

CRUDE OIL MARKET OUTLOOK 2007-2016



SECRETARÍA
DE ENERGÍA

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PRESENTATION

In recent history, oil has become a fundamental element of development. Its relevance is not restricted to a merely economic aspect; it also influences other areas, such as social, political and environmental.

Mexico is the world's sixth most important producer of crude oil, and the relevance of this resource in our country stands out since energy security is based upon it and, due to its contribution to the national economy, it is a significant driver of economic development. It is difficult to think of modern Mexico without relating its history to the history of oil. However, it is also necessary to think forward in order to visualize the industry's requirements to satisfy the country's needs, maintain proper reserve-production level ratios, mitigate environmental impacts and continue being one of the main actors in the global oil industry.

The volume of oil reserves in Mexico at the beginning of the 90's did not make incorporation a priority. The largest part of reserve incorporation was a consequence of the development of existing fields. Nevertheless, this tendency is not sustainable in the long run and a minimum reserve level is required.

During the last few years, efforts have been focused on maximizing production at Cantarell, a super-gigantic reservoir with high reserve levels and low production costs. However, the expected decline on this reservoir's production platform will represent great challenges, including correct reservoir management, aimed at obtaining the best recovery rates through the careful selection of assisted recovery methods.

Considering the decline of this reservoir, maintaining a production platform close to current levels will require multiplying project execution capacity along the exploration and exploitation value chain, as well as important investment resources. Every single one of these projects implies specific problems and challenges; so the initiatives to develop them will also differ. It is important to point out that the approach to such a broad and diverse portfolio is the development of more profitable fields, keeping a balance between production and reserve incorporation. The portfolio is completed with more complex projects with a higher degree of uncertainty, such as deep water development in the Gulf of Mexico.

This is how both challenges – increasing reserves and maintaining production levels – represent a great commitment for the country to achieve the best results. The sector's challenges will require to make the best decisions regarding the actions undertaken within the industry, thus the experience of highly qualified personnel and best industrial practices must be exploited to the maximum to make required projects feasible.

Achieving these operational results implies physical investment levels above the historical levels. Even more, recent investments have, in part, compensated the lack of investment observed during the 80's and at the beginning of the 90's. Nonetheless, it is critical to continue improving best operational practices and modifying the regulatory and legislative aspects that restrict actions in the international environment in which the country has to compete day-by-day.

The above is a clear proof of the need to properly plan the basis of an efficient, competitive, sustainable and world-class oil industry capable of covering the country's future needs, and, at the same time, becoming a driver of the national economy.

With this in mind, the Ministry of Energy is herewith presenting the first edition of the Crude Oil Market Outlook for 2007-2016, the contents of which include the possible dynamics expected in the variables related to this industry throughout the next decade and, with them, the challenges they represent. This document is a tool for experts, sector analysts, researchers and businessmen, contributing reliable and objective information on this sector in Mexico.

Georgina Kessel Martínez

Minister of Energy

EVOLUTION OF THE DOMESTIC CRUDE OIL MARKET, 2007-2016

This chapter describes crude oil production forecasts for the 2007 to 2016 period, according to the data in Pemex Exploración y Producción (PEP)'s project portfolio. Estimates presented herein are aligned with the investment scenarios planned for each project in terms of economic values in 2007 pesos.

PEP's 2007 project portfolio shows a series of opportunities identified so far in terms of exploration and exploitation, upon which two production scenarios have been derived: outstanding and low. These scenarios consider the cost structure of main inputs in the first quarter of 2007, and include costs associated to infrastructure construction and those related to well drilling, among other aspects.

Several exploration projects are developed on the outstanding scenario, allowing crude oil production to remain at levels above 3,200 tbd; while in the low scenario, the production platform has an average level near 2,500 tbd throughout the analyzed period.

Some of the factors that might affect production forecasts are geological risks, project execution capacity, the effectiveness and satisfaction of plans and the development of planned programs, among others.

4.1 Outstanding production scenario¹

This scenario considers PEP's maximum execution capacity through the intensification of exploration activities, the immediate development of discoveries and the consequent drilling of wells both in these new discoveries and in already identified reserves. It also considers a stronger services market with sufficient capacity to timely supply high-quality materials and services related to hydrocarbon exploration, exploitation, conditioning and distribution activities. Investment amount forecasts have been designed to carry out the structural reforms required by the country in order to increase the investment's social and economic profitability, significantly raising thereby the amount of resources destined to infrastructure development. Based on the investment taken into account, PEP has prepared this outstanding scenario, determining production goals and the related physical activities.

PEP's 2007 business portfolio for the outstanding scenario includes a total of 81 projects, 6 of which are integrated exploration and exploitation projects (projects that include both prospective hydrocarbon exploration activities and the production activities of reserves discovered or of existing reserves); 29 are exploitation projects (projects that only consider the production of reserves already discovered), 22 are exploration, and 24 are infrastructure and support projects for the operation and maintenance of hydrocarbon transportation and distribution. It is worth mentioning though that except in the case of infrastructure and support projects, industrial safety and environmental protection investments are also included.

