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CNH

National
Hydrocarbons
Commission

Federal
Government

SENER

GULF TERTIARY OIL PROJECT

FIRST REVIEW AND RECOMMENDATIONS

April 2010

A. BACKGROUND

The “Chicontepec Paleochannel” was identified in 1926 and in 1931 the first field was discovered. In 1952 hydrocarbon exploitation began in the President Alemán area. Towards the seventies, activities intensified in the Soledad Norte and Soledad fields. The records obtained from the exploitation results lead Pemex-PEP to hire an international certifying company in 1978 to periodically evaluate the Original Volumes of gas and oil in the Chicontepec Paleochannel, and to corroborate its reserves. Since then, several companies have evaluated these volumes, all of them agreeing on the large amount of hydrocarbons located in this area.

Field	Original Volume		Accumulated Production	
	Crude (mmb)	Gas (mmmpc)	Crude (mmb)	Gas (mmmpc)
ATG Project	136,784	54,222		
Akal	30,556	14,725	12,187	5,442
Ku	4,474	2,295	1,999	1,062
Abkatun	5,446	3,885	2,210	1,809
Samaria	5,096	4,114	1,553	1,925
Maloob	6,912	2,416	336	
Jujo-Tecominoacan	3,796	4,290	1,102	1,222
Poza Rica	4,810	4,879	1,405	1,902
Zaap	4,678	1,814	274	
Chuc	2,160	2,099	843	944
Pol	2,253	2,445	936	875
Caan	1,564	2,493	834	1,511
Iride	1,909	2,252	465	691
Cunduacán	2,802	3,397	558	807
Nohoch	2,054	941	611	272
Panuco	3,649	10,614	367	1,065
Cacalilao	3,216	9,746	337	975
Cactus	2,069	4,604	327	628

1\ Hydrocarbon reserves as of January 1, 2009.
Source: Pemex

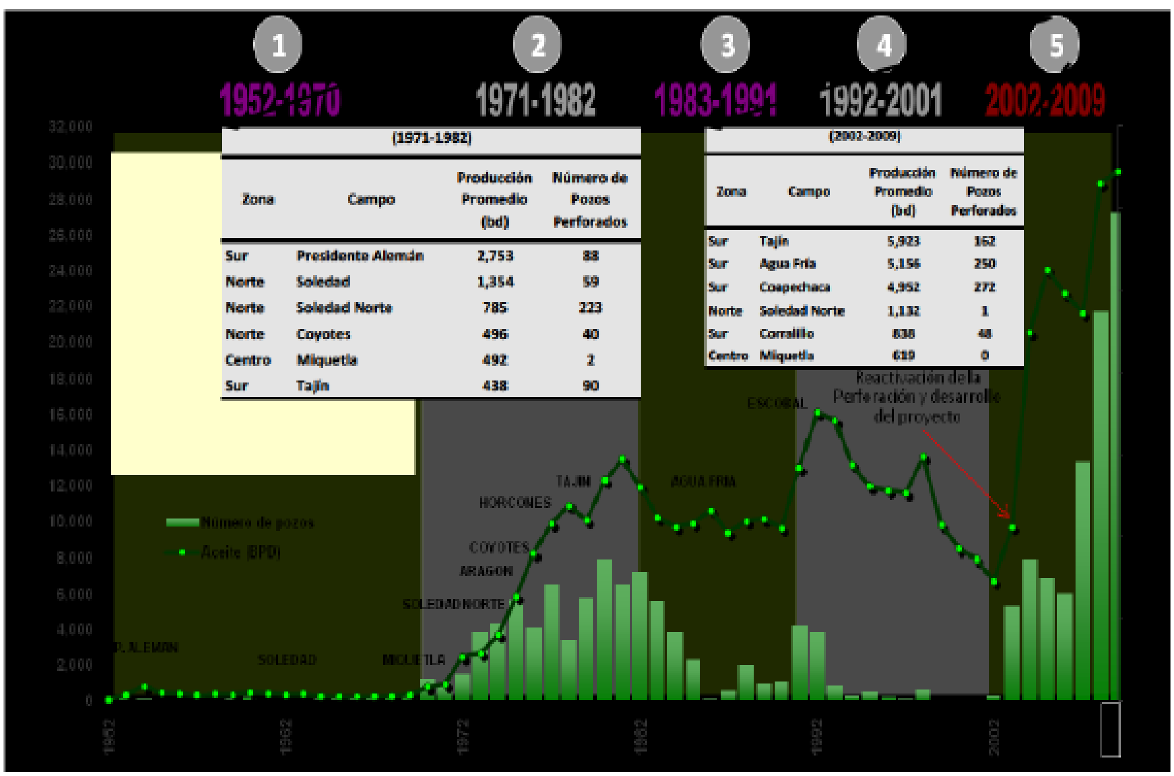
Chicontepec has been known since 1978 to consist of a large continuous geological hydrocarbon resource that constitutes one of the largest accumulations in the Americas. However, given its complex geological characteristics, its profitable exploitation can be difficult and costly compared to the large reservoirs in the southeast of the country. Chicontepec reservoirs are low permeability, generally compartmentalized, with high clay content. In addition, at the beginning of oil extraction, important volumes of dissolved gas are released, which constrict the passage of oil to the wells.

