNANDO CALVILLO ÁLVAREZ
President & CEO of Fermaca

Q: After the construction of the Chihuahua pipeline, Fermaca will be transporting over 20% of Mexico's gas. What should be the role of the private sector in Mexico's natural gas imports?

A: In the future, Mexico will import around 35-40% of its gas from the US, as there is no incentive for the Mexican government to produce this hydrocarbon if it can buy the cheapest natural gas in the world from the US. Around the world – in Europe and the Far East – natural gas is priced between US$8 to US$12 MMBtu, while in Mexico it is priced at around US$3.00 MMBtu. However, if we want to have more interconnections at the border to import more gas, we need to plan ahead, just as Pemex is doing with the Los Ramones pipeline. Another obstacle in pipeline construction is the fact that Pemex has other budgetary priorities: exploration in deepwater, for example, is extremely costly, which means that only a small portion of its budget is left for pipeline construction. No one is going to give a free ride of equity to Pemex, and as a result, I believe they should offer these projects to companies like Fermaca.

Q: How many interconnections are there currently at the border? How does this affect Mexico's gas imports?

A: Mexico has currently around five or six interconnections at the border – without counting the Chihuahua pipeline – and all these interconnections are connected to the El Paso Natural Gas System. This could be a potential problem for Mexico, because if the Americans ever close the valve, we have no other way to import gas. It is impressive that Mexico has vast energy resources and we are still importing gasoline, gas, LPG, and diesel.

Q: Given your experience and success as a pipeline construction company, why would you shift your focus to becoming a pipeline operator?

A: First of all, Fermaca should go into pipeline operation because we strongly believe there is a window of opportunity, even though many companies disagree with us. Furthermore, we are interested in becoming pipeline operators because we have been able to acquire the funds needed, and we have a group of partners that understand the risk-reward balance in this market. We have been chasing projects in South America and the Caribbean; we recently signed a joint venture with a company in Abu Dhabi, but when we came back and made a fair analysis of the opportunities at home, we realized the potential today is greater in Mexico than in any other part of the world.

Q: Which obstacles could impede you from becoming a large pipeline operator in Mexico?

A: The greatest obstacle we find to becoming successful pipeline operators is the atmosphere of insecurity that currently exists in northern Mexico. In January 2012 we lost three engineers in Chihuahua; they were murdered. However, instead of backing out, we were able to unite the team and make them realize the time to move forward is now, especially because most of our competitors are American companies, and I do not see them competing for projects in this specific region.

Q: How do you secure your financing, and how are you able to compete with larger competitors?

A: Due to our size, we take a very aggressive approach on projects during the first phase and invest US$5-6 million: acquiring options and obtaining permits to ensure that our contingencies are as low as they can be. That way, we can compete with the bigger corporations.

Today, the project finance market is very difficult, following the global financial crisis there are not many banks involved in project finance. Before, you could raise US$500 million with two banks. Nowadays, to raise that amount of money, you need six or seven banks, because they want to spread the risk. We have contact with a group of banks; they know us very well and they have seen the progress of our projects. They are very eager to continue helping us, so we already have a credit line. We do not have binding commitments because we do not have the tenders yet, but we do have the letter of interest of all of our banks to keep participating with us on these projects. It helps that our client, the CFE, has a good credit rating, which essentially is equal to a Mexican government bond.

We believe that once we win two more CFE projects, is the time for Fermaca to become a public company, which

is something we have been working towards since 2007. That will be our next step, and we expect it to happen in 2015. Right now is not a good moment for an Initial Public Offering (IPO), and we do not want to do our IPO in Mexico, even though there is a lot of cash from pension funds and savings, because there is limited knowledge about energy projects. Sempra announced it was going public in Mexico last year; I want to see what happens because IPOs in Mexico are not very successful. Furthermore, energy projects need a lot of investment and Fermaca has the structure to go public in Canada or the US.

An example of what we could do is create a master limited partnership (MLPs), which combines the tax benefits of a limited partnership with the liquidity of publicly traded securities, just like Energy Transfer. An MLP does not pay taxes – the ultimate shareholder is the one that does – so the company produces a lot of cash flow, and if it keeps reinvesting its profits then there only a dividend tax. Energy Transfer used to be our partner. When I first met Kelsey Warren, CEO of Energy Transfer, his company was a small intrastate natural gas pipeline operator worth US$25 million. Three years later, when Fermaca and Energy Transfer started collaborating and developing projects together, it had become a US$ 250 million company. Today, Fermaca has a market value of around US$650 million and Energy Transfer one of the largest and most diversified investment grade master limited partnerships in the United States, worth around US$25 billion, operating approximately 111,000km of pipelines. This is just an example of what is possible for an MLP, and this is only for the gas, oil and power industry. However, we are still in the process of analyzing what will work best for Fermaca.

Q: Would it make any sense for Fermaca to start investing in pipeline infrastructure in the US?

A: It would be very interesting, but the market is extremely competitive. It is difficult because as a foreign company we cannot acquire permits from state offices. We would have to get our permits from the Federal Energy Regulation Commission (FERC) in Washington DC, and that is five to ten times more difficult than acquiring them in any given state, such as Texas or California. Besides, the companies operating in the US, such as Williams Companies, have over 65,000 km of pipelines compared to our 16,000km in Mexico; they have more resources, more experience, and the competitive advantage of being local and acquiring their permits in their home states. In reality, for the time being it does not make a lot of sense for us to invest in pipeline infrastructure in the US.

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TAILORED GAS DISTRIBUTION AND TRANSPORTATION SOLUTIONS

When Carlos Arriola Jiménez took over as Director General of Igasamex, his main goal was to accelerate the growth of the company. Even though the company has been in the gas industry for over 60 years, Igasamex had not been able to fully develop its natural gas distribution and transportation services until the opening of the gas market in the mid-1990s.

"Expanding natural gas infrastructure in Mexico creates value for the country since manufacturers are deciding to relocate here because of the competitive natural gas price"

Carlos Arriola Jiménez, Director General of Igasamex

Today, Igasamex offers integrated solutions to meet the energy needs of industrial clients through a unique business model. "Our business model fits consumers that use natural gas as a strategic product, but are not large enough to have any real relevance for the CFE or Pemex. The difference between CFE, Pemex, and Igasamex is our ability to focus on the needs of our customers, especially because we do not service as many companies as they do and which in the end enables us to always find the solution that meets our client's energy needs," explains Arriola Jiménez.

This kind of 'need-based service' offered by Igasamex is a success in Mexico because, under the current regulatory framework, permission for gas distribution is only given to companies delivering to end-users. Igasamex has managed to be successful because it meets the energy needs of its clients, particularly those that are based in locations that do not have access to natural gas distribution centers. "We facilitate a single window operation where we develop all the elements of the natural gas transportation process to deliver natural gas to our clients' facilities. It all comes down to the economics of the project; if we would be working with a single customer and he has a relatively low usage of natural gas, the investment and the amortization of that investment would require us to charge fees that make natural gas an uncompetitive solution for their energy requirements, and that does not make sense," Arriola Jiménez details.

For this reason, 80% of Igasamex's services are offered in 12 states that currently have natural gas distribution infrastructure, like the Gulf coast, central Mexico, and Baja California. However, there is a large section of the country where infrastructure is currently undeveloped or non-existent, such as the Pacific coast. While this seems like an obstacle for Igasamex, Arriola Jiménez has developed a strategy based on using road transportation of natural gas to develop new markets and reach new clients. "We are currently evaluating different projects to deliver natural gas to sites that have not been served by pipeline transportation, and we expect within the next few months to start a road transportation operation to deliver natural gas to these locations," he explains.

Besides expanding to road transportation of natural gas, Igasamex is constantly monitoring pipeline infrastructure projects for opportunities to expand infrastructure and services, lower gas prices, and attract more foreign investment. "Expanding natural gas infrastructure in Mexico creates value for the country since manufacturers are deciding to relocate here because of the competitive natural gas price," claims Arriola Jiménez, who adds that even though it is always risky to talk about the future with a sense of certainty, the North American natural gas market is likely to remain competitive in the long run. Mexico is a great option for foreign companies that operate manufacturing facilities, not only because of cheap gas prices, but also because of our proximity to the US and the competitiveness of our labor costs. "The sum of these factors makes a very interesting case for investing in our country right now, and I would like to underscore the important role natural gas plays," says Arriola Jiménez.

Furthermore, Igasamex has a very ambitious goal of entering the transportation and distribution market for Liquefied Natural Gas (LNG), even though it might seem somewhat radical and risky. Arriola Jiménez believes that the current stage of the gas market creates opportunities for his company to be creative and to think about things that traditionally have not been seen. "The need is there and I think we are the right partner to provide solutions with regard to LNG distribution and transportation. We would like this project to materialize, because traditionally 100% of our business is delivering natural gas through pipelines to industrial end-users, and this project would be a huge step forward to develop new growth platforms," he concludes.

MEXICO'S LNG TERMINALS

Mexico has currently two Liquefied Natural Gas (LNG) terminals on the Pacific coast, at Manzanillo and Ensenada, and one in the Gulf Coast located in Altamira, Tamaulipas. All of Mexico's LNG facilities are regasification terminals, built to receive gas in a liquefied state and convert it back to gaseous form. The advantage of LNG lies in the fact that it takes up 1/600th of the volume of natural gas in its gaseous state. Indeed, the energy density of LNG is 2.4 times heavier than compressed natural gas (CNG). This makes LNG much more cost efficient to transport long distances, which is done both by sea and by road, in specially designed cryogenic tankers.

Mexico is increasingly relying on LNG to prevent energy shortages, and resulting grid failures, due to rising energy demand combined with decreasing domestic production, and, in the case of Mexico pipeline bottlenecks limiting access to much cheaper imports from the US. Pemex paid US$19.45/mmBtu on the spot market for an LNG cargo in March, and in April brought in a spot market shipment at US$15.85/mmBtu, while importing natural gas by pipeline costs substantially less at around US$4/mmBtu. Mexico's CFE, the state owned electricity company, is expecting to contract a large number of LNG cargos throughout 2013 and 2014. At the end of 2014, large pipeline projects should come unlock increasing access to cheaper US imports.

1. ALTAMIRA LNG TERMINAL

The Altamira LNG terminal near Tampico began operations in August 2006 as a joint venture between Shell (50%), Total (25%), and Mitsui & Co (25%), and is the first regasification terminal in Mexico and Latin America. The terminal has two tanks, each with a storage capacity of 5.30mcf and an annual emission capacity of 261.33bcf, and a jetty that can receive LNG vessels with a load of up to 7.63mcf. The emission capacity could be increased to 353.15bcf with the construction of a third tank, but this is unlikely to happen in the near future given current natural gas prices. Throughput capacity of 261.33bcf per year has been fully contracted for a long-term period. In September 2011, the terminal was sold to a joint venture of Enagas and Vopak (60%) for US$408 million.

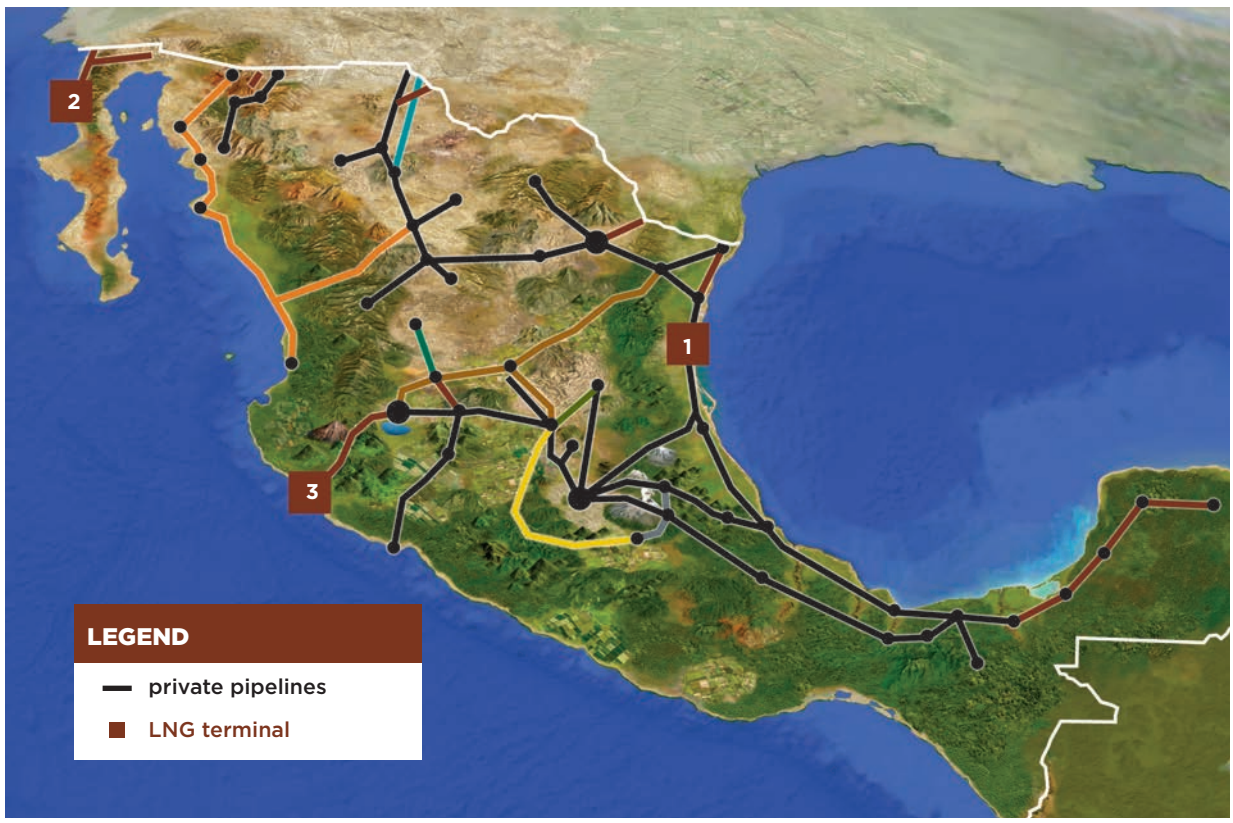
2. COSTA AZUL LNG TERMINAL

The Costa Azul LNG terminal at Ensenada, Baja California, which began construction in 2005 and started operating in May 2008, can process up to 1 bcf of natural gas per day, with a potential to increase capacity to 2.5bcf/d. Furthermore, the Costa Azul LNG terminal is removed from residential areas and has access to deep coastal waters. The natural gas processed at Costa Azul is delivered via a 45-mile section of the Bajanorte pipeline system, which allows it to serve the energy needs of Baja California; however, due to the relative low energy needs of the state, remaining gas is exported to the US. The Costa Azul LNG Terminal was the first on the North American Pacific Coast and cost around US$975 million.

3. MANZANILLO LNG TERMINAL

The Manzanillo LNG facility was constructed in 2008 and began operations in 2012. The facility is owned by KMS de GNL, which is a joint venture between KOGAS, Mitsui, and Samsung, and cost around US$900 million. The plant consists of two 150,000m^3 storage tanks, an LNG facility with the capacity to gasify and deliver 3.8 million tonnes of gas per year, and a port facility for ships to dock and unload/upload from 70,000 up to 216,000m^3 of LNG. The main supplier to the plant is a Peruvian LNG Terminal near the city of Pisco, the plant's main customer is CFE, and most of the gas is transported to consumers via the Guadalajara Gas Pipeline. Even though the plant is currently in operation, it will not reach maximum capacity until 2013.

| MAIN PIPELINES & LNG TERMINALS



TLAXCALA-MORELOS PIPELINE

The first phase of this 160km pipeline will connect the Esperanza-Venta de Carpio pipeline in Tlaxcala to CFE operated electricity plants in Morelos. Although it was initially scheduled for completion in October 2012, it now seems that the project will be completed in early 2013. The second phase, to be completed later in the year, involves the extension of the pipeline from the same interconnection to the Cempoala-Santa Ana pipeline in Tlaxcala. Spanish energy infrastructure group Elecnor will operate the contract over a 25-year term.

TAMAZUNCHALE-EL SAUZ PIPELINE

The 200km long Tamazunchale-El Sauz pipeline will connect the Palmillas-Querétaro pipeline with the private Naranjos-Tamazunchale pipeline. A combination of 76cm and 91cm diameter pipes will be able to transport up to 630 MMcf of natural gas. Awarded in February 2012, the project is expected to come online in the first quarter of 2014. The contract will be operated by TransCanada and has a 25-year term.

LOS RAMONES PIPELINE

The Los Ramones natural gas pipeline will run for approximately 1,000 km through the states of Tamaulipas, Nuevo Leon, San Luis Potosí, Guanajuato, Queretaro and Zacatecas, and could be extended into the states of Jalisco and Aguascalientes. The entire project is expected to require an investment of approximately US$3 billion, and will carry 2.1 bcf/d. The contracts for Los Ramones should have been awarded in October 2012, but in January 2013 Pemex announced that the project would be split into two parts, with the first being constructed by TAG Pipelines, and the second to be auctioned later in the year.

ZACATECAS PIPELINE

The Zacatecas pipeline was the first new pipeline in President Calderón's natural gas development plan, and will be integrated into the Los Ramones pipeline system. This 165km pipeline, to be constructed at a cost of US$110 million will supply 20 mcf/d of natural gas to a plant of Grupo Modelo, Mexico's largest brewer.

CHIHUAHUA CORRIDOR PIPELINE

At the end of 2011, CFE awarded the contract for the 385km Chihuahua Corridor pipeline to Tarahumara pipeline, a subsidiary of Fermaca. The pipeline will transport up to 850 mcf/d from Ciudad Juárez to El Encino, where it will connect with the Chihuahua-Torreón pipeline, to deliver gas from the US for power generation in the states of Chihuahua, Durango and Coahuila. The Tarahumara pipeline will provide transport services over a 25-year period.

NORTHWEST GAS PIPELINE

The Northwest Gas pipeline is the flagship project of the prevoius administration's US$10.5 billion natural gas strategy, which also includes the construction of the Los Ramones pipeline network in central Mexico and the creation of four natural gas distribution zones. CFE has awarded 25 year contracts to Sempra International to build, own, and operate the two sections of the pipeline from Sasabe to Guaymas and Guaymas to El Oro, at an expected investment of US$1 billion. In November 2012, Transcanada was awarded the contract to build the final section of the pipeline from Topolobampo to Mazatlán.

PIPELINE INFRASTRUCTURE DEVELOPMENT OPPORTUNITIES

Since Mexico has linked its natural gas prices to U.S. prices through its netback pricing model, the country is now facing a situation where prices are extremely low as a result of the shale gas boom across the border while supply is constrained. The combination of low gas prices and a growing economy has boosted natural gas demand in Mexico, which grew at 4% per year over the past five years while production increased by only 1.2% annually. While Mexico would like to increase its imports from the US, cross-border pipelines are already operating at near full capacity and Mexico resorted to purchasing expensive LNG shipments from Peru in recent months to ensure that the country's power needs can be met. While this is bad news for Mexican energy consumers, as well as American natural gas producers, it is good news for pipeline operators, constructors and pipe manufacturers.

A report published in 2012 by Mexico's Energy Ministry, states that the country's natural gas transportation infrastructure is scheduled to grow over 40% by the end of 2016. Mexican steel and steel pipeline manufacturers have accelerated their production capacity expansion over the last two to three years in anticipation of rising demand, according to Teodoro González Garza, CEO of Tubacero, a Monterrey-based steel pipe manufacturer. For example, Altos Hornos de México, Mexico's biggest integrated steel manufacturer, has made an investment of US$1.8 billion to increment its plate and coil steel capacity in Monclova. Similarly, Ternium, another big player in the Mexican steel market, is developing a new facility for the manufacturing of higher grades of carbon steel, a key ingredient for the production of more resistant, higher-quality pipelines destined for the oil and gas industry. González Garza sees the current market situation as a huge opportunity from the supply perspective for Mexican pipeline manufacturers.

Companies like Tubacero have begun producing bigger and thicker carbon steel pipes, and incorporating new technologies into their manufacturing processes in order to comply with the technical requirements from the oil and gas industry and meet rising demand. "We have been planning our expansion for the past two years," González Garza explains. "We currently have three continuous rolling mills operating in Monterrey and Pánuco, and the first step was to increase its capacity by at least 50%. By sharing some technologies, processes, and growing the capacity to supply energy more constantly in our process, we have increased the capacity of the welding machines by 75%. Now we are finalizing the next step, by aiming to grow 50% more by the end of this year, which happens to be our 70th year anniversary."

The Pánuco rolling mill, acquired in 2011, enabled Tubacero to increase both the diameter and thickness of its pipe. This has been the company's response to the opportunities that the upcoming deepwater projects are expected to offer. Another advantage of the Pánuco acquisition is its strategic location next to the Pánuco River, which is 7 meters deep, close to the Port of Altamira, and on the way to the southeast. The land around the plant will also enable Tubacero to meet its future expansion needs as business continues growing.

Another planned improvement, the manufacturing of spiral seam pipes, is also a direct response to the domestic gas industry's growing requirements. Moreover, this technique allows Tubacero to benefit from a lower production cost relative to the manufacturing of longitudinal seam pipes. "We decided to build a plant with two spiral mills in Salinas Victoria, Nuevo Léon, with a diameter capacity of 24-144in (60.96-365.76cm) and 1in (2.54cm) thickness, as well as equipment to test 24m long pipes. I believe we should be able to start producing this pipes with API certification by the last quarter of 2013," González Garza says.

Nevertheless, the slew of pipeline projects is attracting a growing number of companies who are eager to do business in Mexico. This means more competition for Mexican pipe manufacturers, and not always on the best terms. "In this market, all tenders are international," says González Garza. While manufacturers like Tubacero offer prices that are very similar to those in the US, the lack of demand for pipes in Europe is pushing some companies to come to Mexico and sell their product at lower prices. "China is extremely aggressive: a couple of years ago, Chinese manufactured pipes were even cheaper than the rolls of American steel coil needed to produce one," he adds.

Pipe producers have countered this cost disadvantage with added value, namely regarding quality and service. González Garza explains that their clients' specifications have increased and the tolerance allowed in pipes has decreased. "We have to help our clients to optimize their margins. Therefore, we have to solve their problems and, in this way, earn their trust. For example, pipe-laying ships have to complete their processes in less time and, in order to make this possible, they need pipes with very specific traits. We are members of the International Committee of the American Petroleum Institute and, even if this organism's variance tolerance is eight thousandths of an inch, we can lower our tolerance to four thousandths of an inch at our clients' request." For instance, following Fermaca's specifications, Tubacero has even added barcodes that allow their clients to trace the origin of every piece of pipe. In fact, the company controls the quality of its pipes throughout both its supply chain and production process. "We request 200 to 300 tonnes of steel from manufacturers and cast it in order to test the material. Even after this stage, our staff visits the steel mill in order to ascertain and approve the quality of the process. Then we produce our pipes, we check them, and request the steelmaker to make any necessary changes, since the properties of steel can shift in the process. Our quality and inspection policies mean that we have become the first pipe-making company in the American continent to obtain an ISO-9002 certificate," González Garza details.

According to González Garza, innovation will continue being an essential element to face the future challenges of the industry: "We are working on a nanotechnology project with Conacyt and Comimsa. Furthermore, we have three projects with students at the PhD level at ITESM (Monterrey Institute of Technology and Higher Education) to foster productivity. Based on our commitment to innovation, we were able to achieve the even-coating of 24m pipes, and we have replaced outdated welding technology; instead of transformers we now use inverters. Also, we have two programs per year where employees present improvement projects and we choose the five best projects, provide budget to the winners, and help them with the implementation. We need our people to understand that our aim is to change routines in order to face the challenges the future will bring."

ECONOMIC BASIS FOR A FAR-REACHING LEGAL REFORM?

By David Enríquez. Mexico is going through a transition that means business opportunities throughout the entire value chain of natural gas. Opportunities arise not only from the increasing proportion of unconventional hydrocarbons in the energy basket, but also – especially in the short term – from the lack of infrastructure development required to provide natural gas efficiently and at competitive rates.

Mexico has had, and will continue having, a commercial balance shortfall in the natural gas arena. According to the 2012-2015 Natural Gas Market Perspective, published by the Energy Ministry, even twelve years from now there will be a negative trade balance of 2,041tcf, in spite of exports of over 1,000tcf. As noted before, the deficit of natural gas in Mexico could only be changed by a shift in the production of unconventional natural gas. That way, with a 2012-2025 based macroeconomic scenario that poses an average annual economic growth of 3.5%, it is estimated that domestic demand of natural gas will experience an average growth of 2.2% per annum, reaching a volume of 10,779tcf in 2025. In the planning horizon, the two sectors that will have more weight in the demand are electricity and oil. As of 2025, both will consume 85.6% of the national aggregate. Industrial sector consumption will grow at a pace of 2.1% per year with a volume of 1,379.1tcf in 2025.

By 2025, most of the gas is expected to be associated, with a share of 63.6%. In this context, the shale gas production scenario is not yet sufficiently clear given the technological challenges and environmental impact its extraction would pose. Overcoming these obstacles will bring forth an obvious increase in the Mexican supply of natural gas. Moreover, shale gas production could become robust enough to shift the Mexican shortage perspectives in the natural gas arena. Actually, through the 2013-2027 National Energy Strategy, the Energy Ministry validates the potential of this resource in Mexico, indicated in the most recent DOE reports. According to said agency, Mexico ranks fourth at a worldwide level in technically recoverable shale gas resources and, thus, hoards almost 6% of the world's potential of this energy source, with an estimated 681 tcf. In fact, Pemex's Business Plan considers the basic programs to handle a potential of 150 to 459tcf in five geological provinces: Chihuahua, Sabinas-Burro-Picachos, Burgos, Tampico-Misantla and Veracruz. Whichever the correct assessment, the fact is that potential is significant, as is the technological challenge to ensure a sustainable exploitation.

If obstacles are overcome and an attractive exploration and production framework is generated – one that sufficiently engages private parties - Mexican shale gas market will be, without a doubt, a new and potent trigger of major investments in the country. The Energy Ministry has committed to undertake the interdisciplinary studies and projections in connection with this matter. The long-expected structural reform to Mexico's oil and gas legal regime will need to effectively implement sustainable standards for the potential boom of the shale gas industry.

Although shale gas projects seem to be booming worldwide, not all cases will prove to be as interesting as most people think. Upon our reading of benchmarking studies and the experience of some of our global key clients, we think that, in addition to the environmental protection and midstream infrastructure development, the following legal areas are instrumental for the success of the yet-to-be-born Mexican shale gas industry:

KEY LEGAL AREAS FOR SHALE GAS

Full protection of property rights: Either a concession or a production-sharing model will have to be enacted – by amending the Constitution and secondary legislation – in order to provide legal certainty to new investors.