¹ Corresponds to the PEP's 3.4 scenario.

The features considered in this production scenario include:

- Budget ceilings for an average 157 billion pesos for physical investment throughout the period. Out of these, 98 billion pesos destined to the exploitation of existing fields, 28 billion to the exploration of new fields and 31 billion to future development;
- Deep water exploration and future development activities intensify, guaranteeing the availability of drilling rigs required to start oil production as of 2014;
- The expected production of exploration wells scheduled for completion in 2007 is also considered 2007, as is the development of discovered fields;
- The exploration drilling program considers the following new projects: Julivá, Comalcalco, Litoral de Tabasco Terrestre, Coatzacoalcos and Campeche Poniente Terciario, Campeche Poniente and Campeche Oriente and Litoral de Tabasco Marino;
- Development project execution continues to improve the recovery factor of remaining reserves; different studies and actions are also undertaken to improve the recovery factor of mature and marginal fields.
- The proposed scenario begins with a crude oil production of 3,256 tbd in 2006, maintaining a production of 3,255 tbd between 2006 and 2016. These production levels depend on the success of exploration activities, generally subject to a high degree of uncertainty; as well as on resource availability, both financial and technical, and on the execution capacity, guaranteeing efficient resource supply according to the execution rhythm of Pemex's projects.

To explain projects and estimated production in detail, the scenario is presented in the following terms:

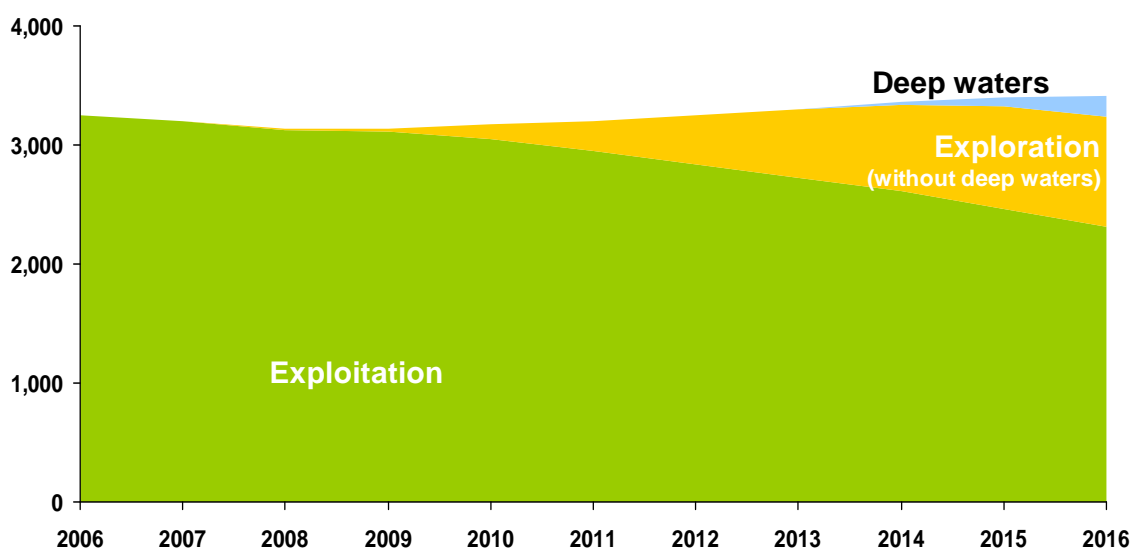
- by activity type (exploration and exploitation);
- by project category;
- by region; and
- by oil quality

By activity

The planning of crude oil exploration and exploitation activities is important on one hand because the exploitation horizon is indicating the effective management of base production coming from fields and wells currently exploited, and how they will respond to diverse elements. Variables influencing reservoir management include: production decline rate due to pressure decreases and to changes in water-oil and gas-oil contacts, which also influence well productivity evolution. This planning becomes more important when considering that large part of PEP's current production comes from mature fields. Some elements are therefore difficult to predict, such as the velocity at which contacts with other fluids other than oil move, above all, if production comes from naturally fractured reservoirs where current technological progress through detailed models reproducing the distribution and conductivity of fractures represents limitations to the accurate prediction of these fluids' movement.

On the other hand, exploration activity reflects new production resulting from investments made in onshore basins, shallow waters and deep waters. In onshore basins, exploration portfolio considers investments for the Burgos, Reforma Terciario, Simojovel and Cuichapa projects. In shallow waters, investment projects are planned for projects like Crudo Ligero Marino, Coatzacoalcos, Lamprea, Campeche Oriente and Campeche Poniente. In the case of deep waters, the Golfo de México B and Golfo de México Sur projects are considered.

Graph 1
Crude oil production by activity type, outstanding scenario, 2006-2016
(thousand barrels per day)



Source: Pemex Exploración y Producción.