The Chicontepec exploitation project was always postponed, not only because of the low productivity of its wells and the complex internal structure of its reservoirs, but also because of the technical and economic challenges it represented to extract hydrocarbons, despite its ample resource potential. Pemex-PEP's priority was focused on the development of the large and prolific oil fields in the Southeast Basin, some of them discovered more than half a century ago, and subsequent to the exploitation of Cantarell and Ku-Maloob-Zaap.

Based on recommendations generated through various internal studies at Pemex-PEP, during the 1980s Pemex drilled 79 exploratory wells, of which 61 were productive. During that decade, the Agua Fría and Tajín fields were partially developed; and in 1990, the Escobal field. In the nineties, studies were carried out in fields already discovered, such as Coapechaca, Corralillo and Coyula.

Figure 1

History of crude oil production in Chicontepec

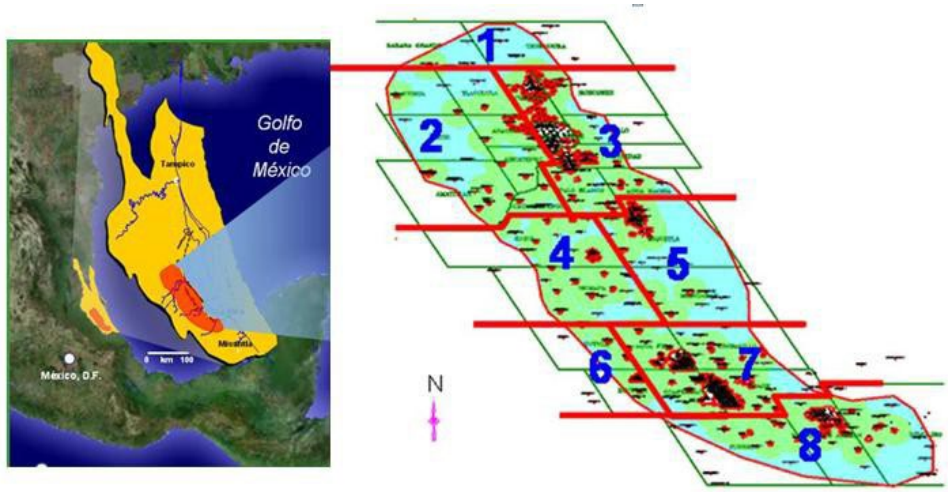


B. CNH´S INTEREST IN THE ATG PROJECT

Since 2006, the official name that Pemex-PEP has given to the exploration and exploitation of hydrocarbons in Chicontepec is the "*Aceite Terciario del Golfo*" (ATG) project. This project, one of the largest investment projects in the country's oil history, is intended to develop an integral exploitation strategy for the region, ambitious in terms of massive well drilling, in order to reach high levels of oil production in an accelerated manner.

For this purpose, the geographical area in which the Paleochannel is located, which at that time included 29 producing fields and hundreds of reservoirs, was administratively subdivided into eight sectors; Of these, only sectors 3 (Coyotes, Horcones, Soledad Norte, Gallo, Soledad, Palo Blanco and Agua Nacida fields) and 7 (Agua Fría, Corralillo, Coapechaca and Tajín fields) were under development and only in Agua Fría were initial studies made for the implementation of a project for the maintenance of reservoir pressure. The rest of the sectors were at a stage where reservoir characterization was required.

Figure 2 - Geographic subdivision of the ATG



The way Pemex-PEP has presented its physical activity plan for the ATG envisions reaching a natural depletion hydrocarbon recovery factor of only 2%. Increasing that recovery factor would require a capital-intensive and execution-intensive project, testing the abilities of any oil company in the world to do it on its own.

The ATG project was approved in 2006 based on a cost-benefit study. Since that year, Pemex-PEP has presented adjustments to the investment projections and production in 2008 and 2009. The last modification was presented in the 2010 economic package.

e. Supply, cost control and economies of scale

Three critical aspects that significantly affect the economic performance of a project with high unit costs, as is the case in the ATG, are:

1° Cost control.

2° Economies of scale.

3° Delivery of goods and services in time and quality.