Ad-hoc fiscal regime that fosters innovation: Considering the innovative and entrepreneurial nature of the shale gas industry in successful countries (the US, for example), structuring a tax regime that creates incentives toward innovation and value creation will be essential.

Goal-based regulation: The environmental, water-consumption and community challenges ahead will require flexible and benchmarking standards of regulation, in which well-coordinated governmental agencies take into account the asymmetric characteristics of the industry.

Unless the above legal considerations are effectively tackled by congressmen and policy-makers, the "entrepreneurial seed" of shale gas will not germinate in the country and the rather massive prospective resources will not be more than a splendid treasure on which the country will continue to be seated.

David Enríquez is Senior Partner at Goodrich, Riquelme y Asociados, a leading Mexican law firm in structuring and implementing far-reaching Exploration & Production projects.

| SHALE GAS WELLS DRILLED IN 2012

Having identified 200 potential opportunities in shale formations, Pemex intends to drill 175 wells by 2015. The NOC is focusing on five geological provinces with shale gas potential: Chihuahua, Sabinas-Burro-Picachos, Burgos Mesozoic, Tampico-Misantla, and Veracruz. Pemex plans to drill 20 wells in Burro-Picachos, 30 wells in Sabinas, and 25 in Burgos-Mesozoic, with 100 wells in other regions. In 2011, Pemex drilled its first shale gas well, Emergente-1. Located in the municipality of Hidalgo, Coahuila, the well has a depth of 2485m, with a lateral well of 1365m. The well is being fractured in 17 stages at a cost of between US$20 and US$25 million. Emergente-1 currently produces 3 mcf/d. In 2012, Pemex drilled several new shale wells.

CHUCLA-1

Located in the Burgos basin, close to where the Emergente-1 and Habano-1 wells were drilled, Chucla-1 confirmed the existence of hydrocarbons during the first trimester of 2013. The Chucla-1 well has an initial production of 1.9 mcf/d of gas and 24 b/d of crude oil and condensates, which fuels the high shale expectations of the region.

MONTAÑÉS-1

Pemex began drilling Montañés-1 on August 8, 2011, in the municipality of Guerrero, Coahuila, located 60km northwest of where the first shale gas well, Emergente-1, was drilled. Drilling operations for the well were concluded on April 30, 2012, and the well was officially labeled as non-commercial. However, Pemex is using a field lab strategy to optimize productivity for the well.

PERCUTOR-1

Located in the municipality of Progreso, Coahuila, Percutor-1 is 150km southeast of previously drilled shale wells in the area surrounding Emergente-1. Drilling operations began on October 30, 2011 and were concluded on March 30, 2012, yielding the discovery of dry gas in the Upper Cretaceous Eagle Ford formation. This confirmed the continuation of the US Eagle Ford play reserves into the Sabinas region. Accumulated production figures for the field totaled 292 mcf of dry gas, at a rate of 2.2 mcf/d.

HABANO-1

Part of the Burgos basin, Habano-1 is located in the municipality of Hidalgo, Coahuila. Drilling operations for the well began on December 6, 2011 and were concluded on April 15, 2012, confirming the presence of both dry gas and condensate. The presence of liquid hydrocarbons has raised hopes that this well will be commercially productive. Initial production figures for Habano-1 totaled 2.8 mcf/d of gas and 27 b/d of condensate.

ARBOLERO-1

Drilling operations for Arbolero-1 started on January 8, 2012, discovering dry gas in the Jurassic play. Though it had an initial production of 3.2 mcf/d, the well was deemed non-commercial due to the lack of liquid hydrocarbons necessary to make it a profitable project.

ANHÉLIDO-1

Located in the Burgos basin, inside Tampico-Misantla, Anhélido-1 was the first well drilled as part of Pemex's shale exploration program to discover shale oil. In February 2013, the well was producing 288 b/d of shale oil. The production decline curve is still being observed to determine the profitability of the well and a field lab strategy has been planned by Pemex to test new technologies here.

DRILLING IN UNCONVENTIONAL FIELDS

LUIS MONCADA
Vice President of Baker Hughes' Mexico Geomarket

Q: What technologies and processes could be brought from Baker Hughes global operations to address main challenges in Mexico's unconventional fields?

A: Right now a group of Pemex engineers is at our R&D facilities in the US to see what technologies Baker Hughes uses in the US that could potentially be applied in Mexico. Even though Baker Hughes has neither drilled any shale wells for Pemex nor has it provided any services in this field, the biggest challenge for Pemex is how to make those wells profitable. The issue that Pemex has had in the north is that it has spent a lot of money drilling wells that did not yield the production that was expected from this high investment. Nevertheless, we are working with Pemex on an after-action review and analysis of the techniques that could be used to increase production, and thus make the company's shale wells profitable.

Q: Mexico is evolving from easily-extractable oil two more challenging production from unconventional oil and gas reservoirs as well as deepwater. Which role could Baker Hughes play in this process?

A: Every reservoir is different but we always try to identify similarities between them. For example, we have drawn parallels between Chicontepec and fields in the US – like Marcellus. There are always things we learn in one place and apply in another, and we always push our scientists and researchers to look for these parallels. For example, water technologies that we have used in places with similar conditions and geology are being considered for potential application in Chicontepec. Our focus is not only on Chicontepec, since Pemex is conducting an aggressive deepwater campaign. Baker Hughes is a leader in both the drilling and completion of deepwater wells in the US Gulf of Mexico, and there are a lot of lessons to be learned from operators on the other side of the border that could be applied here in Mexico.

Q: How successful is Pemex in attracting and applying new technologies for unconventional and mature fields?

A: We are seeing great improvement in this area. There are a lot of technologies that have not been applied in Mexico for different reasons; however, as Pemex opens up its contracting scheme, more companies enter the Mexican market and showcase their technologies. For instance, the field labs are a great example of Pemex being more flexible and more aggressive in pursuing the technologies needed to exploit Chicontepec. What has made our field lab in Corralillo successful is that we really paused and took the time to analyse the reservoir to develop an optimal drilling and well completion plan, rather than rushing in and drilling. That made the difference. In the end it comes down to analysing and identifying where and how to drill those wells in order to optimize production and not commit mistakes that cost time and money.

Q: Is shale gas in itself profitable enough for Pemex or should the company focus on shale oil?

A: Prices of gas today, especially in the US, are fairly low, which makes it challenging for a lot of shale gas wells to be profitable. However, with the right techniques, Mexico has the opportunity to become a large gas producer, able to satisfy national demand and maybe someday once again become a net exporter of natural gas.

Q: What are the main advantages and expertise that would differentiate Baker Hughes from other companies with the ambition to become Pemex's partner of choice in future shale gas projects?

A: In shale gas we have developed new technologies like AutoTrak Curve, which is a directional drilling technology specifically designed for shale gas and shale oil applications. We have been successfully applying that technology in the US, and as Mexico develops its shale resource we could potentially bring this technology to Mexico. It would make a difference in terms of improving drill speed and increasing the contact with the reservoir.

Q: What has been the impact of shale gas drilling in the US on the availability of drilling rigs for international markets? How would a slow-down in the US shale gas market affect the availability of these rigs for Mexico?

A: I think activity has been fairly soft in the US; therefore, there is an excess of drilling rigs that could be readily and easily moved to Mexico. Regarding Baker Hughes, I would say we have great capacity in the US that we can rapidly deploy, as we have done in Chicontepec in recent years.

THE LEARNING CURVE OF THE SHALE RUSH

Even though the existence of hydrocarbons in shale was discovered at approximately the same time as conventional deposits, effective technologies needed to extract them have only been developed quite recently. Hydraulic fracturing – or fracking as it is informally called – has become a hot topic in the US. Its use has led to a late boom of both shale oil and gas exploitation north of the border, making these newly developed deposits a central focus of the US's recent energy policy. NetBrains Managing Partner, David González Sánchez, believes that even though this technology should be the next step in helping Mexico to recover its previous production levels provided by giant fields like Cantarell, the country should not rush into it.

"Cantarell is a 37 year-old reservoir that is still producing at an astonishing rate – even better than many other reservoirs in the world," González Sánchez says. "Nevertheless, all things in life have an ending, and Cantarell's is close. In order to compensate for the losses in production that will come with Cantarell's demise, we have to start using new technologies to extract unconventional resources, such as horizontal drilling and multi-fracturing."

As the country starts facing heavy and difficult oil challenges, and the growing necessity of exploiting these unconventional hydrocarbon resources, technologies such as fracking will keep gaining traction in the market. "Unconventional fields have several characteristics that make them unique," González Sánchez explains. "But companies working on these fields should take their specific challenges into account, instead of just projecting their permeability, porosity, and other characteristics through other similar fields." The philosophy of conducting specific analysis for each unconventional field is arguably no different from what is required for conventional exploration projects. The difference might come from the pressure that Pemex and other companies feel to participate in the shale boom.

Jordy Herrera, former Minister of Energy, was adamant about the fact that Mexico should take advantage of this opportunity to become a net exporter of gas, instead of importer, as the trade balance currently holds. Indeed, a large portion of the Conacyt-Sener-Hydrocarbons fund (US$245.34 million or MX$3.130 billion) was allocated to shale development in the final days of the previous government. Political pressure of producing from shale formations has led Pemex to explore the possibilities of making the shale gas business profitable enough to develop and exploit.

The urgency of developing this market could tempt the government to try to rush through the steep learning curve that is needed to undertake such projects successfully. "Simply using standard approximations for sand grain sizes and the type of propellant needed could result in a negative outcome. With gas prices at current levels, inefficient production might eliminate any chance of profitability," González Sánchez points out. "In-depth analysis is needed first to sort out which type of grain size or propellant is needed for each specific shale gas well – mineralogy and the rock's physical and chemical characteristics have to be defined first through geological studies for improved production."

González Sánchez's thinking, though, takes him to the other side of the spectrum: "With gas prices as they stand, now is not the time for exploring shale gas. Even if Pemex or Mexico needs it, shale gas should not be a priority right now." A whole different argument is made, though, for shale oil. "Pemex should focus on unconventional oil reservoirs, and apply new technologies to exploit them, before entering into the shale gas rush," he believes.

NetBrains has evolved from doing studies and characterizations for the Pemex at the beginning of their partnership, to help it in maintenance tasks: re-fracturing and cleaning all drill cuttings for Pemex to be more effective. Today, the specialized consulting company is exploring different solutions applied in the US by big shale players in the development and exploitation of the unconventional resource. "We are trying to show Pemex what has been done at Eagle Ford, which is just across the border, and lure them into a learning opportunity by sharing equipment that is already in place," González Sánchez explains. If Pemex really wants to dig deeper into shale gas production, opportunities to go through the learning curve with experienced partners might be the best way to go.

"With gas prices as they stand, now is not the time for exploring shale gas. Pemex should focus on unconventional oil reservoirs, and apply new technologies to them, before entering into the shale gas rush"

EAGLE FORD SHALE FORMATION

Located approximately 10km west of Dallas, Texas, Eagle Ford is named after a Texas town in the area. It has become one of the most successful shale plays in the US, contributing to the 'gas boom' that has been experienced in the country. Eagle Ford is a sedimentary rock formation from the Late Cretaceous period, with three main areas of production: the northern part of the play is the 'oil window', with higher volumes of oil and lower pressures in the formations; the middle section is the wet gas window, and the southern section of the play contains dry gas. Permeability in the region is up to 0.13 md, with a porosity of 4% to 15%. Reservoirs are located at depths of between 1200m and 4300m.

ConocoPhillips was the first company to drill in Eagle Ford, at the Sugarkane field, with 600,000 hectares leased in 2008 to various other companies coming to the field. Contracting peaked in the second quarter of 2010, with over 350,000 hectares leased during the three-month period, with the vast majority of leases being awarded for the liquids areas in the region. The most active player since 2010 has been Chesapeake, with 322 permits awarded. Oil permits have grown year-on-year: there were 40 producing oil leases in 2009, 72 producing leases in 2010, 368 in 2011, and 1262 producing oil leases in 2012. It was Petrohawk's first horizontal well, drilled at Eagle Ford in 2008, which exposed the true potential of shale gas production: after fracking, the well started producing at 7.6mcf/d. It is believed that the high carbonate content of the Eagle Ford shale makes it 'brittle', which means that fracking produces very good results.

Eagle Ford has serious implications for Pemex, as the field is extremely close to the US-Mexico border. It is expected that the shale formations in Mexico will share many similarities with the field that is already being exploited on the US side of the border: one of the most relevant facts for Pemex is that Eagle Ford produces much more oil than traditional shale plays. It will be interesting to see the method by which Pemex approaches production at its shale assets in the years to come. With the successes seen at Eagle Ford, it may simply be a case of applying the technology and the best practices used there in order to find success, in the same way that the NOC has approached deepwater exploration. However, it seems that Pemex may yet operate its shale assets in a new way: depending on the outcome of the energy reform, Pemex may look to develop its assets with deeper cooperation from the private sector. If this happens, then many of the companies operating just across the border in Texas might be very interested to participate, given the liquids-rich opportunities they have found on the US side of the border.

THE SHALE GAS WAITING GAME

Juan Manuel Delgado, Director General for Mexico at Schlumberger

The shale revolution is changing the face of energy markets in the US, and the same might be the case for Mexico in the future. Nevertheless, according to Juan Manuel Delgado, Director General for Mexico at Schlumberger, given the current situation companies are forced to wait for future developments. "We have to wait and see what the government's position will be, whether Pemex will be developing shale gas or if private participation will be allowed. We are here to service the stakeholders, whoever they might be, the Federal Government or Pemex," he says. "Whether companies like Schlumberger will be allowed to participate, or if the Mexican government wants to manage the development of shale gas on a different scale, remains to be seen. If it is decided that private companies can enter the game, we will analyse if we are ready to participate directly ourselves, or if we need to partner with another organization, or provide services to another company."

Nevertheless, Schlumberger is ready to enter the Mexican shale gas market with over a thousand patents in shale gas field development in the US, mainly for technologies and processes that will help make production profitable. "The patents are in areas such as drilling, data acquisition, and data interpretation," Delgado explains. "All of these technologies could be implemented in Mexico."

Delgado emphasizes that, in order to ensure that foreign companies can participate in shale gas development for foreign companies, the current model will have to be adjusted: "We are not used to participating in a tender of acreage: we want to see for ourselves what is going on down there. The contractual model will tell us if we will be going forward or not. If the government's decision is that the IMP has to have control, reserves have to be proven first. Another

THE ROLE OF FRACKING IN SHALE GAS DEVELOPMENT

Even though shale gas was discovered a long time ago, it was not developed commercially until recently because the necessary technologies were not available. The main solutions that allow for the commercial development of shale gas include: seismic data acquisition, processing and analysis, core analysis, and petrophysical measurement collectively lead to better reservoir understanding; new drilling technologies reduce the time to reach total drilling depth; horizontal wells maximize the contact with the reservoir during drilling and completions; hydraulic fracking releases hydrocarbons for extraction; and improved reservoir management tools to optimize production management.

Gas in shale is stored in three ways – free gas stored within natural fractures, free gas within the rock pores, and adsorbed gas on organic material – which affects the speed and efficiency of shale gas production, and the hydraulic fracking approach required to optimize production. Since shale gas reservoirs have low permeability, reservoir pressure declines before production is stabilized. Experience in US basins indicates that production levels in shale gas wells typically decline by 65-80% in the first year. To reach viable production rates, shale rock must be hydraulically fractured or fracked. Through multi-stage fracturing and horizontal wells an artificial reservoir is created, and by fracturing wells effectively, higher production and recovery rates can be achieved. Therefore, effective reservoir characterization is essential to optimize production based on a better identification of its properties, including the producing interval and the flow channels inside the fractures.

"In order to correctly deploy fracking solutions, a deep understanding of the geology of the region is required," explains the Director of the IMP, Vinicio Suro Pérez, "which includes an assessment of the permeability and porosity of the region in order to not only select the best drilling site, but to also understand the thickness of the shale formation. Once the geological information is obtained and the well location identified, a vertical well is drilled followed by a horizontal well, where frack plugs are located to introduce the liquid and initiate the fracking process."

Most of Mexico's regions where shale gas is located – north, northeast, and Gulf coast – are facing water scarcity, which complicates shale gas production since the fracking of shale gas wells requires large volumes of water. In addition to further depleting the already limited clean water reserves in these regions, the use of water for fracking could potentially affect the quality of drinking water, since any leak into water aquifers has the potential to damage Mexican drinking water reserves. This makes it crucial to adequately address the water issue during the essential fracking of shale oil and gas wells.

option is that Pemex goes ahead and creates blocks for tendering, and anyone could drill, produce, and get a fee for it. Without having equity, it is not going to be an easy sell."

A constitutional reform is required for this kind of private participation to happen, and Delgado is skeptical about it: "Massive private participation is something that will not be allowed soon. For now the best plan is to continue to let the IMP evaluate the reserves, while searching for a contractual model that includes a reward scheme that is attractive for private operators."

The scenario is similar to that of deepwater a few years ago. "People said that Pemex should not go into deepwater because they did not have the technology," Delgado recalls. "That was not true, and we proved it. Shale today is passing through the same phase. The resources exist, and the Mexican government has to figure out how to extract them in a way that is convenient for Pemex and the contractor. There has to be a major change if Mexico expects shale gas development to be massive." Even if no big shift takes place in the near future, shale gas projects will continue their natural progress, but at a different pace. "It was the same situation in deepwater: it took Mexico several more years than everyone else in the industry to make the discoveries, due to the learning curve and the resources allocated," he adds.

Delgado underlines that Pemex's budgetary restrictions, contracting regulations, and the legal framework in general determine the company's working pace. Other NOCs and IOCs are not facing similar limitations on their ability to operate. "In spite of that, Pemex cannot be underestimated. The company is conducting a lot of hi-tech projects, and while Pemex knows that it is not a technology developer, it is allocating more funds to the promotion of new technology through Conacyt and its sector fund. Schlumberger has been part of these projects and helps as much as it can. The private sector understands progress is not slowed down by Pemex's unwillingness or incapability to advance in these areas, but that external limitations define its pace of development."

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Pemex currently has six refineries operating in Mexico; however, much of Mexico's crude is not refined in the country – it is exported and then bought back as refined product to be sold in Mexico. With an improved refining strategy, Pemex could save money by refining more of its crude in the country: a series of upgrades at Mexico's refineries has been ongoing for several years in order to achieve this.

However, the conundrum of what to do with Pemex's refineries is often controversial. This chapter examines the issues surrounding Pemex Refining: why efficiency is so low, what is being done to improve the situation, and how can the financial performance of this loss making division be turned around. The chapter also examines the long-term future of refining and petrochemical activities in Mexico, looking at new projects under development, and what they mean for the country.

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CHAPTER 12: REFINING

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REFINING TURNAROUND CRUCIAL TO MEET DEMAND GROWTH

Pemex is currently ranked as the country with the 13th largest refining capacity in the world, totaling 1.69 million b/d at its six refineries spread across Mexico. Pemex has been able to refine this volume of crude since 2011, when its refinery upgrade program increased capacity from 1.54 million b/d. However, the challenge for Pemex in recent years has been improving the throughput levels, which have actually been in decline. From the 2009 peak at 1.295 million b/d refined in Mexico, the figure has dropped to 1.199 million b/d in 2012, despite the increase in overall refining capacity. This is also reflected in the production of petroleum products, which dropped from 1.470 million b/d in 2009 to 1.337 million b/d in 2012.

In recent years, domestic sales of petroleum products have increased by 1.3% annually, growing from 1.772 million b/d in 2009 to 1.842 million b/d in 2012. Broken down by product, Pemex produced 204,000 b/d of LPG in 2012, 418,000 b/d of gasoline, 300,000 b/d of diesel, 273,000 b/d of fuel oil, and 85,000 b/d of other petroleum products.

Mexico's domestic sales of gasoline increased from 792,000 b/d in 2009 to 803,000 b/d in 2012, while gasoline production decreased from 472,000 b/d to 418,000 b/d for the corresponding years. As a result, the share of imported gasoline in Mexico's overall consumption increased from 40.7% of sales in 2009 up to 48.2% in 2012, making the country highly fuel dependent.

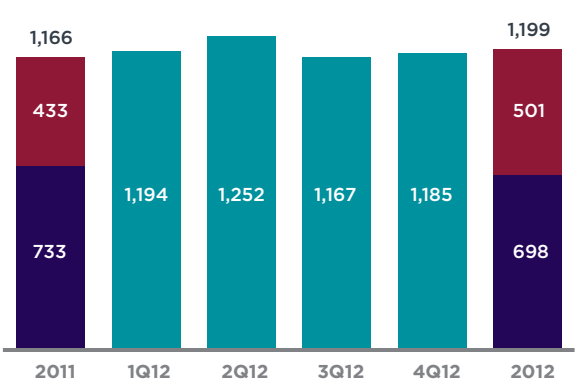
This highlights the challenges that Pemex is facing as the national oil company with a limited refining investment budget, in a country with a growing economy. Refinery upgrades will go some way towards improving capacity, and hopefully refining throughput, but Pemex is now considering its next big move. The conventional move would be to invest in a new refinery on Mexican soil, which would both boost capacity the local economy. However, there are other, cheaper, and faster options available to Pemex, such as investing in an existing refinery outside of Mexico.

The investment in refining has increased year-on-year since 2008, when Pemex spent US$1.4 billion on its refining activities to US$2.3 billion in 2012. In its approved budget for 2013, this figure rises dramatically to US$4.5 billion which represents 17% of total Pemex's total investment budget, of which 79% or US$20.5 billion goes to exploration and production.

Pemex Refining is the worst financial performer of the company's four subsidiaries: in 2012, the division made a total net loss of US$8.2 billion, while in 2011 this loss was even higher, at US$11.2billion. The operating income of the subsidiary has seen an improvement in recent years, however. In 2008, Pemex Refining made an operating loss of US$22.4 billion. In 2009, this had improved to an operating loss of US$10.4 billion; in 2010, it was a US$12.4 billion operating loss; in 2011, a loss of US$23.2 billion, but in 2012, this loss had been reduced to only US$6.9 billion.

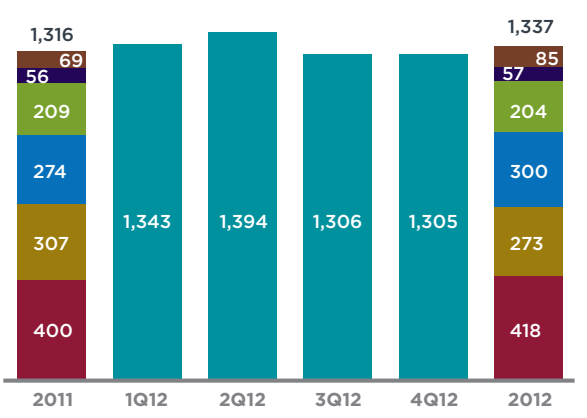
The first quarter of 2013, Pemex Refining showed some signs of improvement: total crude oil processing recorded an increase of 3.6%, with the output of petroleum products increasing by 30,000 b/d. It will remain to be seen whether 2013 is the year that Pemex manages to significantly increase refining throughput in order to reduce imports and improve the financial performance of the division.

CRUDE OIL PROCESSED



Source: Pemex

REFINED PETROLEUM PRODUCTS



THE FUTURE OF PEMEX REFINING

ROGELIO GASCA NERI
Professional Board Member of Pemex

Q: What are the main goals for Pemex Refining?

A: Pemex loses a lot of money through its refining activities. Some of the reasons for these losses are operational, and others are related to the company's structural situation. Currently, efficiency at Pemex's refineries stands at around 70%. One of the biggest challenges that Pemex Refining faces in improving its efficiency is related to the human factor. The communication between Pemex E&P and Pemex Refining needs to improve dramatically in order to improve planning. If refineries are receiving crude oil of a different quality to what they were expecting, or with more salt or water in the mix, then processes need to be adjusted in the refining process, which takes time and reduces efficiency. Better communication and planning between the two divisions could help to improve this situation dramatically.

Mexico's refineries consume between two and a half to three times more energy than international standards, since the original design of the power generation systems does not include cogeneration. Another structural problem is the fact that Mexico's refineries were not originally designed to process heavy oil. Today, we have problems with the efficiency of transformation of this crude into refined products: we end up refining too much crude into diesel fuel. This is an issue because firstly, there is a very small market for diesel fuel in Mexico, and secondly, there is a lack of storage for such products, so when they are not sold, there is also no place to put them. Once these problems have been identified, it should in theory be easy to work towards solutions. For example, if power generation is the problem, then steps need to be taken to introduce cogeneration technology at Mexico's refineries. Our refineries were originally designed to refine oil directly from the pipeline, with very few storage areas. Since more and more oil needs to be separated from water before processing, the need for such storage areas is growing. This is another issue that needs to be addressed. We also need to install cokers at our refineries, in order to improve the refining process for heavy oil. Pemex's investment plan is currently addressing all of these areas in its refinery upgrade program. However, these improvements will only go half way towards the eventual aim of Pemex Refining, which is to make its activities profitable and efficient.

Q: Should the long-term goal for Pemex be to refine 100% of Mexican crude domestically?

A: The new Mexican president is aiming for an annual GDP growth of between five and six percent for the country, which will mean huge rises in the consumption of energy, electricity, and gasoline, in a timeframe that does not allow us to develop the refining infrastructure required to meet rising demand with domestic production. We have to find a strategic solution to optimize the importation of gasoline and other refined products. Options include finding a new relationship similar to the one Pemex has with Shell at the Deer Park refinery, establishing long-term purchase agreements with US refineries, or simply buying a refinery outside of the country.

At the same time, we have to improve our domestic refining efficiency, and perhaps build a new refinery on Mexican soil. We also need to work on the pipeline infrastructure for importing oil, gas, and refined product, as well as on better storage solutions, and building redundancy into the Mexican pipeline network.

Q: How does Pemex view its collaboration with Shell at Deer Park Refinery in Texas?

A: It is viewed as a success, in the sense that Pemex achieved the objectives they set out to at Deer Park. The partnership was established at the time that Pemex's production of heavy oil was starting to grow, and the best way to take advantage of that was to invest in this refinery in collaboration with Shell, designed to process the type of crude that Mexico was producing. Both parties profited from this arrangement: not only did Pemex profit from selling its oil, but also from finding a new market for it and developing efficient processes at the refinery.

It would not make sense to follow the same business plan for the same reasons today: heavy oil is in much higher demand than it was before, as refineries have adjusted their hardware and can now process it with ease. However, we could enter into a similar partnership but for different reasons: if we need to import a large amount of refined products each day for the next 20 years, then co-investment in a new refinery is one way that we could make that more cost-effective.