The planning horizon shows that oil production from exploitation projects will decrease throughout the entire period, at a faster pace after 2009, mainly as a result of the decline of Cantarell and other fields that will reach their maturity by that time. On the other hand, production from the exploration opportunities will start to be incorporated in 2008, with a volume of 2 tbd, reaching a maximum contribution of 925 tbd by the end of the period. This scenario shows a production of 19 tbd from deep waters in 2014, increasing to 174 tbd in 2016.

By project category

This section analyzes the diversification of large oil production projects. In this sense, the business portfolio has been classified into the following projects:

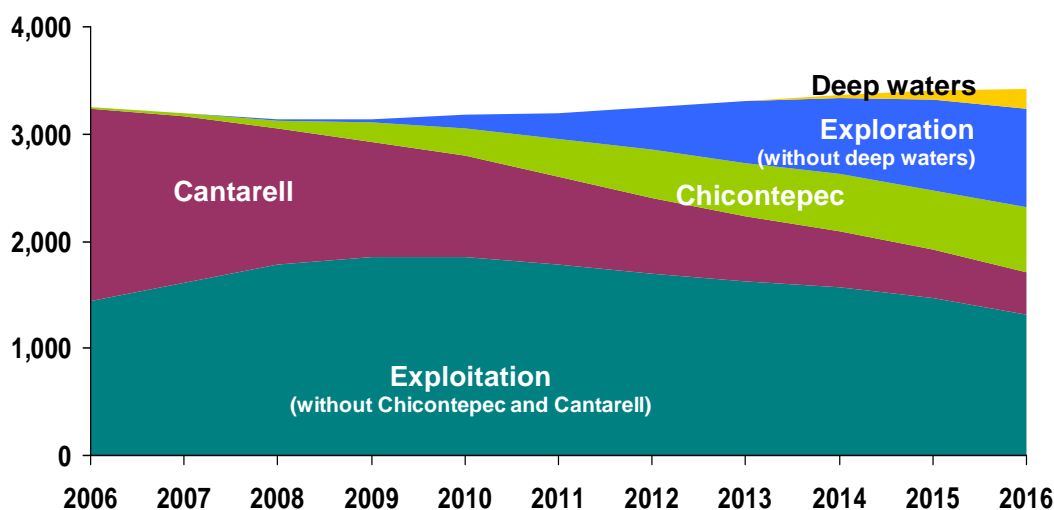
- Exploitation (without Chicontepec and Cantarell);
- Cantarell;
- Chicontepec;
- Exploration (without deep waters); and
- Deep waters.

Exploitation projects will cover an average of 1,637 tbd in the period analyzed. Reaching its maximum production in 2010, rising to 1,851 tbd, that accounts for almost 60% of domestic crude oil production in that year. The production decrease of exploitation projects as of 2011 mainly obeys the start of decline of Ku-Maloob-Zaap.

One of the most important challenges of the 2007 project portfolio is to continue managing the decline of the Cantarell Project, considering the volumetric relevance this complex has had in the country's oil production for several decades. This is why the technical planning of Cantarell includes the design of a new project aimed at maximizing production through an additional hydrocarbon recovery project, so that the current exploitation strategy, based on pressure preservation, shall evolve into another scheme.

Graph 2

Crude oil production by project category, outstanding scenario, 2006-2016 (thousand barrels per day)



Source: Pemex Exploración y Producción.

This project's total production will decrease at an annual average rate of 14.1% between 2006 and 2016, with an average volume of 921 tbd throughout the period. Production decline in Cantarell is expected to be partially compensated by an increased production in Ku-Malooob-Zaap, Chicontepec and other fields.

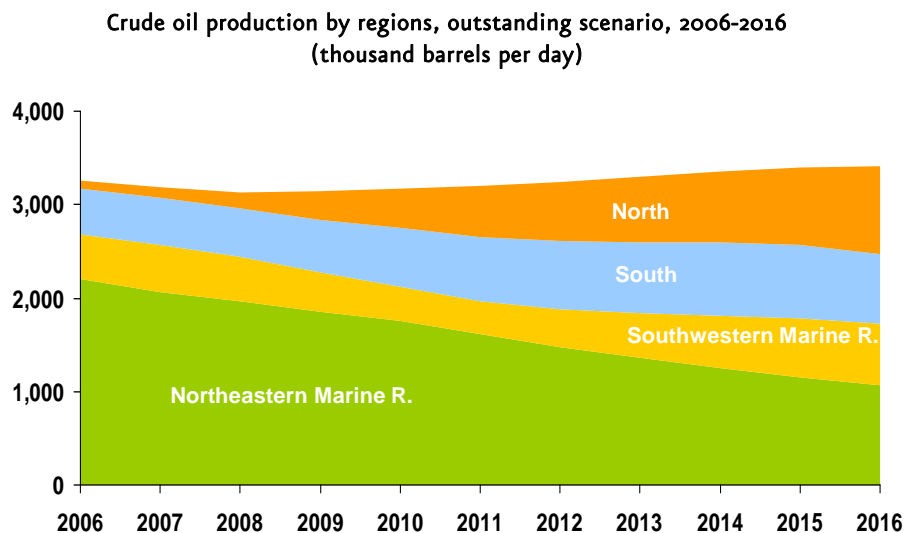
The production of exploration projects will come mainly from the Golfo de México B, Reforma, Cuichapa and Crudo Ligero Marino projects. Deep water projects will start producing crude oil as of 2014. PEP defines deep waters as those exceeding 500 meters of depth. This definition results from considering that, at this depth, the technology used for field development changes significantly.