Regarding the former, hydrocarbon exploitation in the ATG project is intensive in capital costs and operating costs per unit of product, so profitability in many of the low productivity wells can be marginal or negative. Therefore, this type of project requires strict control over costs.

Likewise, the best way to reduce unit costs is through project planning at the level of economies of scale. In a project such as the ATG, which requires thousands of wells and hundreds of installations, it is more feasible to reach agreements with suppliers and obtain price reductions, through:

- Promote competition among suppliers to obtain better prices and conditions.

- Form alliances with selected suppliers.

- Negotiate long-term contracts.

The third aspect, related to project logistics, has to do with the delivery of goods and services in time and quality, which is critical in a project such as the ATG. Given the complexity of the logistics of drilling hundreds of wells annually, having drilling equipment not operating has an additional cost that is unacceptable for this type of project. This makes it necessary to develop processes and systems that make the operation as efficient as possible.

E. CNH PROPOSALS FOR REORIENTING THE ATG PROJECT

The following is a summary of the main proposals for correcting the shortcomings in the ATG project and reorienting its organization, technology and investments to obtain efficient and profitable results.

I. IDEAL TIME TO CORRECT

The ATG Project is the largest investment project of the entire Federal Public Administration, and therefore has large financial resources for its implementation. However, its results have not been able to justify the significant amounts already invested, which indicates that it is the right time to redefine the scope of the project and its implementation.

It is worth mentioning that beyond the contracting of service companies, within the ATG project organization, the advice of independent experts with sufficient experience in this type of reservoir is required. This is relevant since the ATG project is at a critical stage:

- The strong physical and budgetary increases of the last three years have shown that PEP's execution capabilities are at their limit due to the complexity of the project.

- The analyses carried out within the ATG project have not resulted in the implementation of definitive corrective actions from the technical and operational point of view.

- A procedure should be established to ensure the administrative continuity of the project when there are major changes in management personnel.

- Very recently, the plan to establish Field Laboratories focused on accelerating technological development was presented; however, the results expected from these laboratories have also been subordinated to the fulfillment of production quotas.

II. IMPORTANCE OF CONTINUING WITH THE ATG PROJECT

High priority must be given to the development of the resources and reserves found in the ATG. The review of the exploitation project and the use of the best available techniques as well as the adoption of the best operating practices of the international oil industry significantly increase the probabilities that the ATG project will have competitive medium and long term profitability, and that it will become one of the main hydrocarbon producing fields in the country.

Therefore, the CNH's interest in the ATG project is that Pemex has the elements to exploit it efficiently and obtain returns from it for the benefit of the Nation. For this reason, the ATG project is also a challenge to the technological and organizational evolution of Pemex-PEP.

III. ORGANIZATION AND ADMINISTRATION OF PROJECT

As has been observed, despite the significant investments recently applied to the ATG project, in the order of $50 billion pesos over the last three years, the project continues to show low recovery rates.

The preceding sections have identified several causes that individually and as a whole explain the main reasons for the productive stagnation of the ATG project. In the diagnosis-recommendations binomial, the imperative to improve the geological knowledge of the total ATG area, as well as its fields and reservoirs; the need to consolidate the learning stage; the importance of developing at a higher level the strategies for the selection of drilling technologies, fracturing, enhanced recovery, design of surface facilities and installation of meters.

It will be necessary to consider new pilot tests, the drilling of non-conventional wells with more precise steering, the implementation of alternative fracturing methods and the injection of fluids, gases and polymers to stimulate production; It will also be necessary to size surface facilities to actual gauges and to promote the construction of collection systems that will definitively help to minimize the flaring and venting of gas that is currently carried out, as well as to reduce to a minimum the use of pipes and tanks to transport all types of liquids related to the exploitation of the fields.

The ATG project has increased its investments and multiplied its facilities at a faster rate than its organizational development. Its size exceeds its capacity to efficiently manage this project. Organizational and activity management problems can be observed, which hinders the decision-making process to facilitate the achievement of long-term objectives.

The risk of continuing with these management problems is that costs will increase, detracting from the economic value of the project. There is also the risk of damaging the deposits, or of causing social incidents in the surrounding communities due to the accelerated and intensive expansion of the facilities in a disorganized manner, or of leaving an irreversible environmental footprint.

The ATG project must review its managerial, organizational and administrative foundations, focusing on value generation and exercising discipline in costs, processes and coordination of activities to achieve profitability objectives. Coordination and communication between specialists and work groups, which today seem to be fragmented, should be reviewed, making each organizational unit or contractor concentrate exclusively on ensuring the fulfillment of their own assignments without taking into account the final results of the project.

Generating a new organizational cohesion, creating synergies and coupled objectives will require going back to the basic approaches of the project, from its geological conception, the assembly of technologies and equipment adequate to the challenges and the establishment of criteria to be met before multiplying investments in new wells and facilities.