UPGRADES FOR PEMEX'S REFINING INFRASTRUCTURE

In the 1950s, Mexico nationalized its downstream oil sector. Pemex currently has six operating refineries in Mexico, spread out across the country in order to meet regional demand for refined products, at least in principle. Cadereyta in Nuevo León supplies the north of Mexico, Madero in Tamaulipas supplies the central regions and the Gulf coast, Salamanca in Guanajuato supplies the center and east of the country, Minatitlán in Veracruz supplies the south and the Yucatán peninsula, Salina Cruz in Oaxaca supplies the west coast, and Tula in Hidalgo serves Mexico City.

Many of Mexico's refineries are old, the oldest being Minatitlán, which was constructed over a century ago in 1906. All of the six refineries have undergone upgrades and reconfigurations in the last decade, but still there is not enough refining capacity in Mexico for Pemex Refining to process all of Pemex E&P's crude oil production: in 2012, Pemex imported 49.2% of the gasoline consumed in the country, and 33.2% of diesel. These numbers are rising: in 2009, the NOC imported only 41.6% of the gasoline consumed and 13.3% of the diesel. This is due to rising demand in Mexico, and the lack of a corresponding increase in domestic refining capacity. Currently, the installed capacity at Mexico's refineries is 1.54 million b/d, according to Pemex figures, although its actual production of crude does not match this capacity. In 2012, the company processed 1.199 million b/d, a number that still remains lower than the previous refining maximum of 2009, when the company processed 1.295 million b/d. In the meantime, domestic consumption is on the rise: in 2012, domestic consumption rose 1% year-on-year.

In addition to its domestic refineries, Pemex also has refining capacity in the US. In 1993, Pemex bought 50% of Shell's Deer Park refinery, located near Houston, Texas, for US$1 billion. This investment was used to upgrade the facility, and the project was completed in 2001. Today, Deer Park is the sixth largest refinery in the United States, with a refining capacity of 340,000 b/d. The upgrades allow Pemex's heavy Maya crude blend to be processed at Deer Park. This was an very successful move for Pemex, as at the time there was not enough refining capacity in the world to process this type of heavy crude. Heavy and extra-heavy crude processing is definitely a challenge for Pemex, even on its home turf: only two of the country's six refineries have the proper infrastructure to process Mexico's main crude oil type. A new refinery is currently being planned on the site of the Tula refinery, which will expand Pemex's heavy oil refining capacity by 250,000 b/d, at a planned cost of US$11.6 billion. Although it was initially meant to be completed in 2016, the project has been delayed several times.

Pemex estimates that in 2013, 17% of its expected US$25.4 billion budget will be allocated to refining division. Although many critics say that Pemex's biggest downstream problem is that a lack of investment in its six refineries has left them outdated and inefficient, Pemex is taking steps to correct this situation, and looking to improve efficiency in ways that involve little to no capital expenditure.

Pemex presented an action plan for its refinery infrastructure, including measures to make its operational and administrative processes more efficient. The NOC says it has identified 230 opportunities for improvement in four out of its six refineries. When completed, these changes should be worth US$1.2 billion in cost savings. Pemex also says it has identified 85 opportunities for improvement at the conceptual stage and 52 at the development stage, which together should bring US$569 million in value to the company. At the implementation stage, the company has identified 62 opportunities for improvement, representing US$382 million in potential cost savings. Regarding capital deployment, the NOC has targeted 10 modifications, which will add US$110 million. Finally, at the monitoring stage, 21 opportunities have been identified with the potential to bring in an additional US$109 million. Pemex says that these improvements translate into a net gain of around US$3.39 per barrel refined, at October 2010 prices. The company also stresses that only 9.5% of the initiatives identified involve capital expenditure.

A number of capital-intensive upgrade projects are already underway, however. An upgrade of the Salamanca refinery should be finished by 2015, at a cost of US$3 billion. The project will focus on installing a delayed coking plant and hydro-desulfurization plants, which will serve to increase petroleum and diesel production. Despite the fact that all other refineries on Mexican soil are either being upgraded, or have recently had upgrade projects completed, Pemex will still not have the refining capacity to process all of its production.

There are a number of possible solutions to Pemex's refining issues. Some have proposed embarking on a major refinery-building project, which could work as a long-term but expensive solution to current capacity limitation. The sector may eventually be opened to private investment, which would solve the problem of capital expenditure, but this would also be a long term solution. One remedy that could fix Pemex's refining issues in a much faster way would be for Pemex to invest in additional refining capacity in other countries, with the US and Europe being the most likely choices.

1 CADEREYTA

Located in the state of Nuevo León, the Cadereyta refinery, also known as the Ing. Héctor R. Lara Sosa refinery, is responsible for supplying fuel to the north of Mexico. According to Pemex figures, the refinery currently has a capacity of around 275,000 b/d of crude. In 2009, ICA Fluor was awarded an EPC contract for the upgrade of the refinery, including a 42,500 b/d catalytic distillation train.

2 MADERO

Located in the state of Tamaulipas, the Tamaulipas refinery, otherwise known as the Francisco I. Madero refinery, is responsible for supplying fuel to the central and gulf regions of Mexico. The Madero refinery currently has a processing capacity of around 190,000 b/d of crude oil. ICA Fluor also won the contract for the upgrade of the Madero refinery in 2009, which is scheduled to be finished in 2013.

3 SALAMANCA

Also known as the Ing. Antonio M. Amor refinery, the Salamanca refinery is located in the state of Guanajuato, and supplies the center and east of the country with finished product, and has a processing capacity of 245,000 b/d. A refinery upgrade project was started in 2012, which will increase the refinery's capacity to refine heavy crude, and is expected to be finished by 2015.

4 TULA

The Tula or Miguel Hidalgo refinery, located in the state of Hidalgo – approximately 150km north of Mexico City - is the main supplier of fuel to Mexico's capital. It has a processing capacity of 315,000 b/d of crude. In 2010, Saipem was awarded a US$800 million. EPC contract for the installation of two desulphurization units and two amine regeneration units.

5 MINATITLÁN

Located in the state of Veracruz, the Minatitlán or General Lázaro Cárdenas refinery supplies both the south of the country and the Yucatán peninsula. It has a processing capacity of 185,000 b/d. An upgrade was completed at the refinery in 2011, which currently processes a mix of isthmus and maya crude.

6 SALINA CRUZ

Otherwise known as the Antonio Dovalí Jaime refinery, Salina Cruz is situated in the southern state of Oaxaca, and has a processing capacity of around 330,000 b/d. Located on the Pacific coast, the refinery provides combustibles to the entire region. In 2010, Pemex completed maintenance work at the refinery, and in 2012 embarked on a project to use natural gas instead of coke in to power various refining activities, which would earn the company carbon credits worth nearly US$2.2 million per year.

I SHOULD MEXICO BECOME FUEL INDEPENDENT?

"Refining is the ugly duckling for Pemex – the subsidiary that generates the most problems. The current situation stems from the lack of investment that the sector has experienced for several years. If we do not have a proper refining strategy, the priority will continue to be Pemex E&P, continuing the vicious cycle: refineries get old when their maintenance, upgrades, and technology needs are neglected. At the same time, we have to ask ourselves: do we really have the amount of money needed to invest in six additional refineries? Refineries are not really profitable; at least not as profitable as investing in exploration and production. We need to rethink the country's fiscal strategy and allow an investment injection to Pemex Refining, regardless of where it comes from. The issue is how to solve this as a nation, not as Pemex. Fuel independence would give Mexico several advantages. First of all, under the installed capacity restrictions of our refineries, we export oil and import refined products. Having additional capacity in the country eliminates transportation costs resulting from the export-import process."

Héctor Moreira Rodríguez, Professional Board Member of Pemex

"Building new refineries is not the answer to Mexico's refining problems. My proposal is to create a virtual refinery: you do not necessarily have to actually build the plants. For instance, Pemex needs to reconfigure part of the Bicentenario refinery, and install a heavy fuel oil desulphurization plant, a coker plant, and a sulfur plant in the new zone. The refinery then could develop diesel projects with its hydrogen and sulfur plants. Moreover, as part of the reconfiguration of the refining system, Pemex should buy additional capacity abroad. This way, the company can send crude oil abroad at a lower cost and bring the product back to Tula after building the necessary pipelines, storage tanks, and distribution terminals. Within three years, you would have reduced 50% of gasoline and diesel imports, with enough time to inaugurate it during this presidential term. If the pipeline distribution network, terminals, and transportation sectors are opened to private investment, Pemex does not even need to spend anything on the project – it is cost neutral. The first step for a scheme such as this one has already been taken with the Deer Park joint venture between Shell and Pemex."

Luis Puig Lara, Commercial Director Mexico for Saipem

"The current situation of Pemex Refining is really unsatisfactory, due to all of the incidents we have seen in the past few months and the downtime that has come as a consequence. More than 60% of the downtime that the country's downstream plants experience is due to human error. This is why Honeywell is concentrated on improving the skillsets of the people working on downstream processes. I do not believe that the refining sector needs to be privatized; perhaps we could see some sort of opening for the petrochemical sector after Pemex's restructuring, but the solutions for Pemex Refining will not come through privatization. Pemex should adopt a new strategy to improve the country's refining capacity: the company could look at buying refining facilities in the US and bring them back to Mexico. It would cost one third less than building a refinery from scratch. With this strategy, Pemex would also generate jobs for Mexicans and would save all the transportation costs that it is currently incurring, lowering the end price of refined products."

Andrés Rivero Torres, Sales Director of Honeywell

"One of the areas where Pemex has a clear opportunity to improve is downstream: refining has been a low-performing activity, to the point where the Mexican government can no longer justify pouring in additional investment. This is a direct consequence of the limited budget that has historically been allocated to refining and the fact that refining, distribution, transportation, and storage of fuels has to compete with other areas that offer a better return on investment, especially exploration and production. In the end, downstream operations are industrial activities, in the sense that they are necessary for the value chain, but not as profitable as upstream activities. These limitations suggest that we could use additional competition in the area. The international refining market currently offers several opportunities that we have suggested to Pemex: some of our clients are already looking at buying refineries. This would make a lot of sense for Pemex, but instead of acting on the opportunity, the company decided to make a big investment in Tula."

Ernesto Marcos Giacoman, Founder and Senior Partner of Marcos y Asociados

REFINING PROJECT DEVELOPMENT

"With over 300 engineers working for Saipem's Mexican subsidiary, the company is planning on winning new business in the clean diesel market and the Salamanca Refinery reconfiguration project, which is one of the largest projects in Mexico with over eight plants and more than US$350 billion investment," says Luis Puig Lara, Saipem's Commercial Director for Mexico. The company's experience and connection to Italian oil company Eni has given the Saipem the experience needed to compete for such contracts.

As Eni's subsidiary in charge of EPC, drilling, and FPSO operations, Saipem has a unique advantage in understanding the challenges facing the Mexican market, Puig Lara believes: "Eni is one of the world leaders in ammonium production, and has built over 32 refineries, 500 processing plants, and 400 gas plants." Additionally, the fact that Eni is partly state-owned gives Saipem a very good understanding of the bureaucracy often involved in working with a national oil company. However, Saipem's experience does not just come from its work with Eni: the company frequently works on projects in Africa, Asia, Europe, and Latin America, bringing added experience from a number of different global locations.

Besides offering vast global experiences and a strong financial backing from the Italian multinational Eni, Saipem's greatest experience might come from its local workforce in each country. Its Commercial Director, Luis Puig Lara, is a former Director General of Pemex Gas and Basic Petrochemicals, responsible for opening 24 processing plants. Puig Lara's accomplishments over a 27-year career at Pemex handling various administrative, financial, and executive responsibilities, have given him the necessary tools and connections to further advance Saipem's interests in Mexico, especially in the downstream segment.

Some of the greatest challenges Mexico currently faces in refining stem from the fact that Pemex Refining has not been awarded the necessary capital to maintain and upgrade refineries, optimize processes, and develop projects according to market needs. Puig Lara explains that Pemex Refining has been handicapped in its ability to develop projects: "in the past, the Pemex subdivision had a large project development group, but as soon as this group was disbanded, Pemex Refining's ability to develop projects was critically affected." Pemex moved instead to offering front end engineering design (FEED) tenders for its larger projects. Puig Lara believes that this scheme is not as effective as the old development group was at bringing projects through to fruition: "FEED contracts rarely reach the second phase because Pemex bureaucracy slows the development of a project down to a crawl. Projects are paralyzed in this first stage of development as a result, and often never completed," he concludes.

OPTIMIZING REFINING PROCESSES THROUGH AUTOMATION

ANDRÉS RIVERO TORRES
Sales Director of Honeywell Mexico

Q: What is your perspective on the current state of Mexican refineries?

A: In the current situation employee discontent has led to operational downtime at Mexico's refineries. We are currently trying to help Pemex avoid this type of counterproductive situation by implementing automation technologies and methodologies, which will help Pemex reduce this type of events, because 60% originate from human mistakes that can be easily prevented.

Q: In order to increase refining productivity, Pemex is currently investing in renovating refinery infrastructure. What technologies does Honeywell have to contribute to optimizing the impact of Pemex's refinery investment?

A: We have a vast portfolio of products and services that Pemex could potentially use, and is using in many instances, to improve its productivity. The most relevant technology is related to process automation, not only of field equipment, control systems, and security systems, but also with regard to other applications that allow you to maximize value. Such applications, which we call skill development, are based on methodologies that allow operators to identify and administrate situations and empower them to react in real-time, minimizing risk and optimizing efficiency. In the area of automation we have various methodologies to develop human capital, such as Abnormal Situation Management (UniSim), while in the area of efficiency and optimization, we currently offer Profit Suite. For the business side of automation, we offer a technology called Intuition Executive, which offers information management, decision support, and collaboration tools to optimize operations. Even though we offer all these automation technologies and processes to improve efficiency and optimize operations, Honeywell is no longer focusing on simply offering products and services. Currently, we are focusing on offering integrated business solutions that help clients better detect, invest in, and seize available opportunities. Offering products and services may help a company acquire the necessary technology needed to succeed; however, if they do not have the ability to detect and seize opportunities, those technologies are useless. Therefore, we are currently focusing on a strategy that brings this mentality and organizational change to companies so that they optimize the benefits derived from investments in technology, products, and services. Nowadays, the type of innovation we bring to the market is more focused on innovative business strategies than on innovative technologies.

Q: How are you involved in the new Tula Refinery?

A: The project is moving forward and we will be providing 40% of the technological processes. This deal was signed last year and we are currently working on the technology. We are also bidding to introduce our Main Automation Contractor (MAC) technology, which will be decided in May.

Q: What have you learned about the Mexican oil and gas industry, and working with Pemex, through years of collaborating on projects?

A: We have learned a lot from Pemex, but we learned the most at a project in Cantarell where we installed the first and only ever Main Automation Contractor (MAC) solution in Mexico. Even though the project did not advance at the rate we expected, we are very happy with our participation and we were very impressed with Pemex's shallow water technology and processes. There are many other success stories; however, due to Pemex's political structure and the various limitations this imposes on the company, projects and ideas change too often and there is no continuity in proposed projects. Hopefully, this will change soon and we will be able to showcase the results behind the services, products, and strategies that we offer.

Honeywell's integrated main automation contractor (I-MAC) approach builds upon the foundation of traditional MAC to integrate a broader automaton vision to ensure operational and business readiness from day one of operations. The result is an integrated strategy that delivers safety, reliability and efficiency throughout the entire life of an asset by efficiently transferring and protecting knowledge to improve operational and business readiness. The I-MAC approach helps to reduce overall project risk, accelerate production schedules and improve operational efficiency.

THE IMPACT OF MAINTENANCE ON REFINERY PRODUCTIVITY

Pemex Refining attempted to address its efficiency problems through the introduction of its MDO Program (Programa de Mejoramiento Operativo or Operational Improvement Program). Progress in the main objectives of this program is reflected in key indicators that are followed closely and published in a quarterly report. The main objective of the program is to implement best practices in Mexican refineries and improve operating efficiency and profitability. The program establishes efficiency protocols for everyday operations to increase equipment reliability and uptime of refining processes. It is divided into five critical factors that have each to be addressed individually: technical system, reliability, production management, supply and organizational strengthening.

The objective of the technical system component is improving the performance of the refining process, and reduce energy consumption and leakage. Half of the initiatives proposed in this respect are already in operation, and Pemex predicts that addressing these issues will lead to a $US3.79 cost saving per barrel refined, showing the importance of addressing these problems. This is probably the component in the plan with the most significant economic impact, since it addresses equipment performance and the efficient use of crude oil. The target of the reliability component is reducing downtime at refineries, while increasing the availability of critical equipment and personnel. In order to achieve this, Pemex Refining is implementing maintenance schedules under a risk assessment matrix, planning weekly preventative maintenance tasks within the organization's ERP system.The task force in charge of implementing the MDO program has also created several workshops to understand recent incidents in the National Refining System, determine the causes of failure and propose mitigation methods through strategies to optimize preventative and predictive maintenance plans. Through a hierarchical system that ranks cases based on risk and economic impact, groups within the workshops established key indicators to monitor possible failures more closely. Critical equipment has been defined, and is already undergoing revamping and repair processes. Finally, several areas of opportunity are being defined to continue these actions and proactively prevent possible risk situations, such as promoting the safety component of the DuPont Production System. Pemex Refining is currently undergoing assessment and training programs to help personnel learn about refinery management. Through the different evaluations that took place, the task force in charge of the diagnostic phase of the process realized that the main factor lacking in the organization was the recognition of leadership cadres. As a result, several leadership programs have been implemented and evaluations, workshops, and feedback sessions are currently under way.

While Pemex has started to execute actions to improve operational efficiency, the company has a log way to go. This is shown in the quarterly reports of 2012: from the 46 scheduled maintenance tasks that Pemex planned for 2012, only 28 were performed, leaving large areas still to be addressed. The continuation of strategies within the MDO program and the DuPont Production System could lead to a more efficient Pemex Refining division that could reduce the gap between potential productivity and current levels.

DUPONT PRODUCTION SYSTEM

"There is a strong correlation between safety and efficiency in refining operations: maintaining high safety standards leads to less downtime, which results in increases in efficiency and profitability: when personnel risks at facilities are minimized, operations run more safely, and this, alongside preventative and predictive maintenance, minimizes downtime and optimizes productivity rates. The full integration of all these steps from the beginning of a project is what DuPont refers to as the DuPont Production System. In order to operate at maximum efficiency, proper maintenance routines are required at facilities to avoid and correct equipment malfunction or failure. Strict standards and best practice benchmarks are to be followed at every step of the process, creating a safe and secure work environment that allows employees to perform their everyday activities in safety. In this way, safety is both the end result and the first step of the process.

Pemex's refining facilities are operating at an average of 60% efficiency. This is due to all-round negligence in the downstream value chain: Pemex has neglected to keep scheduled maintenance programs running, has ignored precise instructions, and ignored several safety processes in the everyday operation of its refineries. This, combined with suboptimal approach to preventative and predictive maintenance routines, has led to an inefficient downstream industry. The average refinery, in other parts of the world, typically operates at 80% efficiency when the DuPont Production System is correctly observed: Pemex is losing the equivalent of an entire refinery's production by not prioritizing safe and efficient operations at its facilities."

MINATITLÁN REFINERY UPGRADE

Located in the municipality of Minatitlán in the state of Veracruz, the General Lázaro Cárdenas refinery was built in 1906 as the first refining facility in Latin America. As the Mexican oil and gas industry developed, the facility at Minatitlán eventually came to be one of Pemex's smaller refineries, dwarfed by newer infrastructure, only able to process 175,000 b/d of crude oil. With a growing inefficiency at Pemex's refineries, the growth of domestic consumption and the consequent need to import Mexico's gasoline and diesel, coupled with the sulfur reduction requirements that were established for Mexican fuel, the Lázaro Cárdenas refinery became a prime candidate for reconfiguration.

After its creation, the Minatitlán refinery started operations under the management of the Mexican oil company El Águila. In 1938, the refinery's facilities became national property under the expropriation decree. In 1954, the plant underwent Pemex's first refinery modernization efforts, with a reconfiguration that added new production units with higher processing capacity. The result was a refinery with 24 plants for processing crude oil, destined to process the crude exploited in the Mexican oil boom that took place from 1970 to 1996.

By that time, the National Refining System (SNR) had become inefficient by global standards, with commonplace delays on maintenance and equipment upgrades. The lack of adequate infrastructure to supply the country with gasoline, diesel and other refined products was a direct consequence of Pemex Refining's limited investment budget. Pushed by environmental and modernization requirements, Pemex decided to begin the reconfiguration of the entire national refining system, including the Madero, Tula, Salamanca, Salina Cruz, and Minatitlán refineries.

By 2003, the Minatitlán refinery had 27 industrial plants dedicated to the production of refined products. Its 800-hectare extension housed facilities capable of processing 185,000 b/d of crude oil and 30,000 b/d of butane-mixed liquids. Its additional plants, located in Cangrejera Veracruz, give the refinery an extra Maya crude processing capacity of 170,000 b/d. This enabled the Minatitlán refinery to cover most of the demand for refined product in the southeast of the country.

With the objective of lowering gasoline imports by 6% between 2012 and 2016, Pemex planned a reconfiguration of the refinery's facilities that sought to expand its installed capacity to 285,000 b/d. This would be done by adding 57,000 b/d of incremental gasoline supply and 36,000 b/d of incremental distillate supply. The project required an investment of US$3.56 billion for the construction of 12 new processing and integration plants, auxiliary services, water treatment, as well as an oil line and a gas line.

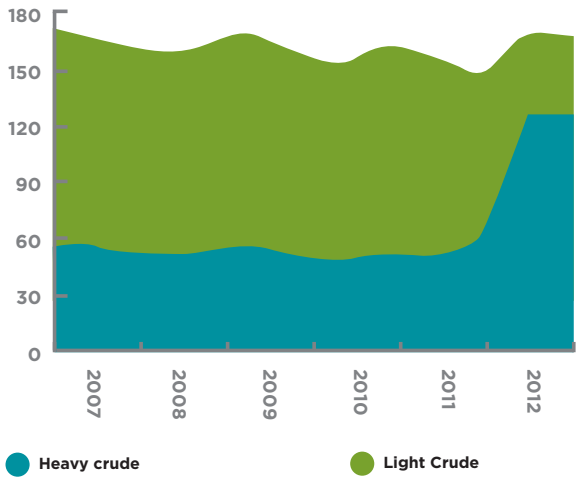
Five EPC contracts were tendered, as well as one for the construction of a pipeline to transport the finished product from Cangrejera to Minatitlán. The Mexican Petroleum Institute (IMP)'s participation in the project began at its conception in 1996, when Pemex requested the institute's assistance to verify the structures chosen for the reconfiguration of the SNR. With help from the SINCI (Síntesis de Complejos Industriales) software, the institute detected certain inefficiencies in the original plan for the reconfiguration: plants needed for the manufacturing of cleaner petrochemicals had not been considered. The IMP delivered the results of the geotechnical surveys conducted at the site and the engineering plans for its conditioning and access road. Once the analysis was complete and the

reconfiguration project was fine-tuned, it was assigned to KBC, which only changed the plants' planned capacity and enlarged the water treatment units from the original proposals of the IMP.

After some changes to the proposed timelines, the reconfiguration was finished by the end of July 2011, when President Felipe Calderón reopened the plant in an official event, saying at the ceremony: "More than a reconfiguration, this is truly a new refinery for Pemex." The upgrade gave the plant an increased capacity of 100,000 additional b/d from the original 185,000 b/d, and its optimal crude processing bulk improved from 175,000 b/d to 246,000 b/d. This 40% increase in processing volume was largely driven by the upgraded infrastructure's capability to process the heavy oil that Pemex now increasingly produces: from a processing capacity that was only 33.1% focused on refining Mexico's Maya heavy crude oil blend, today 71% of capacity is dedicated to this heavy crude blend.

Gasoline and diesel production went up as a result of the reconfiguration. While the refinery used to only produce 45,500 b/d of Magna gasoline, the reconfiguration increased Magna output by 31,900 b/d and allowed the production of 15,400 b/d of Premium gasoline, in line with Pemex Refining's established environmental regulations. While Magna contains 300ppm of sulfur, Premium only has 10% of that level, resulting in a safer, less harmful fuel. The refinery also saw a boost in its processed diesel volume, upping its production capacity from 45,000 b/d of turbosine to 51,800 b/d, while adding an extra 30,000 b/d of ultra-low-sulfur diesel (UBA). Finally, to make up for the decrease in fuel oil demand, capacity was lowered from 65,000 b/d to 23,700 b/d.

REFINING CAPACITY AT MINATITLÁN (B/D)



Source: Pemex

All of the reconfiguration processes that Pemex has performed at Minatitlán are aimed at restoring the commercial balance for petroleum-derived products and reducing the high gasoline and diesel import levels. Through the collaboration of the IMP, along with highly experienced companies such as ICA Fluor, Telvent, Inelectra, Samsung Engineering, Emerson, Honeywell, and Dragados, Pemex Refining has been able to modernize, expand, and increase the efficiency of the Lázaro Cárdenas refinery. The upgrade has transformed Minatitlán into one of the most up-to-date refineries in Latin America despite being the oldest in the region. The project also represented an important economic boost for the region, increasing employment in southern Veracruz: the reconfiguration project generated 7,000 direct jobs, while an additional 500 permanent jobs were created to manage the plant's new facilities.

In January 2013, Pemex restarted operations of the second fluid catalytic cracking unit and the sulfur recovery plant.

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SCHNEIDER WORKS ON INSTALLED BASE REFURBISHMENT PROGRAM

JEAN-LUC VIEUX-PERNON
Vice President Energy Latin America at Schneider Electric

Q: What are Schneider Electric's ambitions in the Mexican refining sector, and how does this compare with the the reality of the work that you are currently carrying out?

A: Our reality is that most of our work is focused on specific refinery refurbishment projects, participating tender by tender at projects such as the Salina Cruz and Minatitlán upgrades. This type of project is limited in scope, because of the size of the contract available, which is normally no more than US$2 million. However, we have a fairly impressive success rate with Pemex on projects like these because of our installed base of medium voltage equipment being used at their refineries. At any Pemex refinery you care to visit, the chance of finding our legacy products is extremely high. One of our first priorities in Mexico is to build a complete database of our installed base at the country's refineries, which is not that easy, because of the amount of sales we have done through different channels in the past. However, this is an important market for us because of its potential size. We have to bring our sales, packaging, and refurbishment capabilities to bear on Pemex's installed base. By auditing electrical installations, we can easily see what needs to be repaired or replaced, and although we prefer to carry this service out on our own products, we can also audit other equipment and installations. Carrying out this service at Pemex's six refineries is the main thrust of our refinery work at the moment. Hopefully, in the months and years to come, we can grow this business in order to provide as much support as possible to Pemex.

Q: How does Schneider support the legacy brands that the company has in its portfolio?