By region

In crude oil production added by regions, the Northeastern Marine Region is expected to decline at an annual rate of 8% between 2006 and 2016. The importance of this region lies in the fact that during 2006 it had a share of 68% in domestic oil production, while in 2016 this figure will decrease to 31%. The decrease is related to the decline of Cantarell, production volume, when is expected to decrease by 1,397 tbd by the end of the period.

Production decline in the Northeastern Marine Region will be compensated by growth expected in other regions, mainly due to the development of reserves in the Northern Region. This region currently represents less than 3% of domestic production, but it will gradually increase its production until reaching a share of 27% of the total in 2016, explained by the development of the Chicontepec project.

Graph 3



Source: Pemex Exploración y Producción.

The rest of regions into which the country is subdivided will also experience a production increase. The Southern Region is expected to increase its current production by 53%, while the production of the Southwestern Marine Region will increase by 37%.

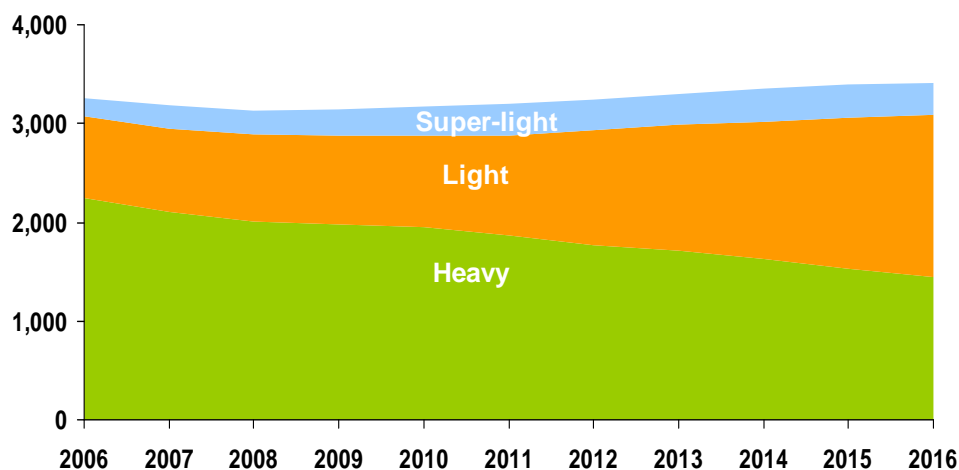
By oil quality

Heavy crude oil production is expected to decrease in the first years due to the decline of Cantarell and, Ku-Maloob-Zaap will show the same tendency afterwards. These factors will lead to a decrease by 35% in the production of this crude oil type by the end of the period.

As to lower density crude, light crude oil production is expected to increase at an annual average rate of 7% throughout the period, while super-light crude oil will increase at a rate of 6%. These behavior is linked to the development of the Chicontepec, Crudo Ligerio Marino, Cuichapa, Reforma and Campeche Poniente projects. Light oil production (light and super-light) will increase from 1,012 tbd in 2006 to 1,972 tbd in 2016.

This scenario is forecasting that the Mexican mix quality will become lighter due to a lower degree of heavy crude oil production. This situation could lead to Maya crude oil becoming a scarce *commodity*, thus showing an attractive price behavior. With the production forecast composition, the National Refining System's (SNR) oil supply will be entirely satisfied under this scenario.

Graph 4
Crude oil production by quality, outstanding scenario, 2006-2016
(thousand barrels per day)



Source: Pemex Exploración y Producción.

4.1.1 Domestic crude oil consumption, 2006-2016

Domestic crude oil has two main consumption destinations: domestic processing and foreign market supply. Crude oil processing on the domestic market is basically divided into oil volume sent to National Refining System (SNR²) and another volume sent to the La Cangrejera Petrochemical Complex. This structure does not change on the planning horizon and the distribution forecast even considers the possible strengthening of installed refining capacity on both scenarios.