Bringing the ATG project back onto a path of competitive profitability will require the re-evaluation of some decisions and practices that are already being replicated. The project cannot be abandoned at this point. The challenge is to consolidate the lessons learned as inputs for a new development strategy.

Under participative and situational leadership, it is possible to generate synergies, commitments, shared values and cooperation, which translates into performance and performance far superior to that of a functional organization, as can be seen in Figure 16.

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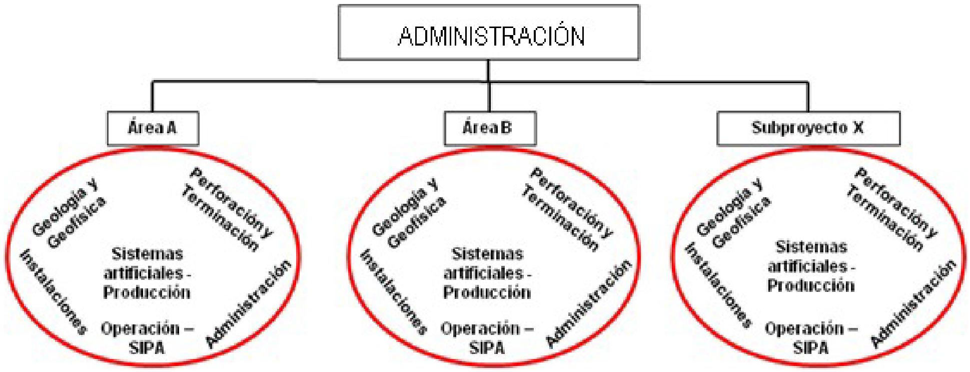
Figure 16 - Organization of multidisciplinary projects



IV. NEW PARADIGMS IN THE OIL INDUSTRY

A reflection that emanated from the CNH during the review of the ATG project is the convenience of "thinking new", of learning from similar experiences in other countries.

a. Definition of concept

The resources and reserves found in the Chicontepec paleocanyon could be classified as conventional from the point of view of their geology and exploitation. However, as we have seen throughout this document, this paradigm could also be questioned if its conceptual framework limits the conception of efficient solutions for its development. In this regard, it is relevant to mention that in Canada and the United States there are practical alternatives for the development of hydrocarbon regions with similar characteristics to those of the ATG that are proving to be successful. Therefore, the introduction of new development concepts should not only respond to academic questions but also to real planning alternatives already proven in other countries.

It is possible that some sections or fields of the paleochannel may contain large quantities of gas and oil that could be exploited with methodologies, economics and organizations not unlike those used for the exploitation of conventional reserves in other petroleum provinces. However, as we have seen, it is very likely that the vast resource potential that accumulates in the ATG can only be extracted profitably and over many decades if another conception of how to develop this type of resource is adopted.

It is worth contrasting what is understood by non-conventional resources and "*resource play*" to open perspectives on how to characterize Chicontepec.

- ***Non-Conventional.*** These are "continuous" accumulations over large areas, which are largely uncontrolled by hydrodynamic conditions and typically require the application of specialized extraction technologies, as in the case of gas or oil in very low permeability sandstones, siltstones or shales, which require special drilling technologies, hydraulic fracturing and artificial systems to produce.

  For these accumulations that are largely uninfluenced by hydrodynamic conditions, it is not possible to use water-gas or water-oil contacts or pressure gradient analysis to determine volumes of oil or gas to be recovered. The *Bakken* shale in the Williston basin is an example of an oil *resource play*. The *Spraberry play* in the Midland sub-basin of the Permian Basin of West Texas is the most successful case of oil reservoir development in very low permeability turbiditic rocks.

- ***Resource Play Concept.*** This concept was developed during the last decade to describe hydrocarbon accumulations that were known to have very large areal distributions, and low geological and/or commercial development risk. For these cases a new type of exploration and development process was considered, based on statistically repeatable results.

  The concept of "*resource play*" has been compared to manufacturing and agricultural processes to describe the repetitive nature of an exploration and development process. In general, the term *resource play* refers to the continuous nature of hydrocarbon accumulations over a large area and is not related to the type of accumulation.

The characteristics that allow a development project to be defined as a *resource play* are:

1. Statistical repeatability of the distribution of expected final recoveries per well.
2. It has a large regional geological extension.
3. Performance in nearby wells does not necessarily provide a prognosis of the performance of undeveloped locations.
4. Gas or oil is not always trapped by water, so it usually produces little water
5. They have low permeability and therefore tend to require extensive stimulation and artificial systems to produce at economic rates.

In these *plays,* "type curves" are not useful to make projections of future production. There are "families" of good and bad wells. The important thing is to establish if the good wells are enough to make the project profitable. This is achieved by establishing the uncertainty in the amount of oil that will be recovered by the well in the total life of the project.