A: Usually, we have a ten-year obligation to provide spare parts. Although this kind of technology moves slower than the consumer market, equipment can sometimes become obsolete, especially if it is over ten years old. In these cases, we have to evaluate whether it is economically viable to tailor a new board for an obsolete piece of equipment, or simply replace it with a newer model. Replacement can be particularly attractive if the legacy equipment is not current enough to feature communication capabilities, a key feature of modern hardware.

Q: How can servicing your installed base help improve the efficiency and throughput capacity of Pemex's refineries?

A: Refinery efficiency comes from two factors. First, the level of uptime continuity at the installations: when one part fails, the whole installation could be immobilized, and this has a big impact on operating efficiency and financial performance. We can help by ensuring continuity of service through regular maintenance, and catching problems before they lead to downtime. If we do need to shut down, we can be flexible enough to ensure this happens at a time when it will cause the smallest impact on productivity. The second part of efficiency comes through monitoring. As equipment starts to age, its efficiency is reduced and an increasing amount of energy is wasted, particularly if the equipment is not properly maintained. Even by looking at voltage changes and cabling, we can find ways to improve efficiency.

Q: What opportunities do you see to add products and services to the midstream portfolio following the acquisition of Telvent?

A: The fact that Telvent is now a part of Schneider Electrich has greatly interested our clients and other operators in the industry. We are currently in the process of identifying synergies between Telvent and Schneider. One such opportunity is to provide complete systems: Telvent previously had to source its components externally or develop them in-house, but now can buy system components internally. Also, the company can provide real-time management software in combination with the hardware that Schneider has traditionally been supplying. Whilst we have been trying to leverage these synergies to win major projects, this still has not happened, due to the fact that most major work currently on offer in Mexico is being handled through EPC contractors. However, we hope that soon Schneider will land its first major project where it can utilize these new strengths.

Schneider Electric specializes in energy management and offers integrated solutions to make energy safe, reliable, efficient, and productive in the energy markets and industrial infrastructure.

CRANE AND LIFTING SOLUTIONS FOR OIL AND GAS PROJECTS

Companies that offer integrated lifting and transportation solutions for the oil and gas industry are a crucial component in the process of constructing oil and gas projects. ESEASA Construcciones is one of the leading companies in this area, with the largest and most complex cranes and lifting equipment in Latin America. The family-owned company, which started its operations in Tamaulipas almost 20 years ago, not only provides heavy lifting equipment and cranes, but also solutions for engineering, permitting, transportation, logistics, assembly, and installation on bigger and more complex structures. "We aim always to provide the highest quality security-certified solutions in the market," says Daniel Santos Lara, CEO of ESEASA Construcciones.

One of the company's most successful projects, which was completed in 2012, was the transportation of vast structures and the provision of services for the installation of a new desulfurization plant at the Minatitlán refinery. As part of the project ESEASA Construcciones reinforced bridges, removed overpasses, and secured a reliable high-tension power supply to ensure the efficient transportation of these structures onto the refinery site, where they were then assembled and installed. In terms of logistics, ESEASA Construcciones works with the Ministry of Communication and Transport (SCT), local transit authorities, and Federal Police in order to transport large structures safely and efficiently. "They usually give us a timeframe and a program, and we adapt to their schedule in order to avoid any safety hazards," Santos Lara says. "The process of transporting and installing these structures is extremely complicated, so it is essential that we work hand in hand with service companies such as ICA and Dragados. Those companies are in charge of operating the plant, while our task is to facilitate the transportation and assembly of the structures."

ESEASA Construcciones is also currently working on the transportation of one of the largest and heaviest structures for the Etileno XXI petrochemical plant in Coatzacoalcos, Veracruz. For this specific project, the company acquired a rare 3,000 ton crane worth around US$32 million. Santos Lara is confident that the company, which has been involved in every Pemex refinery project in Mexico, will also play a role in the construction of the new Tula refinery. "The project has not been awarded to anyone yet," he says, "but we are sure that whoever is awarded the project will require our lifting and transportation solutions."

One of the main reasons for ESEASA Construcciones being awarded a role in both the Etileno XXI and Minatitlán projects, and being so confident that it will play a part in the Tula refinery project, is the company's uncompromising safety and quality standards. "We always surpass Pemex's safety standards; our cranes go above and beyond their regulatory requirements, to satisfy our clients' needs," Santos Lara says. In order to fulfill this promise, ESEASA Construcciones' staff have been instilled with the firm philosophy that safety comes first. "If any of our highly-qualified personnel have the slightest doubt about any aspect of a project, we go over the plan again to ensure that we always meet our quality and safety standards – and those of our clients, too," Santos Lara emphasizes. Though Pemex's safety standards may be below those of ESEASA Construcciones, the company's CEO believes in the NOC's commitment to safety issues, which he says is driven by a savvy and highly-trained workforce that is always looking to improve quality and safety at the company, while also respecting the environment. "As a company, Pemex has continuously strived for better quality and safety procedures, as has been the case at ESEASA Construcciones," he says.

Santos Lara has a strong business ethic, inherited from his father who emphasized hard work, great client service, and the importance of safety, technology, and innovation as pillars of the family business. "My father is still a big part of the company: he still has the final word in every important decision that is made," he explains. "He has taught me that there are no shortcuts to achieving success – it is something that is achieved by building strong, lasting relationships with your clients. We build a superior service for our clients through investment in safety, technology, and innovation – that is how trustful relationships are established; and looking after these relationships is essential to being a successful company." Santos Lara also argues that it is these characteristics that have brought ESEASA Construcciones closer to Pemex. "My father taught me the value of Pemex: the company is always proactively looking to advance by investing in technology and quality, with determined, well-trained staff." Although ESEASA Construcciones must face competition from other foreign companies that are entering the Mexican market, Santos Lara is certain that the company will continue to be a leader in the Mexican construction industry for years to come. "Our biggest challenge is to continue growing in the face of competition from abroad," he says. Nevertheless, ESEASA Construcciones plans to expand to other markets, such as Asia and Europe, and increase its presence in the United States and Central America. "We are a family-run business that always aspires to do things the right way, to treat clients and customers with the utmost respect and dignity, and invest in and acquire new technologies and equipment," he concludes.

PRIME-D TECHNOLOGY FOR ULTRA LOW SULPHUR DIESEL PRODUCTION

Axens is an international provider of technologies and services for basic engineering design. However, the company also has a strong global reputation for converting oil, coal, natural gas, and biomass into fuel and producing and purifying any type of major petrochemical intermediates. As one of the leading process licensors in the world, Axens delivers complete basic engineering design packages, including HAZOP studies and detailed engineering reviews, which range from single unit revamps to extremely large and complex projects. In total, Axens claims to have licensed and designed over 2,000 process units around the world.

Currently, one of Axens' most popular technologies is the Prime-D Technology for ultra low sulfur diesel (ULSD) production, which Axens claims "is a market front-runner in ensuring high quality, ultra low sulfur diesel, since we provide high activity and high stability HR series catalysts and the most advanced reactor internals in the industry – EquiFlow." With regard to diesel production, Axens also has the necessary technologies to produce ULSD or diesel in combination with feeds for other units, such as H-oil, hyTail (intermediate fraction hydrofracking), and HDC-HP (high severity hydrofracking). This technology has been successful worldwide because diesel hydro-processing is a refining activity that is changing rapidly. In order to meet the increasing demand for diesel, refineries around the world are processing higher cracked stock fractions, which has led to more complicated feeds. Furthermore, diesel hydrotreaters (HDT) must be operated under stricter conditions to meet diesel fuel specifications, the most common being the Euro V Norms. Due to all these issues, more reliable and higher performance technologies, such as Prime D technology, are in high demand. According to Axens, "the Prime-D advanced control package combines Axens' latest generation multivariable controller MVAC, in association with on line inferential reactor model and feed switch technology that is designed to maximize the benefits from Prime-D process at the lowest operating cost."

In order for the technology to be safe and successful, Axens uses a six-step control strategy:

1. Precise control of sulfur in ULSD products
2. Adjustment of hydrogen make-up for optimal H2/HC ratio in the 2 reactor beds
3. Control of reactor bed outlet temperatures
4. Catalyst deactivation monitoring
5. Throughput maximization (under catalyst run length and unit constraints)
6. And, if two feeds are available, maximization of lowest value feed

Prime D Technology offers various benefits, including "sulfur on spec without give-away, minimization of feed switch time, catalyst run length maximization, reduction of hydrogen make up, minimization of energy consumption, and increased throughput if feed is available." Pemex Refining selected Axens' Prime D Technology for Ultra Low Sulfur Diesel production, out of many other technologies, for the production of ULSD at its refineries in Salina Cruz, Minatitlán, and Madero. The contracts agreed to by Pemex and Axens will include pilot studies, optimization studies, and basic and extended basic engineering for nine units, which include three new units and six revamps.

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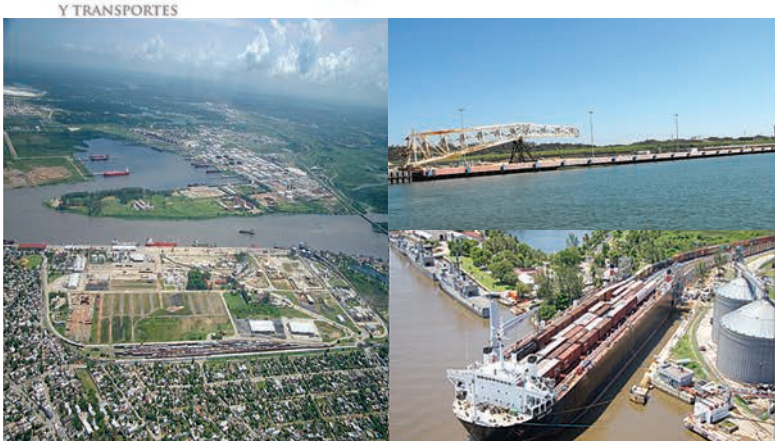

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ENGINEERING SERVICES FOLLOW INFRASTRUCTURE DEVELOPMENT

OPC Engineering and Construction started its operations in 1964 doing port works at Coatzacoalcos – hence the name *Obra Portuaria de Coatzacoalcos* (Coatzacoalcos' Port Works). Since being established, OPC has concentrated on serving the main industries at the port and in the surrounding region, which has meant focusing on the petrochemical market. Over the years, OPC has reached a strong position in the petrochemical segment, which has developed hand in hand with the port of Coatzacoalcos, one of Mexico's main petrochemical ports. Though the company started its operations working mostly with private companies, Jorge Arboleya Pastrana, President of OPC, has seen this market becoming more complex in recent years, while the role of the private sector has grown. "The contracts for large petrochemical projects are structured in a way that makes it prohibitive for companies of our size to participate as a main contractor, placing us instead in a subcontracting role. Etileno XXI is a clear example: Braskem's owner Odebrecht used its construction branch, which is associated with ICA Fluor and Technip, as a result, which left us to focus on subcontracting assignments," he explains.

"The contracts for large petrochemical projects are structured in a way that makes it prohibitive for companies of our size to participate as a main contractor"

Jorge Arboleya Pastrana, President of OPC

"As a result, OPC wants to partner directly with Pemex whenever possible, and has experience working with all four Pemex divisions. Although Pemex Petrochemicals has been the main division OPC has worked with, we also have experience with Pemex Gas and Basic Petrochemicals, and Pemex Exploration and Production, where we work in partnership with other companies such as Grupo Diavaz; the latter is an area where we want to increase our focus," says Arboleya Pastrana. "We have also worked with Pemex Refining, but unfortunately as refinery packages have become increasingly large it has become more difficult to access them. Nevertheless, we are gaining access this through subcontracting in the construction phase."

Arboleya Pastrana also sees engineering projects for natural gas transportation as an area where OPC can apply its engineering expertise, especially in compression stations. "Although pipeline infrastructure is not our core market, it could evolve into an interesting niche market. While other companies may be more specialized in pipeline infrastructure projects, we could tackle these opportunities by working as a subcontractor for companies such as Grupo Diavaz, with whom we are currently working on the maintenance of pipelines in the port of Dos Bocas, and focusing on projects where we have a geographic advantage over companies from other parts of the country," says Arboleya Pastrana. "Separators for the upstream oil and gas industry present another attractive opportunity for us, giving us an opportunity to work directly with Pemex."

At the same time, OPC is preparing for increased competition from foreign companies entering the market. "We are expecting a surge of foreign companies to enter Mexico, and we will be both partnering and competing with them," says Arboleya Pastrana. "Working as a subcontractor is not a problem, but it is essential to have sound controls that ensure that the contracting organizations meet their obligations towards their subcontractors. We will continue entering into partnerships or strategic alliances with large companies, like we have done with Ballast Nedam and Royal Boskalis Westminster, without excluding opportunities for cooperation with smaller companies, because every company has its specialties that can be used to help drive the development of our business and of Mexico. We also cooperate with Grupo Diavaz, which is a good example of a Mexican company that has become a strong and competitive company that can compete with the international players operating in the Mexican market. Nevertheless, the Mexican government should create incentives that enable more Mexican companies to invest in enhancing their competitiveness, and set clear boundaries that prevent incoming companies from negatively impacting the Mexican industry."

According to Arboleya Pastrana, the coming years will be fundamental to strengthen the industry, with increased investment in infrastructure and continuing the infrastructure development strategy started during the last presidential term. "We saw the investment in infrastructure double, and our focus for the future, besides continuing to expand in the petrochemical segment and working with the different Pemex divisions, will be to concentrate on growing our E&P proficiency so that we can work directly with Pemex."

PEMEX REFINING FLEET OVERHAUL

In September 2012, Pemex Refining announced the overhaul and modernization of its fleet. South Korean, Galician, and Mexican companies all participated in the tenders issued by Pemex. The objective of renewing 51 of Pemex Refining's vessels was to reduce the average age of the fleet, which stands at 30 years. This overhaul represents a major opportunity for financial services companies, since the new fleet needs to be both financed and insured. Merchant navy insurance is one of the business areas where London Offshore Consultants (LOC) brings its knowledge and expertise to the Mexican market.

"Even though the rate of development in the oil and gas market slowed in 2012, we saw an increase in merchant navy inspection services during the second semester of the year, especially around the time that Pemex Refining announced its intentions to renew its fleet," explains Bruno Portilla, General Manager of LOC. The fact that Pemex is tendering for the construction of so many new vessels opens up opportunities in several areas of the market. that are no longer suitable for operations due to age or design have to be decommissioned in order to prevent pollution." The process of selecting the configuration of its new fleet depends entirely on Pemex, since it is the only one who knows with any certainty how the fleet will be required to perform in the future, but companies such as LOC are usually called upon to assess whether the vessels chosen meet current safety requirements. "We are already involved in the process," says Portilla. "Right now, we are helping Pemex with the inspection of the vessels that are competing in the tender process. The new vessels in the fleet need to pass those inspections in order to be covered by the relevant insurance and reinsurance companies."

After 34 years of global operations, LOC is well placed to assist Pemex in certifying compliance with national regulations and international best practices related to safety. "Pemex is difficult to diagnose, because of the wide range of activities it is involved in," says Portilla. "However, LOC is definitely well positioned to help Pemex in activities

"Pemex is obliged by law to insure its projects in Mexico"

Bruno Portilla, General Manager of London Offshore Consultants

"Pemex is obliged by law to insure its projects in Mexico. The insurance policy needs to be sold nationally, and LOC is involved in the decision to award those contracts.

There are several new opportunities, both in the insurance of new ships that will make up Pemex Refining's fleet, and in the decommissioning of the ships that will be taken out of service," Portilla explains. "Ships bought by Pemex will need to have insurance in line with industry regulations. Also, according to marine security ordinances, vessels related to insurance, financial coverage, risk assessment for insurance contracts and tenders."

Pemex Refining was rumored to prefer international shipbuilders over Mexican ones, which caused controversy before the tenders had even been issued. Portilla, who is also part of the Mexican Chamber of the Shipbuilding Industry (Cámara Mexicana de la Industria Naval – Camin), states that even though Pemex has the freedom, and even the obligation, to look for the most profitable options

when tendering, it could help to develop the Mexican economy by giving preference to Mexican shipbuilders. "As a Mexican naval engineer, I believe that Pemex should take advantage of the shipbuilding needs it has and promote the national shipbuilding industry and create new jobs in the country," says Portilla.

THE CREATION OF CAMIN

Arguably, one of the main reasons why Pemex has had to look outside of Mexico for shipbuilding capacity is the lack of skill and capacity in the country's shipbuilding industry. Over the last 20 years, the country has depended almost entirely on foreign technologies and companies for the construction of vessels and equipment, especially in the oil and gas sector. As a result, the Mexican shipbuilding industry has focused on small projects. The reasons, as Gabriel Delgado Saldivar, Director General of Marecsa and President of Camin, explains, are various and include: lack of business interest, limited understanding of the industry, government policies with little focus on maritime activities, lack of incentives and unequal conditions for shipbuilders in Mexico, and general maritime industry disunity. To provide solutions to these issues, some of Mexico's largest shipbuilding companies created Camin to represent the sector's interests, while also promoting a maritime culture in the country that will contribute to the socio-economic development of the regions where shipbuilding takes place.

With a Board of Directors composed of Gabriel Delgado Saldivar, Director General of Marecsa, Perla Rice, Marketing Manager of Rice Propellers, José Pablo Peredia, from Grupo Peredia e Hijos, Rafael Villar, Director General of Dockstavarvet, and Víctor Velázquez, Director General of Astilleros Tampico, Camin is determined to be a louder voice for Mexican shipyards and those with ambitions to develop this market. "It is time to know who we are and communicate our current and projected capacity that will permit the development of activity in this area through different strategies in the short, mid, and long term," says Delgado Saldivar.

One of the first items on Camin's agenda will be to help the industry grow to meet the needs of Pemex. This will allow the association to lobby for the preferential treatment of Mexican shipyards over their international competitors more effectively. By developing stronger companies, the association hopes to promote the import of better technologies. This, in turn, will strengthen the industry against foreign alternatives and grow the demand for shipbuilding projects. This could propel companies, engineers, and investors to get involved in the industry, starting an upwards cycle. Camin hopes that in the mid- and long-term the Brazilian model of development could be applied to the Mexican shipbuilding industry, with Mexican companies extracting as much knowledge as possible from their international counterparts.

DIESEL THEFT PREVENTION

"Around 15% of each truck or trailer's diesel is being stolen in Mexico on average," says Eduardo Silva Montaño, Director of Operations at Movimiento Eficiente. This number has grown exponentially, he explains, because diesel used to cost around MX$5 per liter; however, the price of diesel in the last year has increased to MX$11.39, which has made it a major target for local thieves and organized crime. Diesel theft is attractive for petty thieves, criminals, and organized crime, because each trailer usually carries around 1,200-1800 liters, which means the diesel load of each truck is worth between MX$14,000 and MX$20,000.

As a means to counter this threat from thieves and criminals, Movimiento Eficiente created two modern technologies to prevent diesel theft: Diesel Armor and Fuel Check. Silva Montaño explains that Diesel Armor is one of the most effective products in the fuel theft prevention market, because "the diesel trap goes at the mouth of the tank and is made of a wire mesh, which permits the refueling of diesel without any setbacks, while preventing any type of hose from being inserted into the tank because of the wire mesh."

Fuel Check, Movimiento Eficiente's second product to prevent diesel theft, still in development and created after working with Femsa, will eventually have the capability to electronically measure diesel levels in trucks or trailers and inform operators of any drastic changes in those levels. "This innovative technology, which will soon be available in the market, will revolutionize the diesel theft prevention industry," claims Silva Montaño.

Movimiento Eficiente is located in Mexico City, but the company also implements its diesel theft prevention measures in Central Mexico and the ports of Veracruz, Manzanillo, and Coatzacoalcos, where the transportation of goods by trailer and truck is most common, according to Silva Montaño. Furthermore, he argues that "even though diesel theft might seem irrelevant to most Mexicans, this illegal activity has a large impact on Mexico's economy and development, and theft and crime is a cultural problem." In order to not only prevent, but get to the root of the problem of theft and crime, Mexico needs to increase the salaries it pays. "In the US, a driver makes around MX$30,000 a month, while one in Mexico makes MX$15,000, which is clearly not representative of the hours and the risks their jobs entail," believes Silva Montaño.

EXPANDING MEXICO'S LEADING PETROCHEMICAL PORT

Created by Federal decree in October 1825, the Port of Coatzacoalcos has always depended on the region's industrial hinterland. The history of its development has shifted from being a relevant port in the first era of the Mexican merchant navy – devoted mainly to cargo transportation – to being the most important petrochemical port in the country. The Port of Coatzacoalcos devotes itself mainly to facilitating the growth of the petrochemical industry: "We concentrate on the creation and development of facilities for the petrochemical industry because of its economic importance for the region," explains Gilberto Antonio Ríos Ruiz, Director General of the Port of Coatzacoalcos. "The main industry in Coatzacoalcos is the petrochemical industry, so the port focuses on petrochemical-related activity. This is why we have better facilities for fluids management than other ports in the area."

"The first priority for the Port Administration right now is to finish the infrastructure at Pajaritos, since it is the most important project for the region"

Gilberto Antonio Ríos Ruiz, Director General of the Port of Coatzacoalcos

Recent investments made by the private sector in the southern part of the State of Veracruz, aimed at the creation, revival and expansions of petrochemical centers in the area, have increased the importance of the Port of Coatzacoalcos. "We are currently facing important challenges and opportunities," Ríos Ruiz says. "They all revolve around the increased importance that the development of the petrochemical industry has taken in the last years."

The alliance of Pemex and private sector leader Mexichem to expand petrochemical production at Pajaritos and the creation of the Braskem-Idesa's Etileno XXI complex have helped the petrochemical segment to raise its prominence in the Mexican hydrocarbon landscape. In turn, this has given the Port of Coatzacoalcos some revamping work to do in order to satisfy the expanding demand that these new projects will require.

"The first priority for the Port Administration right now is to finish the infrastructure at Pajaritos, since it is the most important project for the region," Ríos Ruiz details. "The construction of the dock is already finished and the onshore infrastructure has been built, but we still need to look for private investment through public bidding in order to build port facilities at the other side of the river to be able to serve the growing demand of the industry." The increasing amount of investment that the private sector is dedicating to petrochemical projects, already lead the Port of Coatzacoalcos to prepare for future expansion of activity in this segment. The port already has three different terminals that meet the needs of the petrochemical industry, and new facilities will need to be developed. "There is not much available land remaining in the area to build the infrastructure needed for future petrochemical projects," Ríos Ruiz comments. "We are not the only ones growing, the city of Coatzacoalcos is growing to the west, which is the only side in which it can grow because we are surrounded by the sea in the north, swamps in the south, and the Coatzacoalcos river on the east side. To make sure that we develop hand in hand with the city we have a special program that is dedicated to the relationship between the port and the city, and we publish an annual report dedicated to our social responsibilities which shows the people what are we are doing, and highlights that the port and city can grow in harmony"

"It is the Port Administration's (Administración Portuaria Integral – API) responsibility to provide the necessary facilities to address the growing needs of the companies that are coming to work in the region." Creativity and perseverance will be crucial as the Port of Coatzacoalcos continues expanding its A-grade infrastructure to support the development of the petrochemical industry.

OPPORTUNITIES FOR MID-SIZED PETROCHEMICAL COMPANIES

Over the years, the market for mid-sized petrochemical companies in Mexico has evolved from being a closed and domestically-focused industry to a highly competitive and open market servicing both Pemex and private companies in Mexico and abroad. This has led to both increased competition and increased opportunities for mid-sized companies with a focus on quality. One such company, Grupo Petroquímica Beta, began operations in Mexico around six years ago and claims to have the latest technology in terms of its control systems, safety systems, and strong environmental philosophy, and which, in the words of CEO Raúl Baz Harvill, is as safe as or safer than large international petrochemical companies such as BASF or Dow Chemicals.

In the 1960s and 1970s the petrochemical industry in Mexico was highly regarded because it represented a complex new business and an industry with the potential to further develop the Mexican economy. "This, combined with a 20% subsidy on the price of petrochemical feedstock, led to a boom of mid-sized Mexican petrochemical companies. They were making a lot of money, until the market was opened to international companies in the 1980s and the subsidy was abolished," says Baz Harvill. "This development drove companies to lower their environmental and safety standards, which culminated in the founding of a strong green movement that demanded the creation of new rules and regulations to protect workers and the environment. The pressure for stricter regulation forced companies to invest in safety and environmental procedures that weakened the bottom line of the Mexican petrochemical industry, and just stopped short of destroying the private Mexican petrochemical industry." The opening of the market to international competition changed the way in which mid-sized Mexican petrochemical companies compete in the international market. Grupo Petroquímica Beta is one example of a Mexican company that was able to grow and successfully build a competitive international business by capitalizing on an opportunity to purchase the assets of a company that belonged to the previous generation of Mexican petrochemical companies, which had been forced out of business following the liberalization of the market. Grupo Petroquímica Beta focused on one specific niche: ethylene oxide and propylene oxide.

It took Grupo Petroquímica Beta six years to both become a competitive petrochemical company in the Mexican market and expand into Latin America, where it will soon dominate the market for refined pentanes, according to Baz Harvill. "The success behind the growth of our company stems from our ability to produce all reactors and machinery, from conceptual and basic engineering to the little nitty gritty things that go into the production," says Baz Harvill. "This in-house engineering has allowed us to save millions of dollars on reactor construction, based on our ability to produce reactors in six months for US$25-30 million dollars, compared to our competitors that spend US$120 million over one and a half years. Our competitive advantage, besides operating in line with the highest safety and environmental standards, is our efficiency in building reactors that provide us with the financial edge, through a competitive pricing model that makes Grupo Petroquímica Beta a successful exporter," explains Baz Harvill.

The future of the Mexican petrochemical industry looks promising, but according to the CEO of Grupo Petroquímica there is still vast room for improvement. "Without a doubt, the first thing that needs to change is the availability of raw materials, especially ethylene oxide," Baz Harvill says. "Currently, Grupo Petroquímica Beta has a quota of 7,000 tonnes of ethylene oxide per year from Pemex, and Pemex must increase the production of this chemical so that production in the petrochemical industry can increase as well. There are plans to expand Pemex's ethylene oxide production capacity by 80,000 tonnes per year, but Pemex has not yet started this project and will not be ready to do so until 2015 or 2016."

"The first thing that needs to change is the availability of raw materials"

In order to make the business more competitive and fair, Baz Harvill would like his competitors to implement the same safety and environmental standards that his company upholds, which include policies and procedures regarding the transportation of ethylene oxide and illegal dumping practices. "Mexico tends to be a petrochemical paradise for international companies that dump their excess production in Mexico. If this does not change, our environment will suffer severe consequences. The lack of environmental law enforcement by the federal government plays an important role in this problem." Even though Baz Harvill is not in favor of raising tariffs, as the Brazilian government has done, he strongly believes that in order to be more competitive Pemex needs to protect its domestic industry by giving Mexican companies the necessary tools to compete with international companies." The solution, in the eyes of Baz Harvill, "is to create rules for a fair game and find a balance that leaves us neither too open or too closed."