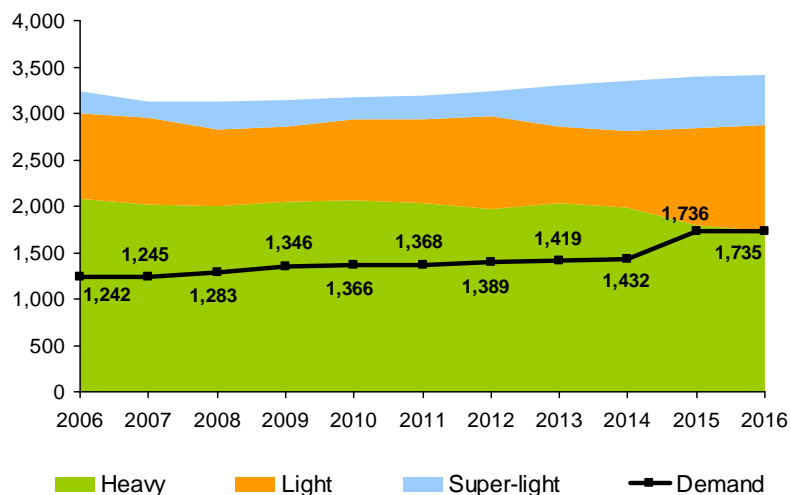
National Refining System

For the period between 2006 and 2016, SNR is expected to continue being the main consumer of crude oil on national territory. Required crude oil ratio will in turn increase as the planned upgrading works of refineries are concluded and new capacities start operations. Therefore, while in 2006 SNR captured 38% of the total volume of crude oil destined to distribution, in 2015 this ratio will increase to 51% as a result of the start-up expectations of new refining capacity³.

Graph 5
SNR's demand vs. domestic crude oil availability, outstanding scenario, 2006-2016
(thousand barrels per day)

² Acronyms in Spanish.

³ The start-up of new capacity will be subject to the level of investment channeled to this industry segment.



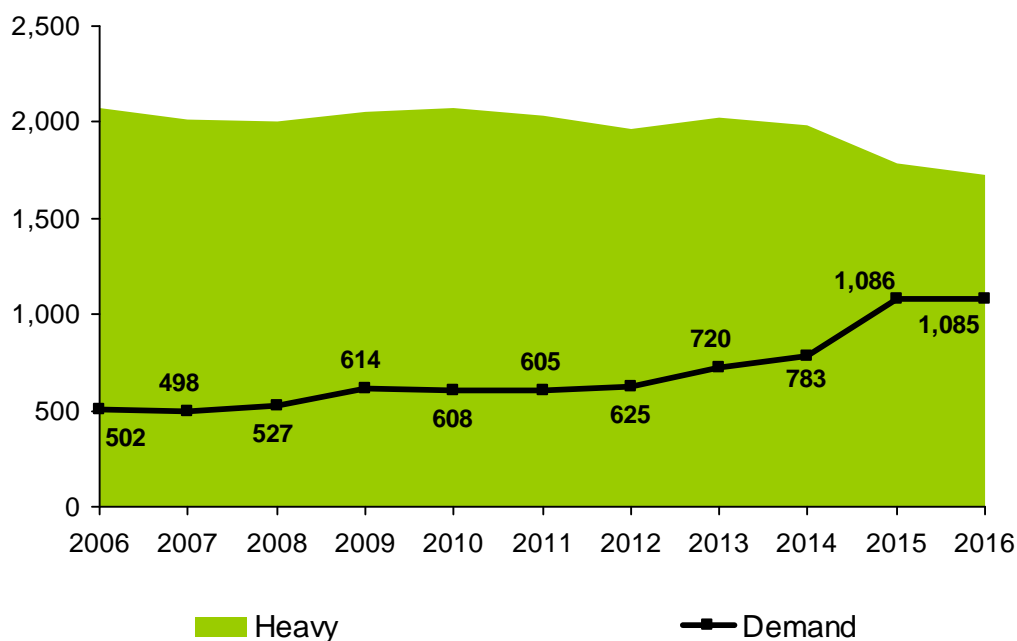
Source: Pemex Exploración y Producción.

Consumption trends by oil types are also expected to change: while in 2006 heavy crude oil represented 40% of the total demanded by SNR, this share will increase to 63% by the last year of the projected period. This increased share implies a growth of 583 tbd in required heavy oil volumes compared to 2006. The consumption of this crude oil type will undergo an average annual growth rate of 8%, the highest among the three crude oil types.

The trend changes of crude oil ratios for domestic market demand are linked to two factors: on one hand, the upgrading of the refineries will allow the processing of a mix with higher heavy crude oil ratios. On the other hand, there is a possibility that a new refining train will start operations, increasing heavy crude oil demand in 2015.

Heavy crude oil ratio captured by SNR will increase considerably between 2006 and 2016 versus the total volume of this crude oil for distribution purposes. In the base year (2006), SNR demand represented 24% of the total available at national level, while by 2016 this share is expected to reach 63%.

Graph 6
Heavy crude oil demand by SNR vs. national availability, outstanding scenario, 2006-2016
(thousand barrels per day)



Source: Pemex Exploración y Producción.

Light crude oil demand by national refineries will decrease as a consequence of planned upgrading projects. This reduction represents 72 tbd during the projected period, that is, a 10% contraction versus demand in 2006. Its share in the mix will decrease from 58% to 37% between 2006 and 2016, therefore becoming the second most demanded crude to SNR for processing after heavy crude oil.

This crude oil type is the only one with a negative growth rate in the period, representing an annual average of 1%. On the other hand, light and super-light crude oil demand will not increase their share if the new refinery starts operations.