Project uncertainty is primarily linked to the volumes to be produced. In these *plays* more than 50% of the uncertainty in the NPV depends on the production, the rest is distributed almost equally between the uncertainty of the subsurface and the value of the cost of capital.

- Production forecasts cannot be made based on individual wells, so they are based on the behavior of several wells, by areas or sectors.

- With a representative sample per area (10 to 15 wells), the probability of having a certain EUR (Estimated Ultimate Recovery) for that particular area is plotted.

- The information by area or sector can be combined with that of other areas to obtain a forecast of the potential of the entire project.

Projects based on the development of a resource should contain two phases:

- **Learning"** phase, where the critical aspects that control profitability, such as the technologies to be used, are defined. In this phase the works are prioritized and the probabilities of success are established. To accomplish this learning phase, one or more pilot studies must be carried out to reduce uncertainty and gain confidence before entering the next phase.

- **Manufacturing"** phase, which is a massive implementation where efficiency is based on cost control, economies of scale and logistics.

Wells must be drilled taking into account the geology. International practice is for the first well packages to be located where the rocks with the best permeability and porosity, known as "*sweet spots*", are found, which ensures that the first production pays for the facilities and generates revenues that allow the less productive areas to continue.

Administratively, four aspects profoundly affect the performance of a project in a *resource play*:

1. The marginal profitability of a *resource play* requires strict control over expense

2. The best way to reduce costs is to develop economies of scale. In conventional fields where developments are with a limited number of wells, limited inputs are required, so achieving economies of scale is difficult. However, when thousands of wells and facilities are required, it is easier to reach agreements with suppliers and obtain price reductions.

3. The delivery of goods and services in time and quality is also critical.

4. Given how complex the logistics of drilling hundreds of wells per year become, having idle rigs has an additional cost that, for this type of project, is critical. Best practice is to develop processes and systems that make the operation as efficient as possible.

Applying *resource play* concepts allows developing unconventional reservoirs in a very profitable way. They are particularly important:

1. Conduct a learning phase to determine the critical elements of technology and management before entering a "manufacturing" phase.

2. The project must be managed by high performance integrated multidisciplinary teams, with executive capacity to make technical and administrative decisions.

3. A well-defined geological model is needed to identify the best areas for development and start with them.

4. Project management must be done with special emphasis on rigorous cost control, development of economies of scale, timely and quality delivery of goods and services, and impeccable logistics.

b. Can the ATG project be characterized as "resource play"?

It has already been mentioned that, according to the literature, the characteristics that must be met to define a *resource play* are:

1. Statistical repeatability of the distribution of expected final recoveries per well.

2. It has a large regional geological extension.

3. Performance in nearby wells does not necessarily provide a prognosis of the performance of undeveloped locations.

4. Gas or oil is not always trapped by water, so it usually produces little water.

5. They have low permeability and therefore tend to require extensive stimulation and artificial systems to produce at economic rates.

In this section a first test is made to evaluate the first condition: the statistical repeatability of the expected ultimate recoveries per well (defined as EUR: *Estimated Ultimate Recovery*).

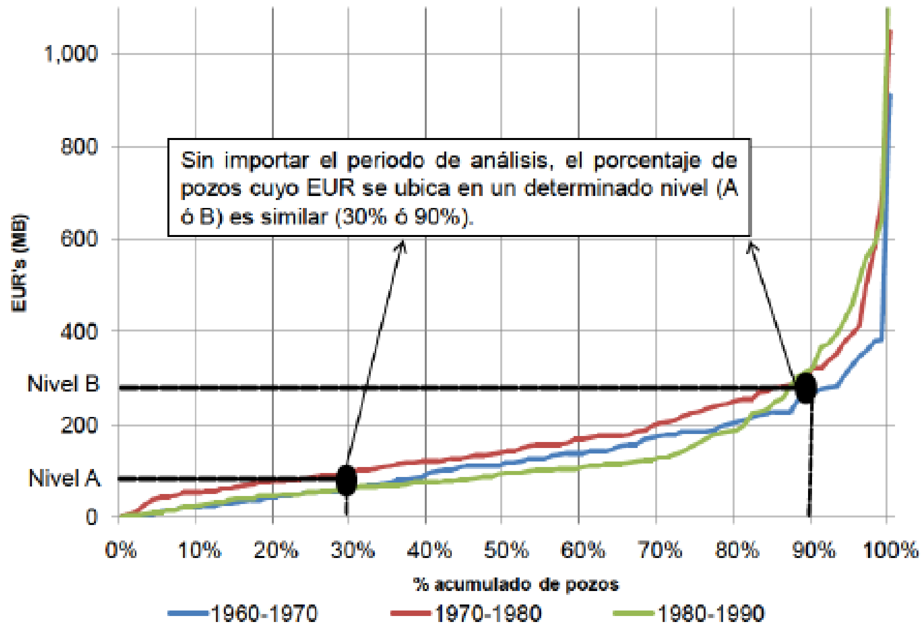
Statistical repeatability means that the probability function of the EURs remains constant over time. That is, for sufficiently large samples, it should be observed that the distribution of EUR's remains constant for different time periods; that is, the percentage of wells whose EUR is below or above a certain level should be very similar in different periods.