REVIVING THE PETCHEM SECTOR WITH ETILENO XXI

The state of Veracruz has always been a center for downstream activity in Mexico. Since the Minatitlán refinery was constructed in 1906 many downstream facilities have been built in the state, and today Veracruz is home to much of Mexico's petrochemical production. It was in this industrial environment that the Etileno XXI project was devised by both private and public stakeholders, as part of an effort to modernize the industrial production of petrochemicals.

According to Roberto Bischoff, Director General of the Braskem-Idesa consortium, "Mexico is one of the few places in the world that can combine all of the key drivers for a successful petrochemical project." José Luis Uriegas, CEO of Grupo Idesa, agrees with his Braskem-Idesa counterpart that all of the elements necessary for building a successful petrochemical operation on a large scale are present in Mexico. This is what has made companies see Veracruz as a perfect location for their downstream ambitions in the country. "We are building a plant in the south of Veracruz, in a small city called Nanchital near Coatzacoalcos, which has only 80,000 habitants," Bischoff tells us. "The area contains all three of Pemex's petrochemical complexes in a radius of 20km, and it is also close to the Minatitlán refinery, which gives us easy access to a consistent supply of feedstock."

Both Braskem and Grupo Idesa have developed big projects in the petrochemical segment. "To build a successful petrochemical project, you have to take several factors into consideration," says Uriegas. "First of all, you need to have access to highly sought after raw materials on a long-term basis. Veracruz has the feedstock needed to start a project this big. Once you have the raw materials, you need access to the markets that demand your end products. Mexico has significant demand from its domestic market, and it also has free-trade agreements with 44 countries to which Mexican petrochemical producers can export with no tariffs." The geographical location of Mexico also eases access to the US market, which has a lot of export potential. "The third vital element is the technology needed to build the cracker, which was available to us here in Mexico, since we bought it from Technip," Uriegas continues. "Apart from technology, the final element needed is human talent. Veracruz has a very well-developed and experienced workforce for the petrochemical sector, which gave us all we needed to set this business up."

Approximately 70% of the polyethylene currently used in the country is imported, which amounts to around 1.1 million tons per year, and around 90% of that comes from the US. The figure is expected to increase to 1.5 million tons by 2015. The Etileno XXI complex is expected to produce 1 million tons of ethylene per year by the time of its start-up, to be fully targeted towards the Mexican market. Its facilities will include two polyethylene plants producing 750,000 tons per day and one low-benzene polyethylene plant producing an additional 300,000 tons on a 1:1 ethylene to polyethylene ratio. It is expected that by 2015 the plant's production will replace most of the imports that currently satisfy domestic demand. "Mexico will continue to grow at an annual rate of 3-4%, and so will the market for polyethylene," Bischoff says. "This means that the production from Etileno XXI will become strategic in replacing imports, but will not eliminate them; imports will continue to play an important role in supplying the domestic market." The project is currently under construction with an estimated completion date of 2015, but it took many years for the Mexican government to accept the proposal. In the late 1990s, during the term of President Ernesto Zedillo Ponce de León, the project was thought of as a solution to modernizing the petrochemical sector in Mexico; however, despite some discussion around the topic the project did not get off the ground. By President Vicente Fox Quesada's term, the conversations about starting such a project re-emerged under the codename of Project Fenix. "At that time we were working with other companies, such as Grupo Alfa in Mexico, to participate in the project," recalls Uriegas. "But unfortunately, Fenix was also discarded during that administration." More than a decade after the project was originally proposed Felipe Calderón Hinojosa, former Energy Minister, was elected President and decided to support the project. "President Calderón had seen the draft proposal for this project during his term at the Ministry of Energy and strongly supported the idea; he wanted to finance the project and intervened to make it happen," Uriegas states. "He called on all of the players that needed to get involved – the Ministries of Energy, Finance and Economy, and Pemex – and put together a strong team to establish the basis to put out a contracting tender." This was how Etileno XXI was born.

Several petrochemical companies rekindled their interest in the Mexican market under the conditions of the Etileno XXI project tender. "The Mexican government made sure that the necessary long-term stability and provisions were there for such an important project," says Bischoff. Both Braskem and Grupo Idesa became involved during the early stages of the contracting process; after meeting and discussing several ideas, they decided that it would make strategic sense for them to combine forces in a joint venture. "We had the experience of doing business in the petrochemical sector in Mexico and managing the distribution and storage of refined oil products; however, we had no experience in crackers nor in any part of the manufacturing process of

petrochemicals, since that was all monopolized by Pemex," Uriegas recalls. "Braskem brought considerable experience to the construction of crackers and the manufacture of polyethylene, resulting from its work in Brazil." The skillsets of both companies complemented each other very well and helped them to overcome the challenges that they later faced at Etileno XXI. In order to align their partnership strategies, Braskem and Grupo Idesa decided to consolidate their alliance by creating a Mexican company with a 75% stake for the Brazilian company, and a 25% stake for its Mexican counterpart Idesa. It was not the first time that Braskem had looked for a project like this: the Brazilian company had been searching for opportunities throughout South America for several years, and finally decided to invest in Mexico, where, for engineering purposes, we have joined together with them and ICA Fluor."

The project's FEED stage has already been completed by Technip, and the contract for the EPC stage is now under way. The consortium, consisting of Odebrecht (40%), Technip (40%), and ICA Fluor (20%), will be in charge of delivering the engineering specifications for the project and building the plants. "Both Odebrecht and ICA Fluor are experts in construction and, with the acquisition of Stone & Webster, we now own around 50% of the world's ethylene technology," Pescador Asaf states. "In this regard, the consortium we have put together fulfills the EPC requirements of the project perfectly."

IMPORTANCE OF THE PRIVATE SECTOR IN THE FUTURE OF PETROCHEMICALS

The petrochemicals branch is not considered part of Pemex's core business, something that is reflected in the amount of investment that the petrochemical division receives: in 2013, Pemex will allocate just 2% of its total investment budget to its petrochemicals division. "The petrochemicals segment has always been given the lowest proportion of investment by Pemex," says Emiliano Pescador Asaf, Director General and Mexico Country Manager at Technip. "If you compare the investment Pemex allocates to its petrochemicals subsidiary to what it allots to its Refining and Exploration & Production subsidiaries, you will see how small the investment for this segment really is." For 2013, Pemex Gas and Basic Petrochemicals and Pemex Petrochemicals together will just receive 4% of Pemex's total budget.

The private sector is expected to play an important role in the reactivation of the Mexican petrochemical industry. Brazilian company Braskem, owned by Odebrecht and Petrobras, joined the Mexican company Grupo Idesa in a shared investment project to develop the petrochemical complex Etileno XXI. "This project represents the largest ever investment of a Brazilian company in Mexico, at US$3.2 million," explains Robert Bischoff, Director General of the Braskem-Idesa consortium. "This huge investment represents a new age of sorts for the Mexican petrochemical industry, where the key objective is to guarantee enough volume of additional feedstock to launch new projects."

The objective of Etileno XXI is to provide ethane as the feedstock for plastics production, rather than having a naphtha-based production. At the same time, the plant will reduce polyethylene imports from other countries, such as the US. "Important financial institutions such as the International Finance Corporation, Inter-American Development Bank, and Bancomext, as well as export agencies from Canada and Italy, and several commercial banks are all involved in the financing of the project," says José Luis Uriegas, CEO of Grupo Idesa. "We get this kind of support for the project because the conditions in the country and the petrochemical sector are right. It also confirms that private investment and Pemex can work together."

Located not far from Etileno XXI, also in Coatzacoalcos, the Pajaritos petrochemical complex will receive a capital injection of US$556 million from Mexichem production of vinyl chloride. This joint venture between Mexichem and Pemex is expected to reduce imports of this type of petrochemical from the US. Mexichem's involvement in Pajaritos, with a controlling share of 58.46%, will also generate an increase in the production of vinyl chloride from 200,000 tonnes to 417,000 tonnes, based on an increase of 24,000 tonnes in the first year and 146,000 tonnes in the second. Ultimately, Mexichem is planning to increase vinyl chloride production to a level where it not only satisfies domestic demand, but also allows for exports to the US and South America.

The Etileno XXI and the Pajaritos projects highlight that private investment in the petrochemical industry is finally starting to compensate for the lack of investment from Pemex. "The investment injection that private companies are providing to the Mexican petrochemical industry will most definitely bring change," Pescador Asaf states. "Private investment will generate a gradual increase in production and profitability of petrochemical activities. These joint efforts from the public and private sector hint at a brighter future for the Mexican petrochemical industry."

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Observers seem optimistic that the recent change of government in Mexico will mean great things for international companies looking to do business in the country. Indeed, compared to its neighbors, Mexico is seen as an excellent option for investment by many, having withstood the global financial crisis with relatively few scars. However, not everyone sees Mexico as an attractive place to do business, or understands how to capitalize on its potential.

This chapter aims to dispel some myths about the Mexican business environment. It will also explain the fiscal situation and potential impact of the upcoming energy reform, the value proposition of the country's human resources sector, and the ways in which companies can participate in the development of the Mexican oil and gas industry.

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THE PROMISE AND POTENTIAL OF ENERGY REFORM

As we enter the second half of 2013, so approaches the next round of energy reform for Mexico. Accompanying the anticipation is much speculation and analysis, hope and fear, fueling the public debate about the potential that this reform could have to stimulate the oil and gas industry and the wider Mexican economy. Guillermo Pineda, Energy Specialist at PwC Mexico, analyzes the varying degrees of success of the country's previous energy reforms, assessing how learning from previous experiences can help Mexico's current political leadership to achieve comprehensive energy reform.

"The government has faced several tough challenges in the past two decades, but it has failed to convert them into opportunities," Pineda says. "The lack of modern regulations is hindering the growth of the Mexican oil and gas industry. While investors got their hopes up during the preliminary discussions of past reforms, they were ultimately disappointed by the limitations on private participation that have persisted in Mexico's legal framework. This has led some foreign investors to see Mexico as being 'all talk' with regard to meaningful energy reform. "In our visits to promote Mexico as an energy investment destination, international companies get enthused about the prospects that the sector offers," says Pineda. "However, the lack of legal certainty that is essential for large investments made in the energy sector is off-putting for potential foreign investors."

"Mexico needs to understand that the more comprehensive the reform gets, the bigger benefits it will enjoy from it"

Guillermo Pineda, Energy Specialist at PwC Mexico

The change of government and the support of Mexico's three main parties for the Pact for Mexico, as well as the growing consensus that energy reform is essential to supporting the country's economic growth and maximizing the value created by the industry, has renewed hope for meaningful energy reform. "Mexico has been waiting for the big wave to come and it seems like it is finally here," Pineda states. "In the presidential campaign, all candidates supported the idea of making changes to the way the industry is regulated. This is also a priority for President Enrique Peña Nieto, who has the ambition of achieving far-reaching energy reform."

PwC Mexico's Energy Leader sees an opportunity to capitalize on previous reform negotiations. "We need to take advantage of the experiences from the discussions that were held five years ago. A lot of work has already been done to identify the main issues, even though the results of those efforts were minimal," Pineda adds. "With those experiences and the current awareness of the need for change, the only possible outcome seems to be a fully inclusive energy reform." Pineda believes that the groundwork for creating comprehensive reform has already been laid by its previous promoters, and the cultural conversion is also in place. "The government has a plan and a well-driven impulse to generate real change. We can deduce from open discussions and the Mexican media that the ambition to make whatever changes are necessary is there, no matter which regulations need to be tweaked to do so," he argues.

These changes should provide Mexico with better access to technology. As Pineda argues, "Pemex needs to be even more efficient and, in order for this to be achieved, the company needs to partner with companies that have the necessary technologies and equipment to bring improvements. From there, the main question is: 'how will we achieve this?" For Pineda, contracting is likely to be a central part of the discussion during the reform process. "Contracting also starts to be an issue: the incentive-based contracts that Pemex is currently offering will not bring additional players to the industry. Will production-sharing agreements finally be allowed in the Mexican market? This is the way Norway, China, and other countries are working – through concessions and PSAs, which are the real incentive-based contracts. These types of contracts generate an additional commitment by sharing risks and results. In any case, for Pemex to acquire the technologies needed to take the next step, the industry needs to have a strong regulatory body that can tower over its players."

While the National Hydrocarbons Commission (CNH) is already executing the regulator role, Pineda believes it has not yet been given the proper authority for it to comply with its mandate. "The industry still needs to create an autonomous, independent body that oversees the way that projects are selected and undertaken," he establishes.

"CNH is making its best effort under the circumstances; nevertheless, it is not taken seriously enough by the industry, since it regulates a company that surpasses it in terms of authority, due to its size and power. For the country to better control Pemex's operations, it needs to grant the CNH the necessary resources to do all the research it is set to be done, and entrust it with the power and authority to hand out orders with which Pemex, and possibly additional players, will comply." Pineda is confident that the CNH already has the adequate people to fulfill its mandate, but that with more authority and support it will be able to better carry out its objective of helping Pemex to optimize its portfolio and strategy. "This stronger body has to regulate which projects should be embarked upon, perhaps even setting guidelines for their execution, but overall, it needs to have the sufficient strength to enforce all of those rules and to ensure greater efficiency in the industry. With a full-bodied, strong regulator, the whole strategy for Pemex would be more cost-effective and it would also help to bring additional players that have the technologies that the NOC is currently lacking into the market."

September 2013 will mark the first target date for assessing the progress on the energy reform, but Pineda believes that in order to assist lawmakers in finding a solution that faces the least resistance, the bigger picture needs to be shared with the entire population. "Mexico needs to understand that the more comprehensive the reform gets, the bigger benefits it will enjoy from it," he pleas. "If we compromise on some of the changes, the benefits will diminish in the same proportion, risking an outcome that would be similar to the 2008 Energy Reform."

MEXICO RISES AS A HUB FOR FOREIGN INVESTMENT

Over the past two decades Mexico has transformed itself from a closed economy with low foreign investment to a highly attractive market for international companies: Mexico changed from having an protectionist economy with high import taxes to a very open model, reducing regulation and signing 44 free trade agreements, which makes it the nation with the most free trade agreements in the world. This change in structure began in 1994 with the signing of the North American Free Trade Agreement (NAFTA), which made Mexico, according to British Insider, "A factory for manufactured goods destined for the US and Canada, and now a factory for the world."

The opening up of the Mexican economy and the policies implemented in the last two decades have helped the country become a highly attractive market for international companies, but with its strategic location, sharing a long border with the largest economy in the world, it has been able to contend with other highly competitive manufacturing economies such as China. In the past, Chinese manufacturing wages were four times cheaper than Mexico's; nonetheless, as Chinese wages have risen and oil prices have soared, Mexico has begun to attract more and more foreign investment, not only because it has low manufacturing costs, but also because transportation costs to the US are significantly cheaper from Monterrey than they are from Guangdong. For this reason, it is not surprising to see some of the largest international companies, such as Nissan, Honda, General Motors, Coca-Cola, and DuPont, opening new manufacturing plants all over Mexico.

It is not only foreign companies that have benefited from the opening up of the Mexican economy and the boom of foreign investment. Companies such as Bimbo and Cemex have been able to grow significantly not just in Mexico but abroad too, distributing their products mostly in Latin America, but also further afield in Europe and Asia. As The Economist argues, "being a multinational corporation based in Mexico is no longer a disadvantage, since raising capital is not hard in Mexico; the Mexican bolsa is flavor of the month with foreign investors because Mexican firms are well-placed to expand north (where there are lots of Mexicans) or south (where Spanish is the lingua franca)."

Even though in the past Mexico offered a cheap labor force for manufacturing, it did not offer international companies a workforce with the necessary skills to compete with other more developed nations; however, according to the New York Times, "Mexico currently graduates around 115,000 engineering students per year — roughly three times as many as the US on a per-capita basis." This drastic increase in producing skilled labor has led to a boom in various industries, such as aerospace, automotive, and other advanced manufacturing industries.

The global recession that hit the US and Europe in 2007-2008 had a huge negative effect on the Mexican economy and its prospects of becoming a hub for foreign investment, but the country has built solid foundations that will help it to achieve strong growth in the future – the country's potential for progress is evident in the fact that Mexico exceeded Brazil's GDP growth rate in 2011 and 2012. If this growth trend continues, the Mexican economy could surpass Brazil's by the end of the decade, and according to Goldman Sachs and Nomura, by 2020 Mexico's economy could be amongst the ten largest in the world.

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THE MEXICAN SECURITY SITUATION

"The challenge of addressing Mexico's security situation should be considered in two parts, the private sector and the public sector," explains Marco Ossio Rangel, Mexican Country Manager of G4S, the world's largest private security firm. With more than 70 known criminal organizations operating in anything from petty crime to drug dealing and human trafficking, the situation in Mexico has reached a point where international companies looking to invest in Mexico are considering safety as one of their primary concerns.

The previous administration attempted to tackle the problem of violence by waging war against organized crime. Even though President Felipe Calderón, whose objective was to leave Mexico with the foundation for true and lasting security, increased the number of active federal police officers in Mexico from 6,000 to 36,000, increased the resources to fight criminals, restructured the Attorney General's office to improve the Mexican justice system, and deployed the army prevent violence and fight crime, the security situation in Mexico is far from resolved. The new administration, which has been very critical of Felipe Calderón's security policies, is attempting to fight organized crime in a different fashion. In its Pact for Mexico agreement with other political parties, it was able to agree on a security policy to not only fight crime in general, but address the three most vital areas of criminal activity: murder, kidnapping, and extortion.

In his security policy, President Enrique Peña Nieto emphasized that to prevent these three vital types of criminal activity, his administration would focus on fighting poverty by creating jobs and providing social services in the areas of the country that see the most violence. This policy, they claim, will prevent the growth of gang membership by taking people off the streets and into employment. According to Ossio Rangel, a new security chamber will be created by the Peña Nieto administration, which will attempt to capitalize on the expertise and advice of the private sector in combating gang violence. He believes that this type of cooperation between the private and public sector in fighting violence and crime in Mexico is the only way to solve the Mexican security problem. "Private security cannot work in isolation, but relies on the legal infrastructure of the public sector," explains Ossio Rangel. "Even though demand for private security in many areas of Mexico is increasing, from built up urban areas like Mexico City, to remote oil and gas projects, we still need the infrastructure in place to help us process and bring to justice the perpetrators of crimes." This increase in demand is startling in its scope, and according to Ossio Rangel, private protection in Mexico has grown by between 30% and 35% in the last year.

Ossio Rangel explains that since the profile and expertise of security guards offering protection to C-level executives is not the same than that of a security guard working in a shop, G4S is working hard to make sure that it offers the correct services the Mexican market demands, and that its security personnel has the skills and training to offer the necessary safety measures to its clients. However, Ossio Rangel explains that one of the biggest challenges is finding personnel who are willing to work in dangerous regions of the country. For this reason, security guards have to be moved across the country because of the lack of local workforce.

Keeping personnel for the long-term is also a challenge for companies like G4S. "Security personnel know that because they are in such high demand, when they quit they will always be able to find a new, perhaps better, offer," he explains. When asked how many private security firms currently work in Mexico, Ossio Rangel says that there could be as many as 10,000 local firms, with perhaps 20-25 international companies currently working in the marketplace. International firms have something of a disadvantage in the market, he explains, because their international labor practices do not allow them to over-work their employees. Whilst this might mean paying more people in order to do the same job, it also means a better quality of security.

Ossio Rangel concludes by saying that G4S hopes to grow its work with the Mexican oil and gas industry in the years to come: "This is an area that is important for the group in other parts of the world, but in Mexico it is an area that we need to investigate more, and place higher on our list of priority sectors," he says.

President Enrique Peña Nieto emphasized that to prevent these three vital types of criminal activity, his administration would focus on fighting poverty by creating jobs and providing social services in the areas of the country that see the most violence

THE OUTLOOK FOR FUTURE FISCAL REFORM

Mexico is, by far, the member of the Organization for Economic Co-operation and Development (OECD) that raises the lowest federal income through tax; whereas member countries raise an average of 34.0% of their GDP in taxes, Mexico's government tax income only represents 19.7% of the country's economic output, and Pemex provides around 35% of this share. Several factors are contributing Mexico's tax revenue, the most salient of which is the country's large informal employment sector. The country's latest employment figures place 29.3 million workers in the informal sector, which accounts for 60.1% of the country's economically active population. Despite reforms made to the Federal Labor Law at the end of 2012 aimed at increasing the flexibility of the labor market, formal job creation was 22.6% lower in the first two months of 2013 compared to the same period in the previous year. Given the relaxation of contracting regulations by the recent labor law reform and the current economic growth rate in Mexico, it seems that flexible hiring schemes and a positive economic outlook alone are unable to fix this structural problem.

Starting up and developing a business in Mexico is extremely difficult, mainly because of the country's lending rate, which is the lowest in Latin America. Loans for new businesses often do not provide sufficient credit to survive the difficult startup period, the amount of time and money that is put in often does not pay off. Moreover, in some ways Mexico's informal sector serves as a type of interest group that has been known to receive incentives in exchange for votes. As such, political motivations have added to the systemic causes of informality in Mexico, thus constraining the country's tax base. Another of the factors affecting Mexico's tax collection is evasion, a common phenomenon among the country's biggest and highest-grossing companies. The country's out-of-date, ambiguous tax code allows companies to deduct a high percentage of their tax load under a number of legally permitted schemes. According to the Chief Audit Office of Mexico, the body in charge of disclosing and analyzing the Public Account, 78.1% of the MX$285 billion that the Tax Administration Service (Servicio de Administración Tributaria, SAT) lost in tax devolutions was returned to large contributors who reported a minimum income of MX$500 million. Moreover, a great number of companies both large and small consistently commit fiscal fraud, of varying seriousness, without being prosecuted. The hundreds of billions of pesos that are lost as a result of evasion and elusion mechanisms greatly reduce the public revenue collected from an already reduced tax base, and make non-progressive taxes such as the Value Added Tax (VAT) very prominent in Mexico's public revenue structure.

Both public opinion and the political class in Mexico are fully aware of the weakness of the country's fiscal structure. Several reform initiatives addressing this problem have been proposed in Congress, since as early as 1962 and more recently in 2012, but few of the proposed changes have been implemented and those that have been approved have failed to significantly improve tax collection.

The political cost of these reforms has been to render the politicians behind them unpopular, and leveraging economic value from Mexico's natural resources remains the easier option. The nationalization of hydrocarbons in Mexico has allowed lawmakers and politicians to overlook the need to improve tax collection for more than seven decades, thus allowing policymakers to avoid the challenge of generating urgently needed structural changes that are unsurprisingly widely unpopular among the country's citizenship. After the discovery of the giant oil field Cantarell in 1974, Mexico's oil dependence grew steadily until Pemex became the contributor of 46.0% of the country's federal income in 1987; since then, the government's income pool has diversified slightly, but oil still remains the source of over one third of public resources.

This combination of a low taxation rate and high dependence on natural resources makes Mexico's fiscal system very vulnerable to the volatile commodities sector, of which the oil and gas sector remains the government's most valuable playing card. As the cracks in the fiscal system become ever more prominent, it becomes clear that the ambitious reform scheme and large-scale public policy actions planned by Mexico's new administration cannot overlook fiscal reform. In order to succeed in making Pemex a flagship in the international oil and gas sector while simultaneously implementing capital-intensive social programs (like the Crusade against Hunger and the endowment of pensions to all Mexicans aged 65 years and above), President Enrique Peña Nieto's government will need to derive public income from Pemex's revenues as well as increasing the efficiency of tax collection in Mexico. Peña Nieto has already started tackling some of the issues surrounding Mexico's fiscal weakness, such as the high level of evasion by large corporate entities. In the first 100 days of the current presidential term, the Ministry of Finance initiated 150 lawsuits for tax evasion against large contributors; this figure surpasses the number of complaints presented by the previous administration in the whole of 2012. However, the most important step that has been taken towards fiscal reform so far is the ample political consensus that surrounds it; this consensus is important, given that it is a subject that has long been

neglected due to the negative attitudes held by several interest groups to potential change in this area.

The commitment to fiscal reform is mentioned in the Pact for Mexico, an agreement that has been signed by the President and the four biggest political parties in the country. In fact, in order to achieve 46 of the 95 goals mentioned in this document, Mexico's tax code must be modified. According to the Secretary General of the OECD, José Ángel Gurría, accomplishing the objectives stated in the Pact for Mexico will cost between 7% and 10% of Mexico's GDP; thus, the prospects of meeting these goals without a fiscal reform that improves the government's capacity for income generation do not look promising. This is arguably why the reform timeline included in the pact predicts the approval of a fiscal reform in the second semester of 2013, and envisions it being implemented by 2014. Given that the commitment of the main political actors to fulfilling the terms of the pact has already been demonstrated with the negotiation and approval of the education and telecommunications reforms, the time for the approval of a fiscal reform is now.

The Pact for Mexico's Governing Council, which is composed of the President and representatives of all the signatory political parties, is already working to formulate a new version of the Federal Fiscal Code, as well as potential modifications to other laws that relate to the fiscal system. Mexico's Ministry of Finance is also collaborating in this effort, both technically and in the promotion of the reform. Luis Videgaray Caso, Finance Minister, detailed the three main objectives that the initiative will pursue: 1) Strengthening the government's financial capacity at all levels – Federal, State, and Municipal – in order to finance education, health and infrastructure projects geared towards fostering economic growth; 2) Creating a fair tax system, where those who earn the most contribute the most; and 3) Simplifying the taxing process and reducing costs for small businesses in order to increase competitiveness.

The specifics of how these objectives will translate into a modification of Mexico's fiscal code remain to be seen. However, if the reform proposal addresses the targets mentioned by Videgaray Caso, Pemex would benefit greatly. The increased revenue that could be collected from other sources would reduce the pressure on Pemex's finances, which in turn would pave the way towards an increased investment in the oil and gas sector and to the modernization of both its upstream and downstream operations. In the words of Héctor Moreira Rodríguez, Professional Board Member for Pemex, "We can't continue to ask Pemex for 100% of its income in taxes; the world does not work like that. A fiscal reform should be pushed forward in order to rescue Pemex from the budget and turn the company into a proper business. It may sound scary or daunting, but we need to look for other sources of income."

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PROJECT FINANCING IN THE MEXICAN MARKET

EDMUNDO GAMAS
Principal of Ultra Maris Capital

Q: Where does your company look for project financing opportunities in the Mexican market?

A: Like every other project financing firm, Ultra Maris Capital is constrained by the Mexican legislative framework: no company here looks for funding unless they either have already been awarded a service contract by Pemex, or are planning to participate in a bidding process and want to have funding lined up. In the same way as all companies, we keep a close eye on the contracts that Pemex puts on the market, and we are limited by those opportunities. Since the majors and even some of the larger service providers typically have their own funding, our company tends to be approached mainly by mid-sized service providers – the ones that do not have access to international capital markets and therefore are more dependent on finding funding from other sources.