The ratio of light crude oil demand and its available volume will be reduced by 2016 as a result of a lower degree of light crude oil consumption by SNR and an increase of its production.

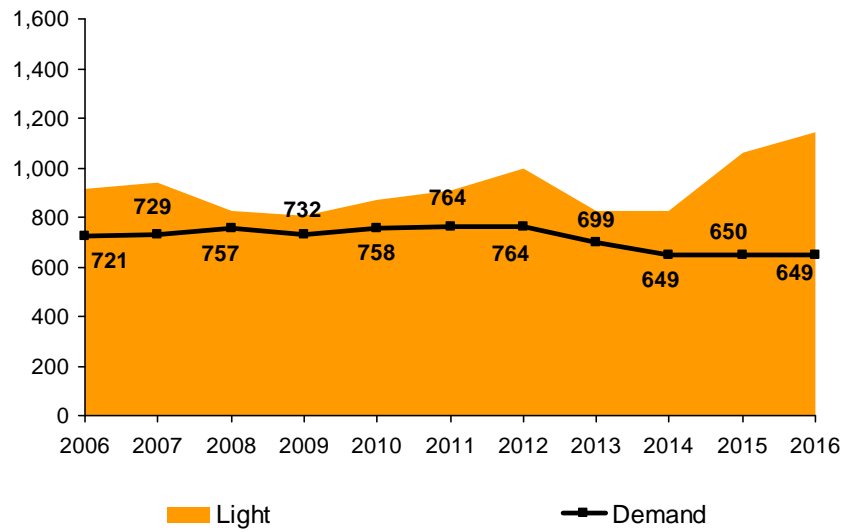
During 2006, light crude oil demanded by SNR represented 79% of the available volume of this crude oil type on national territory; this ratio is expected to decrease to 57% in the next ten years, releasing larger volume of crude oil for other purposes, mainly exports.

Lastly, super-light crude oil will preserve its marginal share in the first years of the period projected and null share as of 2008. In this case, the total volume of this crude oil type for distribution is destined for the export market.

Requirements of this oil type will gradually decrease as a result of lower demand, caused by the conclusion of planned upgrading projects and by increased production.

Graph 7

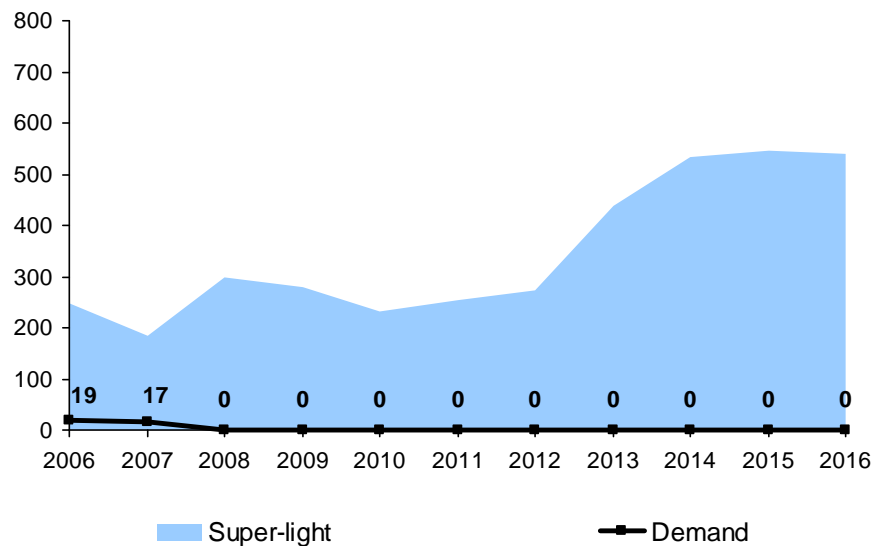
Light crude oil demand by SNR vs. national availability, outstanding scenario, 2006-2016
(thousand barrels per day)



Source: Pemex Exploración y Producción.

Graph 8

Super-light crude oil demand by SNR vs. national availability, outstanding scenario, 2006-2016
(thousand barrels per day)



Source: Pemex Exploración y Producción.

La Cangrejera Petrochemical Complex

Another destination within domestic demand is crude oil sent to “La Cangrejera” Petrochemical Complex, whose products are used to complement the processing of light distillates in SNR.

The crude oil demand of this complex is expected to increase from 122 tbd in 2006 to 165 tbd in 2008, remaining flat as of that year after. Depending on its quality, average heavy crude oil demand throughout the 11 years of study will be 44.2 tbd, representing 27.6% of the total crude oil volume demanded by this processing center. Light crude oil will contribute an average of 53.0 tbd, representing 33.1% of the demand. Lastly, super-light crude oil will represent the highest demand with an average 63.0 tbd, contributing the remaining 39.3%.

Graph 9
Crude oil demand by La Cangrejera Petrochemical Complex, 2006-2016
(thousand barrels per day)



Source: Pemex Exploración y Producción.