To carry out this exercise, the expected recovery of a well (EUR) was defined as its cumulative production over a period of twenty years, which is the expected useful life of a well. Consequently, the performance of wells drilled between 1960 and 1990 was evaluated.

The sample was divided into three periods of equal length: 1960-1970, 1970-1980 and 1980-1990. For each period there was a sample of more than 100 wells, resulting in statistically significant samples.

With the information from each well, and for each time interval, we proceeded to construct the distribution of the EUR's in order to evaluate the possible statistical repeatability. The results are shown below:

Figure 17 – Distribution of accumulative production by well



As can be seen, the distribution of total oil recovery (EUR) has not undergone significant changes over the years. The results obtained suggest the existence of statistical repeatability.

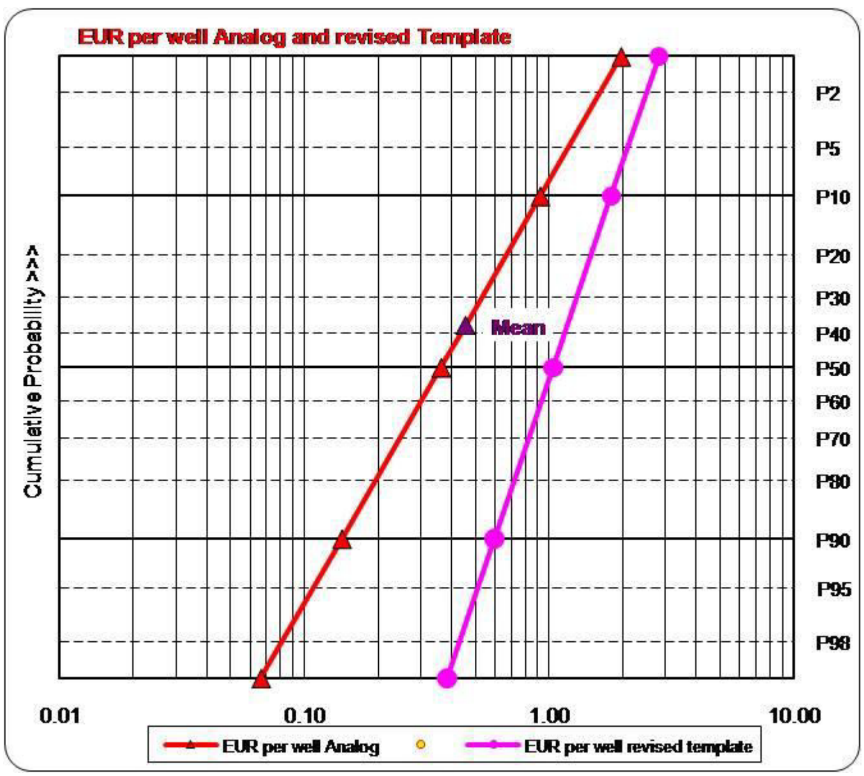
According to the techniques of a *resource play,* the ATG project can be evaluated and its future performance modeled from the production behavior of several wells, by areas or sectors. The international practice is to obtain a representative sample of well results per area (minimum 10 to 15 wells) and based on these, make an uncertainty range distribution graph that allows forecasting the probabilities of obtaining a certain EUR for that particular area.

Figure 18 shows this type of graph where the abscissa axis represents the EUR and the ordinate axis represents the cumulative probabilities of occurrence of the EURs. The line marked with triangles would represent the range of EUR's obtained as a distribution based on real historical data, which when improved with new technologies would result in the data seen in the line marked with circles. Note the difference in the minimum value for uncertainty between the two cases.

Once the information by area or sector is obtained, it can be combined with that of other areas to obtain a forecast of the potential of the entire project.

Once information is obtained from real wells made based on the new technology, a review of the uncertainty forecast must be made and a re-evaluation of the performance must be made, which allows, if the project shows good results, to mobilize resources to expedite it and if not, to relocate them to where they will have a better impact.

Figure 18 – Accumulative probability versus expected recovery



The best analog for this project is the development of the *Spraberry* reservoirs in the *Midland* basin, where the main operating company has been successful because it has identified the most appropriate technologies, has tight cost control, economies of scale for inputs, and works with a multidisciplinary team-based organization.