Q: What size of funding do you provide in the Mexican market, and how does this compare to international markets?

A: We have funding for much larger amounts than are currently required by the market, because our sources are the biggest international insurance companies, pension, and private equity funds. We are not resource constrained; our sources of capital would actually be happier if they could look at larger projects, whether or not as part of a bigger package. As a result, we are just as keen as the private players in the market for the Mexican government to be a little more generous and aggressive.

Q: Which parameters do you use to analyze risk in the Mexican market?

A: It comes down to making sure that all of the legalities are properly dealt with, so no legal quagmire can come back to haunt your project. Normally, we ask our clients to hire a top law firm in Mexico that has expertise in the sector. To make sure the geology is promising, we ask clients to bring a geological report from a prestigious third party that is credible for investors. Once these two aspects are taken care of, the risk/reward ratio has to look good, because international insurers, pension and private equity funds are not looking to take on large amounts of risk. Rather, they are looking for projects that will bring in a solid cash flow for a good number of years. The weaker projects all over the world are being weeded out. In Mexico this is not such a problem, but in other parts of the world you often find projects from small groups that have done enough geological work to know that there is some potential in the project, but have not completed a full-scale geological survey, and in today's market, nothing can be done to help those projects, short of finding an angel investor to help them complete the work that needs to be done. A few years ago, these groups might have been able to find a fund or even an individual investor that was willing to take the risk, but right now they cannot.

Q: What do you expect to be the impact of the introduction of integrated service contracts on the development of the Mexican oil and gas sector?

A: We see it as a positive step for the country. Pemex has access to capital markets; they have relationships on Wall Street and in London, and do not normally work with boutique investment banks like us. The fact that the market participants are more numerous is very good, because it offers us much more scope to work in Mexico. We are definitely all in favor. Right now, we are following the opportunities that Pemex provides, which are predominantly created by the integrated service contracts. We are interested in drilling contracts, because the capital investment required is bigger, and which is attractive for our funding partners. However, our work in this area is still at an earlier stage.

Over the next few years, one of the most important things that Pemex and the Mexican government can do is to redefine the risk/reward ratio they are willing to provide. Once the formulae to calculate this are in place, they will be successful in attracting the capital and technical expertise needed to achieve the industry's goals.

Ultra Maris Capital, a boutique investment bank, offers commercial asset finance, project finance, and capital markets programs for a variety of industries, including energy, mining, manufacturing, transportation, telecommunications, utility and health care companies, in the US, Canada and, Mexico, as well as select markets outside North America.

CAN ENERGY REFORM UNLEASH PRIVATE INVESTMENT

Mexico's new government has, until now, kept very quiet about any details regarding the energy reform that it has been planning. As a result, predicting how it will affect the Mexican economy or foreign investment in the country with any certainty has been near to impossible for analysts. "Before the election, people were expecting that we would see energy reform come extremely quickly, given the importance that the three main political parties gave to it in their campaigns," says Marco Oviedo, Director of Research at Barclays Mexico. "Indeed, both the PRI and the PAN were talking about the possibility of Pemex launching an IPO during the election campaign, which led many to believe that this would happen. However, I believe now that this would be too large a step for the government to take straight away: while it might be in their long-term goals to list Pemex on the stock exchange, a number of measures will have to be taken first in order to ensure that the industry is ready for such a step."

"If constitutional change is included in the energy reform, optimism in the future of the Mexican oil and gas sector would be at an all-time high"

Marco Oviedo, Director of Research at Barclays Mexico

In a recent paper, Oviedo outlined three possible ways in which the Mexican energy reform could happen, on a sliding scale from light changes to a dramatic reshaping of the industry. Oviedo notes that these possible reforms are not necessarily dissociated from one another. "I believe that the first stage of a new energy reform should be aimed at improving Pemex's efficiency and autonomy, in order to make Pemex work more like a private company. In order to do this, it should be detached from the public sector financial framework. One key aspect of this will be to reduce the amount of tax that Pemex currently pays: any company that is taxed 70% of its total annual revenues will eventually fail. The second aspect involves changing the legal framework in order to separate Pemex from the laws that govern its expenditure and investment decisions. There is also the question of Pemex's pension liabilities, which at the end of 2011 represented 43.9% of Pemex's total liabilities. This problem will probably be solved by a combination of Pemex and government funding, but an ideal energy reform should aim to restructure Pemex's pension scheme," says Oviedo. "If the energy reform contains at least one of these components, there will be some optimism in the market, with an accompanying increase in investment, not only in terms of FDI but also portfolio investment. Once we know what the final reform looks like, there should also be a corresponding appreciation of the Mexican peso."

Among the smaller-scale changes that could be made at Pemex, Oviedo believes that one that would change the industry for the private sector would be the opening of less controversial areas of the industry to the private sector. Pointing to the recent announcement of a joint venture between Pemex and Mexichem as an example of a new partnership between the NOC and a private sector company that has not been regarded as controversial, Oviedo believes that this model could feasibly be applied to shale gas in the future, which would spur private investment in an area where Pemex should not currently be spending its budget. The next level of reform would be along the lines of the current structure of Saudi Aramco, which would allow for joint ventures to be created for Pemex's priority upstream activities, but this would require a constitutional change in Mexico. "If constitutional change is included in the energy reform, optimism in the future of the Mexican oil and gas sector would be at an all-time high. If this reform is carried out this year, then perhaps by as soon as 2017, we could see Pemex participating in its first upstream joint ventures," says Oviedo.

The final potential reform of the energy sector is the public listing of Pemex. "I believe that a public listing that follows the Colombian model of only domestic shareholders would be the hardest reform to pass," says Oviedo, "and it probably will not happen in the next fifty years, because a change of mindset, encouraged by increased private sector participation, will be necessary first." Oviedo concludes by saying that even before the reform has been announced, let alone passed, the intentions of the government regarding the reform have helped to encourage positive opinions on the future of private companies in Mexico: "The intention of having private sector involvement is clearer now than it was in 2008, when the government made clear that this window would be very limited. I remember there was a little bit of disappointment at the end, let's see if this will be the case this time."

HOW TO DO BUSINESS IN MEXICO

Juan Pablo Murguía Ashby,
CEO of Murguía, Fianzas y Seguros

| MURGUÍA, FIANZAS Y SEGUROS

Murguía, is a Mexican insurance and surety broker that has grown exponentially since it was founded in 2000. In the last five years, the company has grown at an annual rate of 30%, employing 130 specialists in the insurance and surety market in its ten offices around the country. Juan Pablo Murguía Ashby, CEO of the company, explains that Murguía has many domestic and international offices to be able to give their clients a customized and personalized service, closer to where they operate. Murguía Ashby believes that this is the main reason of success for the company, and why clients think so highly of their services: "We are not just experts in surety and insurance brokerage; we are also a company that is completely devoted to deliver the best service to its clients. This makes up for the greatest difference with our competition in the sector."

Murguía Ashby explains that providing the best service, starting from the management levels of the company, is an added-value that not many companies take the time to provide. "We strive to meet all of our clients and dedicate them all the time needed to satisfy their requirements." This helps the company to understand all its clients' concerns, and provide them with better solutions to solve them.

The company also employs technology that helps to maximize their time and lower their risk in the market. "We provide them with technological tools such as the electronic and mobile surety subscription form," Murguía Ashby details. "With this form, the company delivers the knowledge of the clauses that need to appear in each contract, and loads them electronically. Then, once a surety line for the client has been expedited, the surety bond can be processed within half an hour, and sent via e-mail. This bond will also include the know-how coming from external consultants in technical matters that work with the company. These consultants help Murguía to advise its clients correctly in more technical issues, and assess the risk of the different projects they might want to carry out."

Arturo Martínez,
Director General of
ACE Fianzas Monterrey

| ACE FIANZAS MONTERREY

A key challenge for any company looking to secure a contract with Pemex is ensuring that it has the relevant liability coverage, so that it is protected in the event that it is unable to fulfil the obligations outlined in their original contract - something that is required by the NOC in all of its arrangements with third parties. ACE Fianzas Monterrey, formally owned by New York Life, has been providing surety bonds to the Mexican market for over 70 years, and the energy sector currently accounts for around one third of its work in Mexico.

"If a company wants to do business in the Mexican oil and gas industry it has to do so by contracting with Pemex," explains Arturo Martínez, Director General of ACE Fianzas Monterrey. "The first thing we tell our clients is that, in order to do business in Mexico, they have to take time to understand how Pemex works, particularly in the area of contracting, as the company can be very complex in its requirements."

Martínez explains that when Pemex first launched its integrated service contracts following the 2008 Energy Reform, the only insurance that the NOC would allow for the non-fulfilment of contracts was a letter of credit, which was a requirement for all companies wanting to participate in the tendering process. "For many of our clients, this was a deal breaker," Martínez reveals. "A letter of credit is unattractive for many companies because it takes a long time to organize, and often involves freezing capital. For many companies that want to participate in integrated service contracts, having that capital frozen can often mean that they do not have access to enough money to complete the contracts, given that Pemex does not pay in advance."

As surety bonds do not require any investment capital and are faster to obtain, they are preferred by the majority of companies competing for contracts in the Mexican oil and gas industry, according to Martínez. As a result, many companies lobbied for a change in the new contracts, and Pemex eventually conceded, allowing surety bonds to stand as an alternative to letters of credit in the integrated service contracts.

Horacio López Montes, General Manager of Infrastructure Consulting

| INFRASTRUCTURE CONSULTING

Mexico is high on the list for many oil and gas service companies looking to internationalize their operations. Nevertheless, according to Horacio López Montes, General Manager of Infrastructure Consulting, the country is not necessarily the right location for every company: "Many US-focused service companies would rather work in a safe environment, with an established legal framework, competition rules, and a large market," he states. "A lot of companies used to these established markets are deterred from investing in Mexico because of the fact that Pemex has the monopoly, and the fact that both the US and Canada have plenty of natural resources."

Since integrated service contracts were introduced in Mexico, there has, however, been growing interest in entering the Mexican market. "This represents an excellent opportunity for our boutique consultancy, since there is renewed excitement about the Mexican environment, brought about by the change of government and the sense that more opportunities will be available in the near future," says López Montes. The company provides a roadmap for new companies entering the Mexican oil and gas market, which helps them plan their tax strategy and work with employment regulations, as well as helping to solve the technical and logistical issues of working in Mexico, and assists in planning an effective strategy for operations in Mexico.

López Montes explains that new public-private partnership projects for infrastructure development will also provide new opportunities, because of the new investment framework. "There is not only an opportunity for companies to come and work directly on the many projects on offer in Mexico, but also on the infrastructure projects that these new companies will require in the region," says López Montes. "We expect to find business in this area working with domestic companies, where previously our focus has been on North American companies; our speciality is in explaining new legal and operating frameworks to companies, and with the new PPP model there will be a lot of smaller domestic companies looking to work more effectively under the new frameworks and find business opportunities working within the oil and gas sector."

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Through the British Embassy in Mexico, UKTI's Oil and Gas team provides, support and advice to UK companies to enter and expand in the Mexican market, and strengthen their commercial ties with Pemex, the Mexican Petroleum Institute and the main operators in the country.

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THIS IS GREAT BRITAIN

FOSTERING FOREIGN INVESTMENT AND STRATEGIC ALLIANCES

"Mexico offers many advantages for foreign investment; however, it still poses various complications in terms of bureaucracy and corruption," says Carlos Campos Echeverria, CEO of BC Legal Consulting. "There is also a lack of clear rules that makes it difficult for companies, both domestic and foreign, to understand their place in the oil and gas industry." According to Campos Echeverria, national and international private oil companies carry out approximately 90% of Pemex's activities and of those companies, 80% are foreign. Therefore, he believes there has to be a meaningful focus on assisting the creation of strategic alliances between Pemex and these companies: "Mexico is on the edge of a new energy reform and a new round of ISCs, and we must send a clear message that the country is a great place to do business and that it can be done within the scope of the law."

"We must send a clear message that Mexico is a great place to do business and that it can be done within the scope of the law"

Carlos Campos Echeverría, Managing Partner of BC Legal Consulting

Working with Pemex is supposed to be a clear process of following a tender and bidding process, competing for a contract, and negotiating terms, but Campos Echeverria claims that "in reality, you need an extra dose of patience since you negotiate with technicians and engineers, not with businessmen, and their lack of legal aptitude can sometimes damage the bidding process." Another problem is Pemex's traditional way of awarding contracts. Although, pursuant to applicable law, quality has to be taken into consideration along with price, the reality is that in many cases Pemex contracts are awarded to the lowest bidder, notwithstanding its quality or reputation. "When Pemex awards contracts based merely on cost, projects often exceed the original budget and sometimes are not even finished. This practice leads to delays and loss of time and money. A certification system, more comprehensive than the actual certification system that only revises the good standing and proper authority of a bidder, needs to be created. As a result, companies will be prequalified by Pemex for specific tasks and industries. If a company enters a bidding process for a contract, Pemex will be certain that the bidder complies with all the quality and technical capability required to fulfill such contract," he believes.

"Besides Pemex bureaucracy, corruption is crippling the oil and gas industry because international companies are skeptical of working with organizations involved in illegal practices, but this does not mean one cannot do business in Mexico within the scope of the law. I have had many successful cases and negotiations without engaging in corrupt practices," Campos Echeverria states, "and even though it might be difficult to avoid them, it is not impossible and they should always be eluded, discouraged, and punished."

All these challenges are interfering with Mexico's economic growth and, in order to further foster foreign investment and strategic alliances the government must establish a clear framework for doing business. Companies need to know how they fit in the Mexican oil and gas industry to have a stronger sense of confidence in the country, the oil and gas market, and the opportunities available.

As a means to achieve these objectives, BC Legal Consulting focuses on creating strategic plans where international and domestic companies are advised on the necessary legal, tax, and administrative steps to succeed in Mexico's oil and gas industry. Their main job is to advise these companies to help them reach their potential in Mexico, and assist them in their negotiations with Pemex. As Campos Echeverria points out, "many of these companies already have lawyers, financial experts, and highly trained engineers. However, they do not know the Mexican market and all its various complications. This is why we focus on offering legal engineering, high-level negotiations between companies and the government, with an unbreakable philosophy of zero tolerance to corruption. Our aim is to foster the progress of Mexico by creating healthy strategic alliances for the benefit of all parties involved."

Carlos Campos Echeverria strongly believes Pemex is the engine to create a new Mexico: "We have been missing opportunities for decades and there is a feeling in the country that we must have a long-term mentality, understanding this is a process that would boost Mexico socially, economically, and politically." In his opinion, less complications would not only allow Pemex to keep growing but foster the creation of a stronger, healthier, and more educated citizenry while at the same time attracting foreign investment and bringing more jobs to the country.

COMPETITIVE TECHNOLOGY HUB BEGINS WITH ENGINEERS

Mexico is gradually moving from being a low-wage manufacturing country to a more advanced, science and technology driven economy. This new trend, President Felipe Calderón claimed in October 2012, "has led to the promotion of over 130,000 engineers and technicians from universities and specialized high schools." According to the National Institute of Statistics and Geography (INEGI), over 745,000 students – which equal roughly to 30% of the country's total university population – are enrolled in engineering and technology courses. This means that Mexico is graduating around 115,000 engineering students per year, exceeding the number of engineers graduating from universities in countries such as the US, Brazil, and Germany. This has led to the creation of highly competitive technology hubs and convinced global technology driven companies such as Honeywell and GE to hire Mexican engineering graduates to work in their research and operation centers. For example, despite already having four global research centers in China, India, Germany, and the US, GE recently opened a Center of Excellence in Queretaro, dedicated to research and innovative technology specifically tailored to Mexican needs.

The President of the Mexican Association of Mechanical and Electrical Engineers (AMIME), Lilia Coronel Zamora, believes that in order for Mexicans to fully exploit their degrees and help Mexico become a leading technological and engineering nation, "foreign companies must hire Mexican engineers on a long-term basis in order for them to grow and eventually become technology creators rather than simply temporary technicians." However, Coronel Zamora claims there is a large gap between the demands of engineering companies and the abilities and professionalism of recently graduated technology and engineering students in Mexico. "Mexican engineers are extremely well prepared and can compete at the highest levels, but if engineering companies believe there is a gap between their demands and the qualifications of the Mexican workforce, they should create programs to train engineers in whatever specific discrepancies they deem necessary," she states.

To close the gap between company demands, recent graduate qualifications and professionalism, the Mexican College for Petroleum Engineers (CIPM) is in the process of creating a petroleum engineering certification system, to shorten the demand-qualification gap by giving the CIPM "the technical authority to be part of the most important decisions in the oil and gas industry while at the same time having an important say on the competitiveness and quality of petroleum engineering academic curricula nationwide," explains José Serrano, President of CIPM.

SOFTWARE TO MAXIMIZE WORK EFFICIENCY

FTI Consulting is a global business advisory firm offering multidisciplinary business services in corporate finance and restructuring, economic consulting, forensic and litigation consulting, strategic communications, and technology in various fields. "Currently, we are working very closely with various oil and gas companies, offering security assessment and risk management services," says Aldebarán Malgrejo, Managing Director at FTI Consulting. His company also offers services to maximize employee efficiency, prevent corrupt practices, establish proactive processes, and implement technology and software systems to make sure that money, information, and human resources are well protected. "Our software can check whether a member of staff has sent an email with confidential or incriminating information, and every employee must sign a disclosure agreement, which represents their agreement that anything done on the company's computers can be monitored and controlled," says Malgrejo. In essence, FTI Consulting's software allows managers to monitor the workforce as a whole, and to make sure that everyone is working. "We do not check personal emails or phone calls randomly; we only check those that are filtered by our software with a red flag. This allows companies to optimize their productivity."

Security is one of the greatest challenges international companies are facing in Mexico, according to Malgrejo. The company is regularly advising its international clients on where to locate workers' families, as well as on the different protocols that should be followed in order to protect their human and material capital. "We provide solid services in security, offering thorough background checks and investigations that help our clients to know that the people they are hiring are reliable and have a clean and safe background. But this does not mean that we are only a consulting firm for human resources - this is only a small part of what we do in Mexico. On the whole, our business focuses on making international companies trust and feel safe with their employees and the families of their employees," states Malgrejo.

COMPETITIVE PETROLEUM GEOLOGIST CERTIFICATIONS

Pemex will soon be facing a serious drain of talent in its workforce, as many of the petroleum geologists that were hired during the company's boom in the 1970s and 1980s reach retirement age. In order to ensure that Pemex, and the industry at large, has enough newly qualified petroleum geologists in its ranks by the time this situation arises, and to make sure that those recent graduates have the skills required by the industry, the Mexican Association of Petroleum Geologists (AMGP), headed by Juan Antonio Cuevas Leree, is creating a new certification for Mexico. "We are currently working on a program to certify petroleum geologists, which will offer students graduating from petroleum-related degrees a better opportunity to work for Pemex or other national or international oil and gas companies in Mexico or abroad," explains Cuevas Leree.

The certification, besides helping students and other prospective workers interested in working for oil and gas companies in Mexico, will also allow companies to make sure they are hiring talented and certified people. "If any company wants to hire a petroleum geologist and one of the applicants is certified by the AMGP and the other is not, we have no doubt that due to the recognition we command in this specific field, our certifications will satisfy any doubts any company might have regarding their qualifications." Furthermore, the same people that are retiring from Pemex are members of the AMGP, and in their role as members they engage and evaluate, on a personal and professional basis, what each student needs to perfect in order to pass the examination and be certified as a petroleum geologist by the AMGP. However, in order to succeed in creating reliable and competitive petroleum geologist certifications, the AMPG "must have more open lines of communication as a means to interact more with oil and gas related forums, so in the future Pemex will not only want, but require, these certifications," explains Cuevas Leree.

He believes that the AMGP certifications will not only help students get new jobs and help Pemex attract qualified and ambitious prospective employees; it will also help the industry as a whole. "These certifications will open job opportunities for students, and they will prevent Pemex from having the brain drain that is currently affecting the company. Furthermore, we will be populating the Mexican oil and gas industry with highly qualified people, making us a more competitive and attractive market for international oil companies to come and work here not only for our resources, but also because of our highly capable personnel," he states. "As a means to further advance the needs of everyone involved in the Mexican oil and gas industry, we are working with the Mexican College for Petroleum Engineers to complement our certification plan with theirs."

BREAKING MARKET ENTRY BARRIERS

Geolog has been active in the mudlogging industry for over 30 years. Today, Geolog is present in over 35 countries and has over 200 units operating worldwide, but the company did not enter Latin America until 2007 because of the various complications these markets represent. Mexico has been one of the most complicated markets for Geolog. The company has been able to acquire contracts with large oilfield service providers such as Schlumberger, Halliburton and Baker Hughes in Mexico, but Christian Genty, Regional Manager at Geolog International BV, says that the company has not been able to work within the Pemex system of tendering because there are too many cultural differences and the market protection for local companies is very strong. Furthermore, he believes that one of the greatest obstacles to successfully working with Pemex is effectively communicating the value proposition that his company offers. "Pemex must understand that the different services we offer will not only help to optimize their oil and gas operations, but will ultimately add more value than the actual cost of our services in the long run," says Genty.

Although it seems that the main obstacle to convince Pemex to use its advanced technology is cost, one cannot underestimate the importance of the cultural differences. "To introduce technology, most of the time you have to change the way people work, and since people do not like change and the technical specifications applied to tenders do not match our international expectations, winning a contract with Pemex becomes difficult for us," Genty adds. He also sees contracting issues. "The contracting system is extremely complicated, and prioritizes cost over value," Genty says. "Our private sector clients are every satisfied with our services and work, but we don't seem to get a foot in the door with Pemex. Our hopes rest in Pemex changing its contracting formula, raising its technological specifications." Genty believes deepwater is the most tangible opportunity for Pemex and Geolog to work together in the near future. "Our monitoring tools, if applied to deepwater operations, can make the difference between quickly spotting anomalous issues, as opposed to spotting them too late," explains Genty.

DEVELOPING THE NATIONAL WORKFORCE

"With an economy that has grown steadily over the past few years and is expected to continue to grow, Mexico will need to further develop national talent in order to meet the growing demand of the Mexican economy, particularly in the oil and gas sector. Mexico is trying to develop deepwater fields, for example, which in practice ensures that the investment in that area will continue to grow," explains Thierry Gonnet Crabos, Director General of Adecco Mexico. This could also put Pemex in a challenging position, since the labor market might not satisfy the increased demand. The situation becomes more worrying for the future, since the industry already has a lot of international workers filling positions that should, by law, be occupied by Mexicans. "The law currently states that no more than 10% of a company's employees can be foreign, but there is a loophole in the regulation that most companies take advantage of," states Gonnet Crabos. "Even though Mexico has changed in the last 10 years, developing more specialized personnel with increased technological knowledge, the problem continues to be that the rate at which labor demands are satisfied is way below the rate at which the country is developing economically."

Based on his knowledge of how international companies operate in the market, Del Castillo Román proposes a solution: "Adecco has developed several alliances with international companies to manage their recruitment and selection departments through an outsourcing scheme. In this way the organization has looked into how companies can use their international workers to train Mexicans to become specialists in their technologies, boosting the national talent base to satisfy future market demand. Adecco then adds these newly-created experts to its talent base, which helps to further invest in skills development programs for the future." The skills development programs that Adecco offers improve the ability of the domestic labor force to satisfy labor market demands.

One of the biggest challenges that Adecco faces in enhancing the Mexican talent base, though, is that talents are scarce and dispersed throughout the country. "With talent being spread throughout Mexico, the organization ends up having to recruit people from different parts of the country, which increases the costs of hiring a Mexican candidate," says del Castillo Román. "Mexico currently lacks an efficient geographic strategy capable of satisfying the talent requirements of the oil and gas sector." The challenge of developing national content for the oil and gas industry might be a long-term task but in the long run the benefits will undoubtedly outweigh the investment.

"The problem continues to be that the rate at which labor demands are satisfied is way below the rate at which the country is developing economically"

Thierry Gonnet Crabos, Director General of Adecco Mexico

The problem comes down to the capabilities of the Mexican workforce, the speed at which they are developing new skills, and the number of skilled workers available compared to the number of highly skilled international workers that want to come to Mexico. Alberto del Castillo Román, Director of Recruitment and Consulting at Adecco and the company's specialist in the energy sector, explains the differences between both profiles. "Expatriate workers have an advantage over Mexican candidates in terms of advanced specialization. When technologies needed for a project exceed the capabilities of Pemex, or new technologies are introduced, it is extremely hard to find the national talent needed to perform the tasks required," he says. "The profile of the average Mexican worker is of someone who adapts and learns quickly, absorbing many functions at the same time and at a lower cost than it would take to bring in an expatriate." The challenge to increasing the number of Mexican workers in the industry is how to make these workers more competitive in terms of technical knowledge.

An additional problem that companies such as Adecco face in filling positions is the issue of security in the country: "States that are of great importance for the petroleum industry are filled with criminal organizations that hinder the industry's development," Gonnet Crabos explains. Nevertheless, Adecco's presence in the majority of Mexican states helps it to accurately assess each individual situation along the lines of safety provision, and act as consultants for firms trying to establish themselves in different cities and candidates being asked to work in them. "When the risks of working in a specific place are too high, Adecco recommends the client not to work there, since the conditions make it impossible to develop an adequate recruitment process," Del Román Castillo adds.

COOPERATION IS CRUCIAL TO CLOSE THE SKILLS GAP

Fausto Muñíz Patiño, President of Grupo PAE

Both Mexican and international companies are facing growing challenges to find potential employees with the profile to fill complex technical positions in the national oil and gas market. While there is a substantial applicant pool, many potential employees have characteristics that do not quite meet the ever evolving, increasingly technologically advanced, needs of the oil and gas industry. Fausto Muñíz Patiño shares his insight as President of Grupo PAE, a Mexican human resources company, on the mismatch between the current skill and experience level of Mexican oil and gas workers, and those required in the marketplace. "In our market search for personnel, PAE has found that there is a lack of skilled labor for specialized positions," he says.

"The people we manage are on average 20 to 35 years old, and many either have intermediate qualifications, or have too much experience for certain positions and none for others. People with optimal profiles usually look to emigrate abroad," Muñíz Patiño explains. Candidates who stay in the country and have average knowledge and skills often seek to obtain job stability and benefits to improve their quality of life, even though they are not meeting the requirements that oil and gas companies are looking for to fill vacancies. "Mexican candidates need to take their academic preparation more seriously, and not limit themselves to conformism," Muñíz Patiño points out. "However, the responsibility for the skills gap not only lies with the candidates, it is shared among several players. The academic institutions must make internship programs a requirement for graduation. The government needs to improve its education programs to better train people, while also intensifying job creation and retention programs. Teachers must be better trained too, removing political factors from the education programs. Finally, human resources companies must reach out both to the government and private companies to create improved training programs for employees, since it is not formally required by law today."