4.1.2 Foreign trade, 2006-2016

Mexico's crude oil exports will diminish as a result of the increased domestic crude oil demand, causing -by the last year of the projected period- the average total crude oil volume destined for export to be reduced by 364 tbd versus 2006.

As a consequence thereof, export tendencies according to crude oil quality will change inversely to domestic consumption trends and changes in the production volumes of different crude oil types in the country. In the case of heavy crude oil, the smaller production platform and the increase of domestic consumption will lead to the reduction of export volumes.

In 2006, heavy crude oil volume for export accounted for 75% of the total crude oil volume available for distribution, and this share is expected to decrease to 37% by the end of the period. In terms of volume, this decrease represents a reduction of 929 tbd in heavy crude oil exports versus the first year of the projected period. Its share within the total exported crude oil volume will decrease from 84% in 2006 to 43% for the last year of the period.

Despite the higher light crude oil production on national territory, export volumes will not increase at the same rate. This is due to the fact that part of the production is used for mixes of heavier crude oils to facilitate transportation and improve quality for better exploitation at refineries. Even so, this crude oil type will increase its share within Mexican exports, since, while its export volume in 2006 represented 4% of total crude oil exports, by 2016 it will increase to 22% as a consequence of a growth of 261 tbd in volumes available for export during the period.

The behavior of light crude oil volumes for export is closely related to domestic demand, since until 2014 large part of the production will be used for mixes destined for domestic consumption. As of that year, the production of this crude oil type is expected to increase together with a decrease of domestic demand, releasing part of the volume for export purposes.

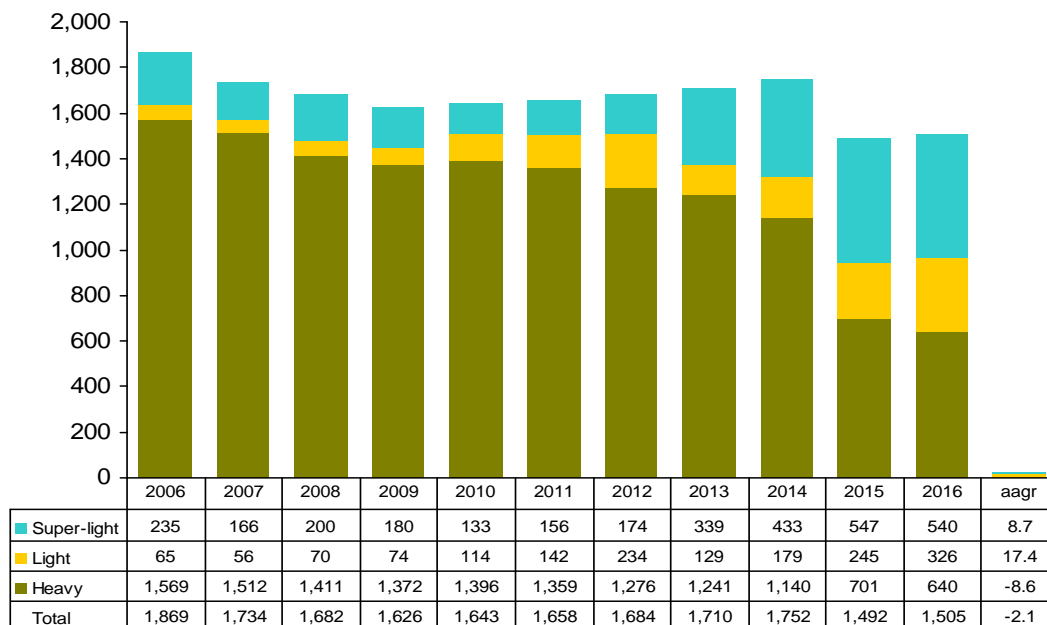
Super-light crude oil destined for the international market in 2016 will increase by 305 tbd versus the volume in 2006, increasing its share in export mixes from 13% to 36%, reaching volumes very similar to those of heavy crude oil.

If the crude oil quality ratio expected on this scenario is consolidated, higher volumes of light crude oil will be available at terminals, favoring export mix prices regardless of the markets toward which they are channeled. Moreover, the quality of this mix will lead to the increase of export destinations since no highly complex refineries will be necessary for its processing.

If the new refining capacity is not completed by 2015, this heavy crude oil will be available for foreign market trading.

Graph 10

**National exports by crude oil type, outstanding scenario, 2006-2016
(thousand barrels per day)**



Source: Pemex Exploración y Producción.

4.1.3 Investment program

The development of the outstanding scenario contemplates a relevant increase of infrastructure investment resources as a result of structural reforms.

Investment associated to this production scenario is estimated at an annual average of 157 billion pesos of 2007 throughout the period. Total investments in PEP's 2007 portfolio are divided into:

- Exploitation;
- Exploration; and
- Future developments.