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Box 6. The pioneer Energy Resources case at Play Spraberry

An analog of major relevance to the ATG project is the *Spraberry play*. There the company *Pioneer Energy Resources* has obtained important results. The characteristics of its operation are as follows:

- Main operator.
- It operates 6,000 wells, of the 13,000 in production from 200 operating companies.
- Drills approximately 300 wells per year (1,000 by 2012) out of more than 1,000 drilled by all companies with 82 rigs.
- It produces 52,000 barrels per day out of 190,000 barrels extracted.
- To date, it has produced 2,000 MMBPCE of its original 30,000 MMBPCE volume. *in situ*

- Discovered in 1948
- Depth of deposits 2,000 - 3,000 m.
- 20,000 wells, covering 600,000 hectares.
- 13,000 wells in operation
  - ✓ Average production 14.5 bd / well
  - ✓ Cost / well: $ 1.0 MM USD (2009)
  - ✓ Well spacing 400 m
    - - Initial production: 40 bd, 20 bd per year, 10 in 4 years and 5 in 15 years

- The FR (Pioneer Company):
  - ✓ 12 - 13% drainage area of 400 m
  - ✓ 18 - 19% drainage area of 200 m
  - ✓ 27 - 28% by injecting water.
- Produce several intervals at the same time
  - ✓ 1980 a single interval
  - ✓ 2009 up to 6 intervals at a time

V. ATOMIZED PROJECT MANAGEMENT AND USE OF INCENTIVIZED CONTRACTS

A reflection that must be considered for the development of the ATG project is that its complete exploitation can hardly be carried out successfully by a single company, particularly if it is a company traditionally focused on large exploration and exploitation projects.

The most successful cases are those in which many companies participate in the development of a section of the project. Specialists are required in this type of development, since their competitiveness will be linked to economies of scale, repetitiveness of efficient concepts, cost control, feedback of experiences and the association and sharing of risks with suppliers.

The legal space opened by the 2008 energy reform contemplates the possibility for Pemex-PEP to hire specialized companies for the development of different sections of the ATG project. The current contracts, signed until a year ago, are rigid and are not focused on generating value, due to the legislation that prevailed until then:

The contracts are not designed to generate synergies or link subsequent activities.

It is identified that several current contracts generate delays in operations due to discontinuities in the activities, since they do not include drilling, completion, fracturing, SAPs, measurement and operation in an integral manner. This is illustrated in the table below.

Table 7. Description of Times: 2006-2009

	Días entre Perforación y Terminación	Días entre Terminación y Primera Producción	Días entre Perforación y Primera Producción
AGUA FRIA	80	42	122
COAPECHACA	60	35	95
CORRALILLO	58	39	97
COYOTES	88	58	146
COYULA	114	65	178
ESCOBAL	83	13	96
FURBERO	98	33	132
HORCONES	107	95	202
HUMAPA	74	40	114
PALO BLANCO	100	1	101
SOLEDAD	80	76	156
SOLEDAD NORTE	88	40	128
TAJIN	63	39	102
Total general	**77**	**41**	**118**

Given the observed drilling rates (500 wells per year), the days lost between drilling and production implies not producing 25 mbd per year (almost the total production of the project). In terms of profitability, this means postponing project revenues when 80% of the investments have already been made.

It is estimated that if the agreement of wills is in place, and if the legal mechanisms are in place, the renegotiation of contracts with existing suppliers could be considered in order to adapt them to the new legal framework and orient them towards integral exploitation.

VI. FEEDBACK

There is consensus in business administration studies that feedback is definitely one of the most efficient and least costly forms of learning, which is generated by the company itself based on its experiences and the creativity of its personnel. However, although this concept is intuitively easy to understand, in reality it is difficult to implement. The reason for this is that very few companies have the organization to collect the results obtained, analyze them and regenerate them into a better product to reincorporate them into the depths of the organization on a daily basis.

The most progressive companies are those that focus on continuity in learning. In the ATG project, the reproduction of knowledge, difficult and costly to acquire, as well as its continuous improvement, must be considered as a fundamental process to increase the recovery rates of hydrocarbons and to improve the profitability of the project. Therefore, investment in a true retrofit process would also increase oil revenue, which should be considered a top priority at the national level.

On these issues, the recommendations of this working group point to the following:

- Feedback is the learning process within a system, which allows a structural review of the way in which an activity is carried out. The above, in order to re-incorporate the knowledge acquired within the process itself, in order to make new efforts more efficient.

- So far, the lessons learned have not been reflected in the organization or in the selection of technology sufficiently to ensure that efficiency gains are being made because of this new knowledge.