One of the reservations that international companies might have about hiring Mexican workers industry is based on the perception that some of them might bring inefficiency, low productivity, and might be offered the job because of nepotism, among other cultural misconceptions. "PAE's personnel management includes the service of replacing those workers that may hamper the companies' operations with their malpractices," Muñíz Patiño details. "This helps international companies to have certainty that the future Mexican workers they employ are competent, hard-working employees, with a high learning capacity." Moreover, the introduction of probationary contracts included in the 2012 Labor Law Reform now empower companies to test hire candidates for trial periods of no longer than 30 days. This could eliminate the ordeals of permanently hiring candidates that could present problems eventually.

The main advantage that PAE has as a national company working in Mexico is in-depth understanding of the specific needs of companies working in the country's oil and gas industry. "Knowledge of how to adequate handle human capital is a critical success factor for projects in this industry, and removing unnecessary burdens from companies to make their investment in the Mexican market efficient has been a trademark for PAE," Muñíz Patiño says.

"Being a fully Mexican company, PAE can act as a real commercial partner for foreign investors in the country. The search, acquisition, and retention of talent presents an important challenge for international companies trying to enter the Mexican market. With our support, international companies can turn this challenge into an opportunity to create sustainably competitive advantage. It is of great importance to perform an adequate profile search survey to adequately capture the client's necessities within the context of its company's culture. The main challenge is the adaptation to an ever-changing market, where a careful cost management is of the highest importance."

"In an operating environment that is increasingly characterized by change – driven by global market trends, financial crisis, cost reduction necessities – there is growing demand for organized, responsible personnel, and outsourcing companies such as PAE are aiming to meet this need by positioning themselves as ideal human resource partner for oil and gas companies," Muñíz Patiño states. With PAE's recent opening in Peru, the company will be able to bring additional expertise to its already successful Mexican operation, while continuing to export national talent abroad. "We have created a talent network database that has allowed us to relocate Mexican workers and offer the expertise they have acquired to other countries," he explains. "This way, we continue to export the best talent from Mexico and import best practices from other countries to improve the Mexican oil and gas industry."

AN ETHICAL APPROACH TO OUTSOURCING SERVICES

Comive was founded in 1998 in Ciudad del Carmen as an outsourcing company with the objective of providing highly qualified personnel for the oil and gas industry. According to the CEOs and founders of Comive, the company is different from its peers because, as a dedicated human resources organization, it only works with established corporations on large-scale projects. In the past, legal ambiguity regarding subcontracting and outsourcing offered opportunities to cut corners in the human resources and outsourcing market; however, Comive has been complying with all the legal requirements concerning labor relations since before the legal framework was even changed. Its CEOs watch with concern as "other companies register their employees with a lower salary than the one they actually receive. This practice, while very common in Mexico, deeply harms both workers' welfare and government finances." According to them, tax avoidance is very common in the country, but companies are looking for the outsourcing firms that do not follow these practices.

The reliability of its legal and hiring practices has allowed Comive to position itself favorably among big companies in the oil and gas sector. "Our seriousness and commitment to legality and ethics has enabled us to attract important clients such as Todco and Seadrill," stress the CEOs. They recall that Seadrill contacted Comive because of a recommendation by another company. "Seadrill came to Mexico with a contract with Pemex in hand and a platform ready in Singapore, which made them an attractive client. They chose us because of our reliability, they saw that we are up to date with all our taxes, and have a good reputation for training our personnel and providing them with the necessary qualifications," they mention. Comive develops candidate profiles based on the needs and desires of its clients, always requesting its clients to determine the skills, academic and professional qualifications of the personnel they need. However, oftentimes the clients do not provide this information, so they usually focus on work experience. "This is one of the main complications of the outsourcing business," the CEOs explain. "Many of our candidates are in the process of finishing their internships and most clients require three, five, or more years of professional experience."

As a means to fill the gap between the clients' needs and the available personnel, Comive works hand in hand with a company that offers personnel training and skills building services. However, Comive has a policy of not hiring recent graduates since its main customer is Pemex and the NOC has very specific requirements regarding its needs and personnel qualifications. In order to meet all these requirements, Comive asks candidates to take an exam to demonstrate their technical capacity and experience. According to Comive, the company's focus on training enabled it to become the first outsourcing firm to award the Rig Pass certification – a security protocol required by Pemex - to its trainees in Mexico.

Comive offers regular safety courses, since the safety certifications have expiration dates, and personnel always have to be up-to-date with new guidelines and requirements. "In order to be the most successful outsourcing company and to satisfy our clients' needs and requirements, it is vital to provide the necessary safety training and quality certifications, especially with regard to jobs with elevated risk exposure on offshore platforms," emphasizes one of the CEOs. Pemex and other companies in Mexico have very strict guidelines and regulations regarding the hiring of personnel, but this is not the only hurdle in becoming a leading outsourcing company. "In order to be successful we have to be very careful, since sending personnel without sufficient work experience, qualifications, or safety certifications could be very damaging to the reputation of a company working in such a small market," they conclude.

PUTTING PEOPLE FIRST TO SATISFY ALL PARTY'S NEEDS

Headhunting in the Mexican oil and gas industry is a complicated endeavor due to the lack of experienced talent available domestically. For this reason, Match Personnel was created to serve as a people-oriented company, linking the employment needs of Pemex and private oil and gas companies with unemployed workers searching for a job. "Our goal is to be the link between the unemployed that have a strong desire to learn and be trained, and companies that have the need but do not have the resources to train people," explains Yina Muñoz Pineda, Director General of Match Personnel.

As well as offering headhunting services for the Mexican oil and gas industry, Match Personnel also offers operational support for maintenance, drilling, and vessel operations. "For example, one of our clients in Singapore required a complete vessel crew, which we recruited for them, from the captain to the cook; another American client came to Mexico with three vessels and we provided them with three complete crews. We offer more services than headhunting in various different fields of the oil and gas industry," argues Muñoz Pineda.

The strategy of Match Personnel's headhunting system is to understand the different strengths and weaknesses of each of its candidates, and develop them in certain areas where they might be lacking. For example, Muñoz Pineda claims that instead of teaching candidates specific technical skills relating to their jobs, Match Personnel engages its subjects in programs that improve their attitudes, emotional well-being, and mental state, helping them to become more self-motivated. "The success of Match Personnel lies in the happiness of our candidates, since we invest a lot of resources in training courses and valuing their work. We do not see our candidates as a number - on the contrary, we see them as humans with a strong desire to move forward and succeed."

Due to the growth Match Personnel has experienced in recent years, some have expressed concerns about the company losing its core values – the feeling that Match Personnel is a family-run business; Muñoz Pineda believes that in order to counter this, Match Personnel must continue to invest in the leadership skills of its managers. "The leadership skills of our managers are key – they have to be able to transmit to our clients the harmony and spirit of the company that we transmit to them – without this, Match Personnel would have fallen apart a long time ago."

Match Personnel also offers training programs, through which it administers psychological and personality tests in order to better understand the values, goals, and desires of each applicant. "This is an essential part of our enterprise, because we want to recommend the right people in order to achieve the best match, thus satisfying everyone involved," adds Muñoz Pineda.

In order to achieve this, Match Personnel hires and trains managers with the ability to transmit the spiritual, emotional, and intellectual knowledge needed. "We have managers from all backgrounds – some with Masters' Degrees and others with none; however, since harmony and self-motivation are the most important attributes required for Match Personnel employees, education levels do not predetermine who we hire," explains Muñoz Pineda.

Even though there are multiple successful human resources companies in Mexico, Match Personnel has been able to succeed because of the company's willingness to invest time and money in achieving the physical, mental, and emotional well-being of its workers. Its policy is to regard each employee as a human being with the inherent capacity to expand the mission and values of the company while continuing to grow personally and professionally. "Our passion and goals lie in creating self-motivated individuals with the desire – not the need – to succeed, by offering the necessary skills to help them to get jobs," Muñoz Pineda details. "We have a monthly rotation rate of 3% in the company, and usually the employee leaving us has been offered a position by one of our clients. This represents an accomplishment for us."

Match Personnel has an aggressive growth strategy, in the name of succeeding in headhunting and outsourcing services not only in Mexico but also abroad – especially in Singapore and the US, where they have already sent workers in the past. Since not all Match Personnel employees can be sent abroad for training and experience, Muñoz Pineda explains that the company has created a selection process based on attitude, aptitude, and personal and professional ambitions. "With this selection process we make sure we send the people abroad who have the strongest desire to work and the qualifications to succeed," says Muñoz Pineda.

Besides this, Muñoz Pineda claims one of their objectives is to acquire a Pemex quality certification in order to be able to bid for contracts in the next rounds of Integrated Service Contracts (ISC's). "What we want the most is to acquire a Pemex quality certification; therefore, we will constantly supply Pemex with our highly trained personnel in administrative and environmental roles."

LABOR MARKET OPTIMIZATION BEYOND THE 2012 REFORM

"With more adept candidates on the market, companies will start to hire teams or crews instead of people. Each crew will have its own leader and projects will be tendered, offering the job to the most capable team"

Mónica Flores Barragán, General Director of Manpower Mexico

Until November 2012, Mexican employees had worked under the same Federal Labor Law since 1970. Successive governments had made small changes to the regulation, but had largely left its structure untouched. As a result, the operating framework became increasingly misaligned with modern employment practices. This was particularly true in the oil and gas industry, where particular skills, knowledge and experience requirements limit the size of the potential workforce. In November 2012, a new law was passed to improve market conditions, but how much of an improvement was it?

Mónica Flores Barragán, General Director of Manpower Mexico, believes that the main priority of the labor reform was to achieve better job placement that meets the needs of a technologically advancing and increasingly competitive workplace. "Technology has changed the labor market as a whole, since now people can work from home or from another country, or even just punch-in for a couple of hours," Flores Barragán explains. "The concepts of employment, vacations, meetings, and teams, have all evolved with technology, and it is Mexico's turn to finally adapt to it."

In the amendments made to the labor law since the 1970s, flexibility was mentioned frequently, but the labor law failed to address the challenges of modern Mexico. New hiring modalities for entry-level employees became available under the 2012 Labor Reform: companies could now consider trial periods for new hires, as well as initial training contracts and temporary jobs. Also, by regulating hourly rates, employers were given the opportunity to hire people by the hour.

Flores Barragán is convinced that if employers are subjected to tight regulations, labor will flow freely under market conditions. "Regulations should be stricter when paying contributions and taxes. The past labor reform had a loophole in fiscal compliance, which companies used to create a strong informal labor market," she explains. "The government needs to establish clear guidelines and stronger penalties to encourage companies to meet their tax obligations, pay their social security contributions, and create formal jobs."

Flores Barragán explained that encouraging the creation of more jobs in technical industries is crucial. "The government needs to develop incentive programs to encourage students to look at more specialized career programs: a solution could be reducing fees for the programs with the most unfulfilled supply in the labor market. According to a 2011 survey conducted by Manpower Group, 42% of the companies in Mexico find obstacles in filling vacancies," she says, pointing out that the percentage is further increased for technical jobs, such as petroleum engineers. By making information available about the high demand that companies have for technical graduates and the opportunities these careers offer, the number of potential applicants for positions in markets such as oil and gas could eventually begin to grow.

The education sector also has a role to play by improving the match between education programs and current job market needs. "Universities and technical training institutions should be more dynamic in the way they structure career syllabi, since the technology and knowledge needed in the market changes almost every year," says Flores Barragán. Students have to bridge the gap between knowledge gained in the classroom and knowledge needed on the field, since most students graduate from their programs in Mexico without any practical experience. "Training positions are a first step, but internships need to be formalized as part of the learning experience in degree programs." Getting to know the market and developing the skills needed to participate are priorities for recruitment, and should therefore also be priorities for the education system.

Once a better pairing between companies and candidates is achieved, the market should be ready to seize the advantages that technology brings. "With more adept candidates on the market, companies will start to hire teams or crews instead of people," Flores Barragán says. "Each crew will have its own leader and projects will be tendered, offering the job to the most capable team; people will still be needed out there, performing oil-specific jobs, but the soft-skills and the interaction will be different."

RAISING THE COMPETITIVENESS OF THE MEXICAN WORKFORCE

Increasing the competitiveness of the Mexican labor market, and improving the match between the supply and demand of essential skills required in the oil and gas industry, offers an important opportunity to make Mexico more attractive for foreign investment and enable domestic workers to advance their careers and purchasing power. Virgilio Ruíz Issasi, CEO of Grupo Hegemonía, a Mexican HR outsourcing and payroll management company, believes that even though Pemex is implementing mandatory training courses, there is still a concern about the lack of experience and capabilities of the Mexican workforce.

"Expats have more experience and technical preparation because they have had more opportunities to work with new equipment and technology," Ruíz Issasi explains. Mexican workers have the mental, physical, and technical ability to compete with any expat worker in the country, but since they have just started working with new drilling and production equipment, it will take them some time to catch up. "In the next 10-15 years Mexico will be creating highly trained and competitive personnel in the oil and gas industry and the technical capabilities between international and national workers will be unnoticeable," he adds.

"In the next 10-15 years Mexico will be creating highly trained and competitive personnel in the oil and gas industry and the technical capabilities between international and national workers will be unnoticeable"

Virgilio Ruíz Issasi, CEO of Grupo Hegemonía

The challenge seems daunting, but Mexico has been advancing at a steady pace. Currently, as a means to improve the labor market and abtain more contracts with Pemex and private oil and gas companies, Grupo Hegemonía has been working with the Ministry of Education to create educational standards and regulations for the industry. According to Ruíz Issasi, Pemex usually demands at least two or more years of professional experience as an employment requirement, but since there is no real educational program that offers internships to Mexican students in the oil industry, many recent graduates are forced to look for jobs in other industries or go abroad. He believes this loss of talent is debilitating the national workforce and for that reason Grupo Hegemonía is opening a school to educate and provide professional experience in the oil and gas market. The timing of the opening of this school is coinciding with an important rise in offshore drilling activity in the Gulf of Mexico that has started in recent years and is scheduled to continue in the near future, creating a sustained demand for skilled labor in the Mexican oil and gas industry. Recently, the Grupo Hegemonia created an alliance with New Tech Global – the largest offshore training company in the world – to jointly build a training center. Its vast experience in safety training for offshore drilling activities is destined to offer new opportunities for Mexican oil personnel. "The training centers, besides offering services for offshore security training, will also give Mexican workers the unique possibility to work in Africa, Venezuela, or Brazil. There, the trainees, will learn and interact with state-of-the-art technology, and eventually return to Mexico with new technological capabilities. Nowadays, there are about 52,000 oil and gas workers in the Mexican side of the Gulf area. Of those, 11,000 belong to Pemex, the other 41,000 work with private companies; training and educating these workers is where our biggest opportunity lies," Ruíz Issasi details.

The new Labor Law also creates opportunities: "The new framework legalizes the hiring of personnel on a temporary basis, which could not be done before," Ruíz Issasi emphasizes. "This is beneficial for everyone because it allows the creation of better working schemes. Furthermore, it is a strong incentive for Mexican oil and gas personnel to perform better, get more training, and find better jobs."

Mexico has the potential to be among the leading oil and gas producers in the world but, but in order to do so, it has to be able to retain the best domestic and international workers. According to Ruíz Issasi, the discrepancy in salaries between national and international workers has led to an exodus of Mexican workers: "Companies operating on the US side of the Gulf of Mexico and in the North Sea pay 40-45% more than Pemex." To become more competitive Pemex and private oil companies active in Mexico need to raise salaries by at least 20% -30%. Foreign companies have been working in the oil and gas industry in Mexico for decades, but salaries have not increased substantially. "It seems unlikely that, even with a comprehensive energy reform, salaries will become competitive for Mexican workers in the near future," he adds.

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GUIDING PRIVATE SECTOR BIDDERS THROUGH ISCS

GABRIEL RUÍZ ROCHA
Lawyer at Thompson & Knight

In the second round of integrated service contracts (ISCs), the consortium known as Monclova Pirineos Gas (MPG) was awarded two contracts at Tierra Blanca and San Andrés. Their legal representative in the bidding process was Thompson & Knight. Gabriel Ruíz Rocha, a lawyer at the firm, explains the contracting process from a legal perspective, and discusses his experience of guiding the consortium through the procedure.

Q: What were your experiences guiding Monclova Pirineos Gas through the ISC bidding process?

A: With two existing contracts in the Mexican market, MPG had a proven track record with Pemex, which helped them establish their credentials for the second round of ISCs. However, despite this, it was interesting to see a partner in the consortium that was not directly experienced in the oil and gas industry, Grupo Alfa. The mix of the two companies was very compelling, as was following the bidding rules for consortiums. As a result of this match, we have been working on both preparing the project, and the consortium internally.

Q: What were the most challenging aspects of the bidding process, in your opinion?

A: The most challenging aspect has been preparing for the type of contract that this second round entails. The multiple service contracts that MPG already had with Pemex at Burgos were good experience, but this oil production contract represents new challenges, such as dealing with environmental, labor and community issues, that were not present in the same fashion in the natural gas contracts.

We are currently entering the transition phase of the contract, and a lot of care has been put into selecting the company that will do the environmental baseline report, dealing with labor law issues, being regularly in contact with Pemex to determine the baseline production, and generally preparing the company to be physically located in Poza Rica, recruiting personnel, and so on. The companies are looking to take possession of the block as soon as possible, and start production, so that the economics of the project start working.

Q: What were the most noticeable differences between the first and the second round of ISCs, from a contractual and legal perspective?

A: There are two major changes: the exploration costs, which are 100% covered by Pemex in this second round, and the formula to calculate the obligation in the development period.

On the other side there are operational changes, and the blocks themselves are considered by many in the industry to have very different profiles between the first and the second rounds. It is generally agreed that the second round blocks are much more attractive in terms of production than those that were offered in the first round.

Q: What are the biggest hurdles for international companies that do not have operations in Mexico to participating in the integrated services contracting rounds?

A: The most challenging aspect is competing with the companies that are already present in Mexico and have a long history of working with Pemex. That has been the most important challenge in dealing with international companies: the expectations and economics of companies with no experience in Mexico are entirely different to those of companies that already have a presence in the country.

Q: What contractual commitments do companies have to make regarding establishing a presence in Mexico?

A: Companies had to make very specific investment commitments in the first round of integrated service contracts. There are also specific commitments in the second round, but the heavier part of that commitment is not yet defined, which is the development phase investment obligation. However, I think companies like Petrofac, which is a pure service company, are the ones that are taking the most advantage of these new contracts.

Seeing how service companies have capitalized on these contracts that represent a different level of risk has been the interesting aspect of these rounds. Service companies are not accustomed to taking the amount of risk that these contracts entail.

PEMEX PROCUREMENT SERVICES: A GUIDE TO SELLING TO PEMEX

The participation of private companies in the Mexican oil and gas industry is directly constrained by contractual relationships with Pemex. According to law, all government purchases - including those of Pemex - must be conducted through public tender processes. "The Law of Acquisitions and the Law of Public Works apply to all government agencies including Pemex, and the Pemex Law establishes the guidelines that companies need to follow in order to bid for a Pemex contract," explains Arturo Henríquez Autrey, President and CEO of Integrated Trade Systems (ITS). As a result, contractors are facing are longer reaction times, while Pemex might end up paying higher prices."

Although the Pemex Board is the governing authority that issues the general guidelines for the procurement process, purchasing committee within each of the Pemex's subsidiaries are in charge of its execution. The first requirement that each purchasing committee has to fulfill is the disclosure of the original purchasing plan for the following year in the Official Gazette of the Federation

(DOF) before the year's end. All the details for each planned tender throughout the year have to be mentioned in the document, including the scope of the project, technical specifications, a description of the terms and conditions for the contract, and timelines to achieve specific milestones. This plan is not set in stone, since contracts might undergo alterations; however, companies should be notified of any changes to the original document before the tendering process begins. If a pre-qualification round is required, only companies meeting the set criteria will be allowed to present their proposals. Once a tendering process is under way, Q&A sessions will be held. When the main issues have been addressed, each bidder can proceed with a bid that consists of both a technical and economical proposal. The technical proposal demonstrates the company's capabilities and experience, validating its capacity to fulfill the contract, while the economical proposal presents the price at which the supplier or service company is willing to provide the goods or services. The bids have to go through several evaluations within Pemex before a final decision is reached. "Bigger acquisitions by amount or significance have to go through six different committees and boards all the way up the ladder," Henríquez Autrey explains. "Pemex is very slow in reacting to its own needs because bureaucracy from within restricts its operations. We have to find ways to simplify the process." Once the relevant committees and boards within Pemex have reviewed the bids, the winner is announced and given a specific time to sign the contract.

Transparency is a vital component in the execution of the bidding rounds. "As any government agency, Pemex has the obligation to be transparent in its processes," Henríquez Autrey states. "However, when transparency gets taken out of context it can excessively restrain the pace at which Pemex is able to carry out its mandate." Pemex is obliged to publish all tender documents in the DOF, on the webpage of the subsidiary issuing the tender, as well as at www.compranet.gob.mx, the government's procurement website.

Although contracting processes are usually executed through public tenders, the Pemex Law allows certain exceptions in specific cases. "While the concept of a public tender is good and promotes transparency, the result is not always optimal for Pemex," Henríquez Autrey states. "ITS fills the gap where the Pemex Law allows exceptions to a public tender, using direct assignment or restricted bid invitations to three or more participants. In order to justify avoiding a public tender, the subsidiary committees need to explain their motivation through an official opinion. The direct purchasing method is usually used in case of emergencies, such as the need for immediate containment or remediation. Restricted invitations can be applied when technological innovation and training is required to fulfill the conditions of the tender. In this case, at least three candidates must be nominated. Purchases that are linked to Pemex's core activities – or substantive productive activities – have a specific set of guidelines under the Administrative Dispositions for Contracting (DACs). To protect the Mexico's national interest during tenders the Pemex law requires a set percentage of national content as mandatory. Under DACs for the contracting of substantive productive activities, Pemex may seek compensation from suppliers that do not meet the agreed-upon contractual obligations.

The procedure that companies have to follow in contracting with Pemex might be considered laborious, but once companies have qualified to participate in a bidding round they can sign a framework agreement that enables them in some cases to contract directly with the Pemex subsidiaries in the future.

BALANCE BETWEEN NATIONAL AND INTERNATIONAL PLAYERS

With the new Integrated Service Contracts (ISCs) being awarded to private national and international companies, Pemex has finally found a formula that allows private companies to invest and profit in Mexico's oil and gas sector based upon their performance, efficiency, and application of technology, explain the CEOs and founders of Zenteno Lira, Humberto Lira Mora and Javier Zenteno Barrios.

Even though it has been difficult for companies to adapt to Mexican business practices, culture, and customs, these new contracts have succeeded in bringing foreign investment into the country's oil and gas market. However, Mexican companies are competing for contracts against some of the largest oil and gas companies from around the world, Lira Mora and Zenteno Barrios claim that the largest problem facing domestic companies is the lack of an adequate response to market opportunities, which Lira Mora believes will continue to be the case in the near future. "For example, the electricity industry opened up and there is not one Mexican company producing energy for the market; the gas transportation industry opened up and only a couple of Mexican companies are involved in two projects; and the natural gas industry opened up and only one Mexican company is participating in projects," says Lira Mora.

For this reason, Lira Mora and Zenteno Barrios believe that, if they are not able to win contracts or do not have the necessary business model to react to market opportunities in a timely fashion, there are other ways that Mexican oil and gas companies can participate in the market. They argue that Mexican companies should not fear the larger international companies they are competing with; on the contrary, they believe that Mexican companies should try and create strategic alliances, though before this can happen on a regular basis there needs to be a comprehensive energy reform and a solid and embedded regulatory framework.

Furthermore, Lira Mora and Zenteno Barrios are concerned that many Mexican companies do not understand or capitalize on the value they can offer to international companies, since most international companies in Mexico require Mexican companies' support in advertising, commercial and sales activities, as well as in other operations such as installation, transportation, and the maintenance of equipment and facilities. "There is enough work for everyone and great synergies could be formed that benefit both national and international companies," explains Zenteno Barrios.

FULLY GRASPING THE MEXICAN MARKET

Inelectra was originally set up in Venezuela in 1968 with the aim of catering for the needs of the power generation market; however the rapid growth in the Latin American oil and gas industry eventually pushed the company into redirecting its focus. After spending much of the 1980s and 1990s developing Venezuela's oil and gas infrastructure, Inelectra later expanded into Colombia and Argentina. The company first came to Mexico in 2003, after winning a bid to become the Project Management Contractor at the Minatitlán Refinery. According to Carlos Sandoval, General Manager of Inelectra Mexico, that was the turning point that peaked the company's interest in increasing its portfolio in the country. "After this experience, Inelectra identified Mexico as a key Latin American market, and decided to look for more business in its offshore market," Sandoval recalls. "After collaborating with Bay and being awarded an EPC contract for Ku-Maloob-Zaap's living quarter platforms, Inelectra then divided itself into two parts: a domestic Venezuelan company and an international company headquartered in Panama."

This structure was not sufficient to satisfy Pemex's demands for EPC services, so at that moment the company decided to form a third branch, Inelectra North America, in partnership with a Mexican engineering company based in Monterrey. The new company, however, was not an individual service provider for long; Inelectra sold its international operations on to Tiger Companies, and the joint venture was sold back to the original partner. But, as Sandoval explains, things did not stay that way. "In early 2011, Tiger Companies decided Mexico was too profitable a market to resist, so it built a new strategy based on its experiences in the country. The company's first change was to establish its main operations center in Mexico, in order to be closer to its clients, and to staff the business predominantly with Mexican employees, so as to obtain a better understanding of the country's business culture." The result has been dramatic: the company has grown from 20 people in April 2011, to 150 by mid-2012, and it is expected to peak at 200 by the end of this year. "Our experience shows that you need to have three or four different approaches in Mexico before landing, in order to fully grasp the complex Mexican market: it is key to understanding how business works here, what people mean when they do or say certain things, and then figuring out what will work best for the company," Sandoval concludes.

SENSE OF URGENCY FOR UK-MEXICO COOPERATION

JUDITH MACGREGOR
British Ambassador to Mexico

Q: What have been the highlights for the British Embassy's work during your stay in Mexico?

A: The British Council has managed to communicate the growing strengths of the Mexican economy to more companies in the UK. Besides this, one of the most important projects we have been involved in was the 2010 Mexican Climate Change Summit in Cancun, which was a triumph for Mexican diplomacy in bringing climate change negotiations back on track. We claim it as a success because it culminated last June with the passing of a New Climate Change Law that is based heavily on the British model and which holds the Mexican government to legally binding targets. Furthermore, as particular highlight of our activity in Mexico I would also like to mention our work on strengthening economic reform provisions, increasing transparency, and human rights and freedom of expression, even though there is much work to be done in this respect.