- The feedback process is complex and involves several levels, it is also part of the administrative control function and requires the establishment of the following elements:

    - Establishment of standards: This is the application of a unit of measurement that will serve as a model, guide or standard on the basis of which the control will be carried out.
    - Performance measurement: The action of measuring performance and results, and in a way, modifying the same unit of measurement.
    - Correction: It is the concrete and tangible utility of control and is based on corrective action to integrate deviations in relation to standards.
    - Feedback: This is the establishment of corrective actions; it is in this step where the closest relationship between planning and control is found.

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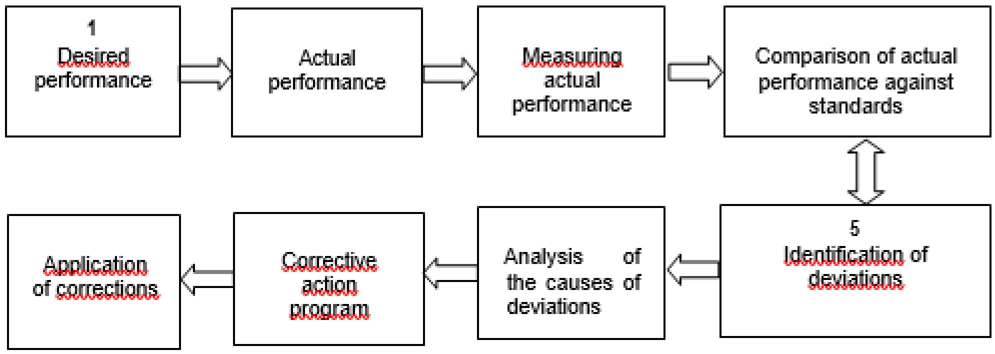
Figure 19 – Feedback Process



1. Establishment of objectives and standards from the beginning.
2. Compilation of results describing the situation of the process or status quo.
3. Application of standards.
4. Compare performance (actual results) with planned goals and standards.
5. Performance report showing actual results, planned results and differences between the two.
6. Analysis of variances and related operations to determine the underlying causes of variances.
7. Develop courses of action to correct any deficiencies and learn from successes, as well as make a selection (corrective action) from the menu of alternatives.
8. Implement corrective actions and follow up on them to evaluate the effectiveness of the correction, in order to generate re-planning.

VII. TRANSPARENCY AND ACCESS TO INFORMATION

Throughout this document it has been pointed out that the ATG project must consolidate its learning process, which mainly comprises the study of the subsurface and the evaluation of different technologies. This process will require the participation of technicians and scientists in a much larger number than Pemex has had so far. In fact, due to the magnitude of the project, it will be necessary to incorporate the efforts of the different research and technological development centers at national level.

So far, the participation of the academic community has been limited. This is largely due to the insufficient information available on the ATG project. In particular, the academic community has limited information on the development of the project and very little data on its evolution, much of which is outdated. The areas in which it would be desirable for the academic community to have information for analysis and studies are the following:

- Geological: petrography, sedimentology, stratigraphy, geochemistry, tectonics, and paleontology.

- Geophysics: magnetometry, gravimetry and seismic (2D and 3D).

- Drilling: well logs, drilling fluids, cores, and completions.

- Production: well testing, fracturing, production per well, recovery mechanisms.

- Costs: capital and operating costs, as well as unit cost estimates.

VIII. FINAL OBSERVATIONS AND RECOMMENDATIONS

a. Remarks

- The ATG project has large petroleum resources that must be considered for exploitation. There is evidence that significant volumes of hydrocarbons can be extracted.
- According to CNH's analysis, the recovery factor of 2% with respect to the original volume indicates that there is still room for significant improvement in the exploitation strategy.
- The ATG project should be managed according to best practices for this type of project. Despite the complexity of this type of field, successful experiences have been identified at the international level.
- The ATG project needs to intensify the process to conclude its learning phase, emulating international best practices, in order to establish the optimal development plan and exploitation strategy. It will then be in a position to have the elements for large-scale implementation of one of the technological alternatives.
- The project is at a low stage of maturity, both in terms of subsurface knowledge and technology selection, so there is great uncertainty around production forecasts.
- Three major themes are identified for successful well productivity: drilling, completion of conventional and unconventional wells in optimal locations, and artificial production systems.
- The reservoirs of the ATG project have low self-energy that lasts for long periods of time, so it is essential to consider this aspect in the exploitation strategies such as pressure maintenance and secondary and enhanced recovery methods, seeking the production of hydrocarbons in the liquid phase within the reservoir.
- The analysis carried out by the CNH shows that if the 2P reserve were to be extracted, a large number of wells would be required, reaching the extreme of what would be possible for Pemex to handle. However, the number of wells will decrease as better productivities and estimated maximum recoveries are obtained through the use of more adequate technologies, as a result of the learning stage.