Q: Why was the development of the trade relationship between the UK and Mexico developing at a slow pace between 2000 and 2009?

A: It was due to a lack of awareness of the opportunities that existed for British companies, since quite a lot of engineering products and power generation materials were being exported back and forth between the two countries, but not much retail or any other products. It was a question of the markets just not understanding and exploring each other. Nonetheless, trade did grow during that period, but mostly as a result of the European Union-Mexican free trade agreement that was signed in 2000 and because of the Mexican government's industrial strategy, which has been successful in attracting huge international investment.

Q: People are finally starting to realize that there is a real opportunity in Mexico and it seems the world is starting to move its focus from Brazil and China to Mexico. How have you made sure that British companies get their fair share?

A: I can tell you that the sense of urgency has been with me since day one. I came to Mexico just after the economic and financial crises in the Western markets and it was becoming very obvious – as we found ourselves in the UK with a huge deficit – that we needed to export much more seriously and in a much more diverse fashion. The British Embassy has always urged companies to profit from the Mexican market and to get more Mexican investment into the UK. Clearly, Brazil slowing down at this moment has focused attention on those markets that are still continuing to grow, such as Mexico. The good macroeconomic fundamentals that were created and maintained through the previous two administrations in Mexico have provided a very solid basis for the new administration, and securing political consensus on reforms has been taken through with a sense of real urgency so far, which is generally considered to be critical for unlocking further potential in the market. However, it is not a zero sum game: I would like more exports from Britain in all directions, not only to Mexico.

Q: Should we be expecting some more bold moves from British companies in the mexican oil and gas industry?

A: I would certainly like British companies to be more present in the Mexican oil and gas market, and I think that companies will have to assess their own risks and games, but I think the work that the British Embassy is doing – to present Mexico as never before – is actually working and people are watching and listening to what is going on in Mexico.

Q: What are the key opportunities for British companies to contribute to the development of the Mexican oil and gas industry?

A: UK companies have developed a strong expertise in all the aspects of the oil industry whether upstream or downstream. Their know-how in exploration and production of unconventional and mature fields, developed through more than 40 years of experience in the North Sea, makes the UK an indispensable partner for Mexico. Furthermore, the UK subsea industry offers numerous technologies for Mexico's deepwater developments; from risers to remotely operated vehicles (ROVs), as well as subsea trees, umbilicals, drilling fluids, and so on. On the other hand, UK companies could help with the exploration of huge shale gas fields in the north of the country, providing 3D and micro-seismic technologies, horizontal and extended reach drilling, and water treatment and management. In terms of transmission, distribution, and downstream activities, UK companies offer monitoring and safety services, as well as high standard petrochemical products. UK companies

could advise and associate with their Mexican counterparts in projects as diverse as pipeline construction, refinery reconfiguration, or co-generation projects, in a context of capacity expansion in the country.

Q: What technological strengths and international best practices can British companies offer to the Mexican oil and gas industry?

A: UK companies collaborate very closely with universities and research centers to develop the technologies and skills the sector requires through joint industry projects. In particular, the model of spin-offs – private companies created after a patented technology developed in a public university or research center – is very effective in promoting job creation and innovation. Furthermore, The UK is also a great promoter of low carbon strategies applied to industries with a high ecological footprint. Various companies offer carbon evaluation services for the industry's new projects that could apply to shale gas developments, the new Tula refinery, or the Pajaritos project. More generally, numerous internationally recognized certification companies offer environmental, quality, and management advice specialized for the industry. Mexico's growing commitment to carbon footprint reduction and environmental responsibility has engendered work for British companies in Mexico's oil and gas market.

The British embassy has a trade and investment team focused on energy, which is dedicated to finding business opportunities for British companies in Mexico and to strengthening commercial ties with Pemex, the Mexican Petroleum Institute (IMP), and other main industry operators and regulators. British companies working throughout the entire value chain of Mexico's oil and gas industry contribute to the improvement of Pemex's performance in these aspects.

One example is Petrofac, since the company has already been awarded four contracts by Pemex. Along with its business, Petrofac's commitment towards the development of local resources and the improvement of surrounding communities has grown. Petrofac is a very encouraging story for everyone, because it has come in and made a long-term commitment to the market, taking out contracts over a twenty to twenty-five year period. This commitment is also reflected in the company's relationship with local communities, and having a local office rather than working out of another country gives the company a personal presence. That is certainly something that we counsel those who really want to work in Mexico to consider doing.

Judith Macgregor, British Ambassador to Mexico

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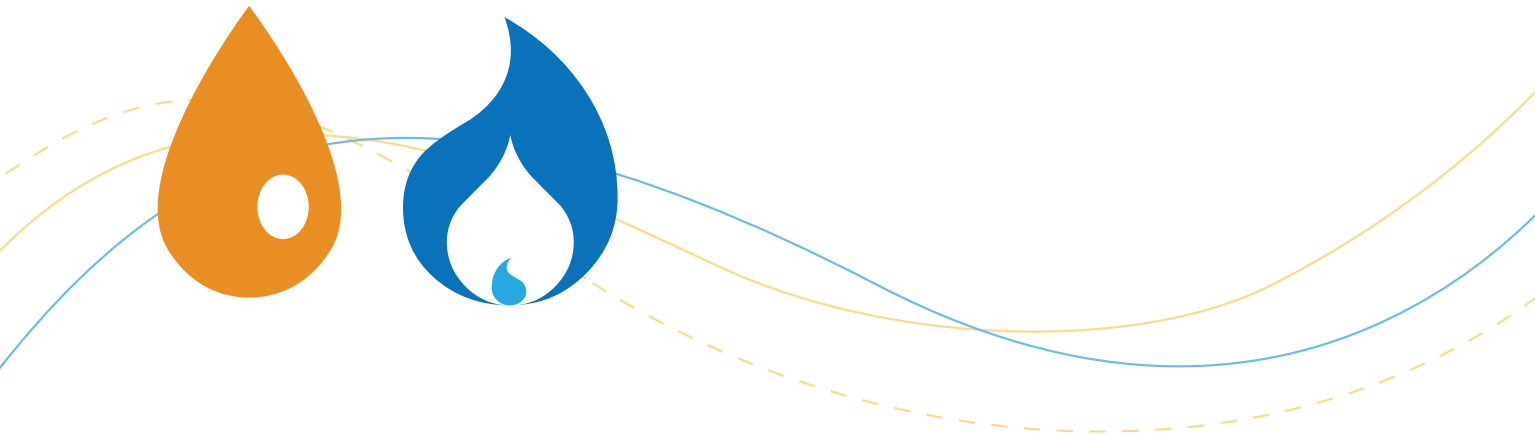
2014 will be a key year for the oil and gas industry. The new administration is expected to have passed its energy reform and the resulting changes will surely shape the industry's outlook for the years to come.

This chapter examines the issues such as the role of the private sector in upstream operations, the optimal approach for Pemex to start deepwater development, and the role that the CNH should play. It takes a look at what 2014 has in store for the oil and gas industry, and looks at how the industry could develop as the months pass by.



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CHAPTER 14: FUTURE OUTLOOK

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STRATEGIC DIRECTION OF THE MEXICAN OIL AND GAS INDUSTRY

2012 marked the 75th anniversary of Mexico's petroleum expropriation, a day of great historic and political importance in Mexico. To honor the occasion, President Enrique Peña Nieto led a ceremony in which he affirmed that the country is facing an unprecedented opportunity to transform its oil and gas industry. "The energy sector is facing challenges that must be heeded with the same boldness and determination with which Lázaro Cárdenas nationalized the hydrocarbon industry," he said in his speech.

"The time has come to drive Pemex, if Pemex is to drive Mexico"

President Enrique Peña Nieto

As stated in the 2013-2027 Energy Strategy, approved by the Senate in March 2013, Mexico will become a net energy importer by 2020 unless Pemex increases its production significantly. Despite the three-fold increase in E&P investment that the NOC made between 2000 and 2012, Pemex's crude oil production (2.548 billion b/d) is still 26% below the maximum production attained in December 2003 (3.455 billion b/d). Approximately 80% of the oil assets that are currently being exploited by the NOC have reached an advanced production stage: 90% of the company's oil production in 2012 came from fields that were discovered at least 20 years ago. Pemex is well aware that the phase of easy oil production in Mexico has come to an end. Pemex's most promising projects for the future are far more complex than Cantarell or Ku-Maloob-Zaap ever were, and none of them will deliver output at the scale that these giant oilfields did in their prime. Nevertheless, Pemex hopes to make 2013 a turning point, putting the company in a position from which production growth will be both possible and feasible in coming years. The NOC is aiming to expand the life of its mature assets by increasing their recovery rate, while at the same time continuing an aggressive exploration and development strategy to further diversify its production portfolio and maximize yields in complex assets with the help of new technical advancements.

Despite the challenges presented by the growing complexity of its assets, Pemex is planning to mark 2013 as the first year of production growth since 2004, while at the same time accomplishing the feat of maintaining its reserve replacement rate of 100% for the third consecutive year. Pemex CEO, Emilio Lozoya Austin, affirmed in March that Pemex reached a 104.3% 1P reserves replacement rate in to 2012, and that 3P reserves held by the company equal 32.9 years of production at current rates. "Production is now stable and we estimate that, by 2018, crude oil production will have grown 15% to reach 3 million b/d," Lozoya Austin asserted.

In response to decreasing oil demand in the US, Pemex is also betting on the Asian markets as an export destination. During an official visit to China and Japan, President Enrique Peña Nieto was accompanied by Lozoya Austin, who signed commercial agreements with various public and private companies in the sector. As part of these contracts, Pemex committed to increase its oil exports to Chinese company Sinopec to 30,000 b/d. The sales margin that Pemex will receive from these exports is high in comparison to those resulting from crude oil exports to other regions. In addition to this sales contract, Pemex signed a series of cooperation agreements and service contracts with Japanese and Chinese firms involved in the oil sector. Pemex is also planning to open an office in Hong Kong in order to further pursue its expansion strategy in Asia. Considering that, as a result of the decline of Cantarell and a decreasing petroleum demand in the US, Mexico's exports to the US have fallen 39% since 2004, finding export partners in other countries is a necessity for Pemex. The high yields for crude oil, as well as the technical and commercial advantages of partnering with Chinese companies in E&P projects, signal a possible path of growth for Pemex over the coming years.

Further changes that Lozoya Austin expects to achieve during his period as head of Pemex are the restructuring of the company, centralizing administrative processes and aligning priorities within Pemex in order to eliminate the inefficiencies caused by its current subsidiary-based structure; reducing the high cost of the sector's pension system, which has not been changed in decades and still grants retirement at the age of 55 with the right to receive a pension of 100% of salary; and finally, making the sector's subsidies structure more transparent, in order to reduce government spending on gasoline subsidies. All of these measures would support the transformation of Pemex into a more efficient, productive company.

POTENTIAL FOR ENERGY REFORM

In 2008, after a year of intense debate, political wagers, and an intense campaign both in Congress and in the media, an energy reform was passed in Mexico. The changes were published in seven decrees which modified or created 10 different laws. At the time, President Felipe Calderón Hinojosa stated: "I can say, without exaggerating, that this has been the most favorable change in Mexico's hydrocarbons sector since 1938."

However, four years down the road, Pemex's production has continued to fall while bureaucratic processes within the NOC have grown. While crude oil production has fallen 9.6% since 2008, the number of corporate personnel at Pemex has risen 21%, resulting in a 15% increase in the company's operating costs. Certainly, the reform did bring about positive changes, such as permitting Pemex to sign incentive-based service contracts with private companies, which are expected to start raising production and improve recovery rates at some of Pemex's mature and abandoned assets this year. They have also boosted Pemex's technical and development capacity, enabling the NOC to embark on complex development projects such as Lakach and improve its performance in challenging fields like Chicontepec.

Now, President Enrique Peña Nieto is calling for a new reform of the energy sector. During his presidential campaign, he emphasized his intention to modernize Pemex. As President, one of his first actions was the signing of the Pact for Mexico, in which he along with Mexico's four main political parties committed to push for a reform that will substantially benefit the country's hydrocarbon sector. In one of the seven commitments related to the oil and gas industry, the Pact for Mexico states that laws and regulations in both the energy and fiscal sectors will be modified in order to transform Pemex into a public company with business-like objectives.

So far, nothing specific has been said about the energy reform. The Pact for Mexico's Governing Council - composed of representatives of all the signatory parties, technical experts and Peña Nieto - has announced that it is working on a reform project that will be presented to Congress during the second half of 2013. However, making Pemex a public for-profit company would entail a significant reform to Mexico's fiscal system, which largely depends on taxes collected from the NOC. As a result, modifications to tax laws and regulations are being discussed in parallel to the energy reform. This complex situation and the political risk involved are expected to complicate the reform process.

The current administration has already tackled some of the obstacles that have served to block reform in the past, including issues regarding the discussion and ratification process of the 2008 Energy Reform. While in 2008 there was significant and visible opposition to allowing private companies to become operators of Mexican oil fields, at the moment there are no relevant political actors or interest groups pitted against a new reform of the energy sector. The notion that an energy reform requires the modification of Constitutional Article 27, which states that hydrocarbons are the property of the Mexican people, has dissipated. In fact, the first of the Pact's seven commitments concerning oil and gas specifically states that "the property and control over Pemex and the nation's hydrocarbons will remain in the hands of the nation."

One of the main challenges that the current administration will face is the adverse reaction and general unrest that the imposition of new tax duties under an accompanying fiscal reform would generate. Pemex currently contributes 34.5% of the federal government's income, and meangingful energy reform is likely to include a reduction of its tax burden. The PRI recently modified its internal rules, lifting the ban that blocked the party's members from discussing the addition of a value added tax (VAT) to food and medicines, which is still a taboo in many circles in Mexico. This change might indicate that, among other measures that might affect a wide array of interest groups, the PRI might propose to charge the general population with this unpopular consumer tax in an effort to diversify its tax collection away from Pemex.

The President, his party and the Pact for Mexico's Governing Council must quickly and carefully design an energy reform before the current political consensus evaporates. The pact has already faced a notable crisis, and is expected to face further strain as a result of the local elections that will take place in 14 of Mexico's states in July 2013. Nevertheless, the potential for the approval of a comprehensive and effective energy reform has never looked better than in 2013.

FROM THE ANNUAL REPORT OF PEMEX FILED WITH THE US SECURITIES AND EXCHANGE COMMISSION:

Pemex has the status of decentralized public entity of the Mexican Government, which means that the Mexican Government would have the power, if the Mexican Constitution and federal law were amended, to reorganize Pemex, including a transfer of all or a portion of Pemex and the subsidiary entities or their assets to an entity not controlled by the Mexican Government. Such a reorganization or transfer could adversely affect production, cause a disruption in our workforce and our operations and cause us to default on certain obligations.

SHELL ON ENERGY REFORM

Shell works around the world in extremely different environments and with different contractual conditions. In general we always look for business, intending to create a win-win situation for the country where we operate and for our company. If the Mexican government decides to move forward with any type of energy reform, the key is that the contractual terms are competitive vis á vis the world, and that the fiscal system balances risk and reward. The current fiscal system does not recognize this balance, thus making it hard to undertake high-risk projects. If the country adopts a broader energy reform in 2013 that establishes mechanisms for the potential participation of private investment and by strengthening the state operator, it could achieve industry consolidation and guarantee energy security for future generations. From the private investors' point of view, our investment capital is finite and many projects within our portfolio are competing for the same funding. Therefore, natural competition occurs within our evaluation of investment projects in which factors ranging from primary and secondary legislation, contracting schemes, return on investment, and long-term positions, to the ease of doing business in a country, political, social and economic stability, and the geopolitical situation are considered. We have seen in other opening markets that the proper scaffolding within the secondary tier the legal framework supports investments in the long term and attracts a larger amount of domestic and foreign private investment, thus increasing the size of a country's economy. We are confident that our experience and our relationship with Mexico, developed through a local presence for almost 60 years, will continue to result in future business opportunities. We will closely follow the reform plans, always bearing in mind the possibility of increasing our presence in the Mexican market if the energy reform is approved.

2013 FEDERAL & PEMEX BUDGETS

On December 7, 2012, the President of Mexico submitted the proposed Ley de Ingresos de la Federación para el Ejercicio Fiscal de 2013 (2013 Federal Revenue Law) and the proposed Presupuesto de Egresos de la Federación para el Ejercicio Fiscal de 2013 (2013 Federal Expenditure Budget) to Congress for approval. The law and the budget were approved on December 13, 2012 and December 20, 2012, respectively, and were published in the Official Gazette of the Federation on December 17, 2012 and December 27, 2012, respectively.

The 2013 Federal Budget does not provide for a public sector budget deficit (excluding physical investments by PEMEX), and is based on an estimated weighted average Mexican crude oil export price of US$86.0 per barrel, which together with an estimated volume of oil exports of 1,183.5 thousand b/d, would result in approximately US$99 billion (MX$1,243.0 billion) of projected oil revenue for 2013. It expects total federal revenue to reach US$288 billion (MX$3,601.1 billion), a 5.1% increase in real terms compared to the federal revenues estimated for 2012 by the Federal Revenue Law. This allows the Mexican government to increase expenditures for social development by 3.6% and economic development by 3.0%, each as compared to the amounts budgeted for 2012.

2013 EXPLORATION AND PRODUCTION CAPITAL EXPENDITURES BUDGET

For 2013, Pemex Exploration and Production has a total capital expenditures budget of US$15.59 billion (MX$194.80 billion), which represents an 0.5% increase over the previous year's budget of US$15.50 billion (MX$193.86 billion). The 2013 budget includes all of the 27 ongoing strategic exploration and production projects and US$2.46 billion (MX$30.81 billion) for other exploratory projects. Approximately US$12.91 billion (MX$ 161.36 billion), or 82.8% of Pemex's 2013 capital expenditures budget, is to be allocated to projects relating to field development , production and transportation infrastructure such as pipelines, and around US$2.68 billion (MX$33.50 billion), or 17.2% of the total budget, will be allocated to exploration activities.

The 2013 exploration and production budget includes US$2.02 billion (MX$25.36 billion) for investments in the Ku-Maloob-Zaap project, US$1.87 billion (MX$23.42 billion) for the Cantarell project, US$1.27 billion (MX$15.93 billion) for the Tsimin-Xux project, US$974 million (MX$ 12.18 billion) for the Chicontepec project, US$826 million (MX$10.32 billion) for the Chuc project, US$ 772 million (MX$9.65 billion) for the Crudo Ligero Marino project, US$755 (MX$9.43 billion) for the Burgos project, US$728 (MX$9.10 billion) for the Antonio J. Bermúdez project, US$425 million (MX$5.31 billion) for the Delta del Grijalva project, US$ 395 million (MX$4.94 billion) for the Yaché project, US$375 (MX$4.68 billion) for the Ek-Balam project, and US$5.16 billion (MX$64.51 billion) for the remaining projects as well as administrative and technical support.

STRUCTURED FOR PROGRESS

September 2011 marked a new starting point for Pemex Exploration & Production, with the reorganization of its internal structure to better approach the challenges that Mexican oil projects posed. Two new entities dedicated to exploration and field development were created to work alongside the production division. This transformation also meant partially shifting from an asset-based regional structure to managing projects based on their stage of development: exploration, development, and production. With the exploration division on track after the investment injection in recent years, and the production division planning to move its target from production stabilization to production growth, the field development will play a central role in transforming the discoveries of the exploration division into producing assets for the production division. "The role of the development division has become completely crucial: it has the key objective of reducing the time between discovery and first production," Morales Gil states. "If we do not achieve that, then Pemex E&P will have failed, and it will be evident two years from now." Under the diversification strategy implemented since 2006, Pemex E&P will continue focusing its efforts on finding additional hydrocarbon resources to boost total production and reserves figures, with the clear objectives of maintaining a healthy reserve replacement rate and stable production that could start to increase marginally in 2013. "The key is to make the necessary investment to maintain a reserve replacement rate above 100%; this should be our first priority," says Carlos Rafael Murrieta Cummings, Pemex's Chief Operations Officer. "The fact that today we have 3P reserves that represent 32.9 years of potential production gives a lot of certainty to Pemex's operations. From that point on, having 10.2 certified years of production fits our strategy and complies with international best practices."

E&P INVESTMENT TRENDS

In 2012, Pemex invested US$2.65 billion (MX$33.16 billion), or 17.1% of the total capital expenditures of Pemex Exploration and Production, in exploration activities, representing a 6.5% increase over the US$2.49 billion (MX$31.16 billion) invested in exploration activities in 2011. In 2012, the company invested US$ 12.85 billion (MX$160.64 billion), or 82.9% of the total capital expenditures for Pemex Exploration and Production, in development activities, which corresponds with a 10.1% increase over the US$11.67 (MX$145.93 billion) invested in development activities the previous year.

The US$2.68 billion (MX$33.50 billion) budgeted for total capital expenditures for exploration activities in 2013 represents a 1.0% increase over the amount invested in exploration activities in 2012. For development activities, Pemex has budgeted US$ 12.85 billion (MX$160.64 billion), which translates into 0.5% increase over the amount that Pemex Exploration and Production invested in development activities in 2012.

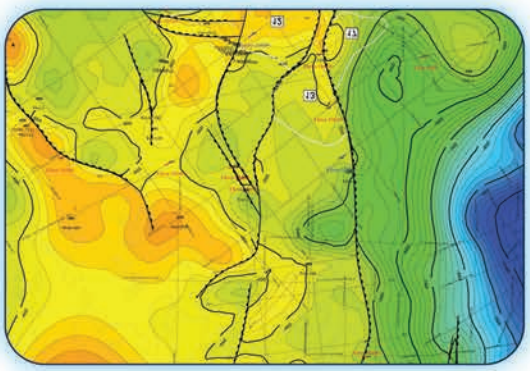
In 2014, Pemex expect to invest US$3.77 billion (MX$47.09 billion), or 22.5% of total capital expenditures of Pemex Exploration and Production, in exploration activities. This planned 40.6% increase in exploration investment between 2013 and 2014 is a clear indication of the growing priority given to this activity.

In 2015, exploration investment is scheduled to increase to US$4.32 billion (MX$54.04 billion), which means that exploration activities will represent 29.3% of the total capital expenditures of Pemex Exploration and Production in two years. This corresponds with a 14.8% increase over the amount projected for 2014.

In 2016, Pemex expects to invest US$4.65 billion (MX$58.12 billion), or 35.1% of total capital expenditures of Pemex-Exploration and Production, in exploration activities. This represents a 7.5% increase over the amount projected for 2015 and, more importantly, confirms that investment in Pemex's exploration program is set to increase by no less than 75.3% between 2012 and 2016.

The capital expenditures of Pemex Exploration and Production have constituted more than 84% of the company's total capital expenditures in each of the last five years. In 2013, Pemex Exploration and Production's budgeted capital expenditures constitute 73.6% of that total.

Source: Annual Report of Pemex filed with the UStates Securities and Exchange Commission. Exchange rate conversions have been made at MX$12.5 = US$ 1.



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FUTURE AMBITIONS FOR PEMEX

EMILIO LOZOYA AUSTIN
CEO of Pemex

Q: What are your priorities for 2013?

A: Our priority is to increase investment in the exploration and production of hydrocarbons. This year we will be allocating around US$18 billion to exploration and production, which will allow us to increase oil production for the first time since 2004.

Q: Mexico has a significant trade deficit in refined products; what are the most feasible solutions to increase Pemex's refining capacity, either in Mexico or through international refining investments?

A: We have designed a series of very important projects for Pemex Refining, and we will be investing around US$20 billion over a number of years to increase the production of refined products, while making both the refining process and refined products more environmentally friendly. One of these projects is the construction of the new refinery in Tula, Hidalgo, which together with the existing refineries will comprise the largest refining complex in the world.

Q: What are Pemex's ambitions to internationalize its upstream activities and gain experience, expertise and access to new technology through E&P operations outside of Mexico?

A: For Pemex it is essential to incorporate new technologies and develop its human capital. To achieve this, we must strengthen our cooperation agreements with universities and research institutes in the United States and Europe, in addition to the technological cooperation agreements we already have in place with international oil companies. These types of agreements allow us to advance the acquisition of technology and knowledge to better align our ways of working with international best practices. In the past Pemex has participated in exploration and production projects abroad, and I think that we should not discard the possibility of Pemex, once again, starting to work outside of Mexico.

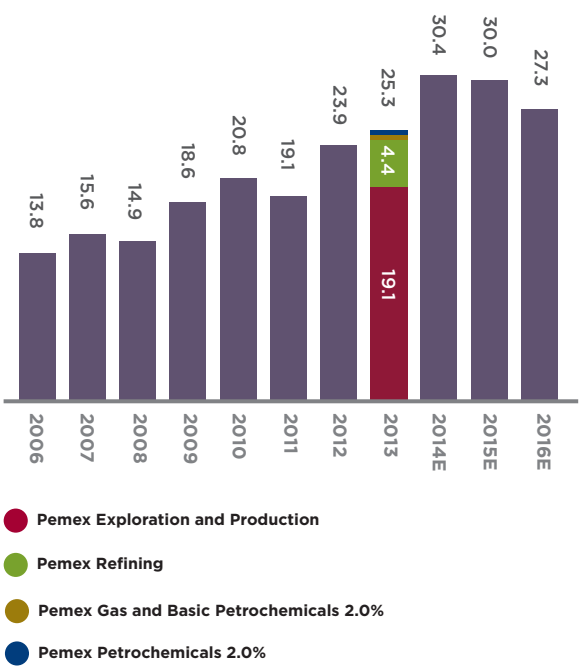
Q: What would be the main elements of an optimal energy reform from the Pemex perspective?

A: We need a more adequate regulatory framework, and a legal framework that allows a larger participation of private investment, as well as a new fiscal regime that allows Pemex to pay a more appropriate tax rate that leaves the company with the necessary financial resources to invest, operate in a flexible manner, and develop more sustainable projects. The legal framework must give Pemex the budgetary and management autonomy that allows the company to make the right investment decision at the right moment, and allows us to enter into partnerships with companies that we find most convenient, without risking Mexico's ownership over its hydrocarbons.

Q: In order to claim success at the end of your period as Pemex's CEO, which indicators concerning the company's performance should be prioritized and why?

A: President Enrique Peña Nieto's administration is committed to a series of reforms of which the energy reform is one of the most important components. This reform is focused on transforming Pemex into a company that maximizes the value of the country's hydrocarbon resources for the benefit of all Mexicans, and be an engine of Mexico's economic growth. If we achieve this goal, we will have fulfilled our mission.

INVESTMENT BUDGET (US$ BILLION)



Source: Pemex

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