On the crude oil production scenario, there is a goal of 3,182 tbd for 2007 and after that year, production will depend on the amount of PEP investments. In the first years, only smaller changes will be observed on the outstanding scenario, while, with time, effects will be much greater. This is due to the fact that investments made currently in infrastructure and well drilling will have impacts in the medium and long term, contributing to the maintenance of production levels. As to reserve incorporation, the outstanding scenario establishes that the goal of investments made for the development of these fields is to have a proved reserve and 3P restitution rate of 100% by 2012.

Variations in terms of investment are mainly related with two elements: changes in hydrocarbon prices, deriving into increases in material cost and service prices in the oil industry, and the execution rhythm of the different projects that constitute this investment portfolio. In this context, the scenario contemplates a cost structure that reflects the commercial conditions prevailing in the first quarter of 2007.

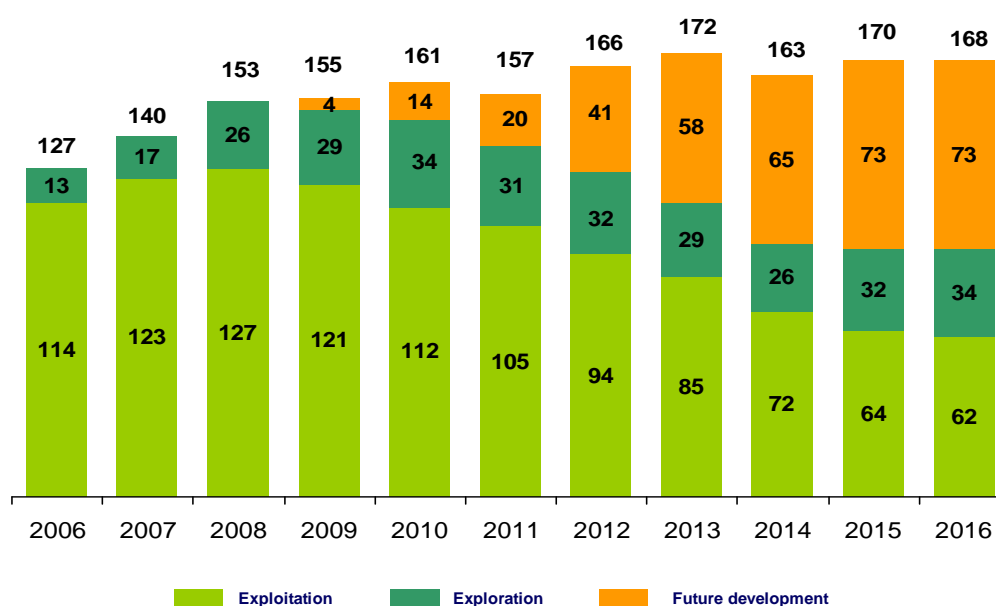
From the average investment amount, 62% is destined to the exploitation of existing fields, 18% to the exploration of new fields, and 20% to future developments. PEP's strategy is to attend to mature basins and dwell into deep waters. Projects like Chicontepec, Ku-Maloob-Zaap, Cantarell, Burgos and Crudo Ligerio Marino will represent levels above 60% of exploitation investments throughout the period between 2008 and 2016. As of 2010, exploration investments will increase mainly in offshore projects, such as Golfo de México B, Golfo de México Sur, Crudo Ligerio Marino and Campeche Oriente. The increase of future development investments as of 2012 is explained by the execution rhythm of the Golfo de México B and Golfo de México Sur deep water projects.

As of 2007, investments destined to exploitation in projects already approved will decrease due to the conclusion of the main offshore projects, like Cantarell, Ku-Maloob-Zaap and Crudo Ligerio Marino. Out of the physical exploitation investments scheduled between 2008 and 2016, 55% are linked to onshore projects, including hydrocarbon extraction in Chicontepec, Burgos, Antonio J. Bermúdez, Veracruz and under the Financed Public Works Contracts (FPWC). Shallow water investments will represent 38% of the total and will be destined to the Ku-Maloob-Zaap, Cantarell, Crudo Ligerio Marino and Chuc projects. The rest of the investment for the planning horizon will be destined to support and maintenance activities.

Exploration projects will maintain their annual average investment rate of 28 billion pesos between 2006 and 2016. Investment in offshore projects represents 75% of the total in the 2008-2016 timeframe. The main shallow water projects are Crudo Ligerio Marino, Coatzacoalcos, Campeche Oriente, Campeche Poniente and Lamprea. Deep water investments are concentrated in the Golfo de México B and Golfo de México Sur projects, while the main onshore projects are Reforma Terciario, Burgos, Simojovel and Cuichapa. As of 2009, physical investments in future developments are expected, favoring shallow water projects such as Crudo Ligerio Marino and Coatzacoalcos, that represent 32% of the total investment destined to this item throughout the projected period. Onshore project investments will mainly be focused on the Reforma Terciario, Simojovel and Cuichapa projects, representing an average of 25% of investments. In deep waters, investment will be

concentrated on the Golfo de México B and Golfo de México Sur projects, constituting 43% of the total investment to them during the period.

Graph 11
Total physical investment, outstanding scenario, 2006-2016
(billion pesos of 2007)

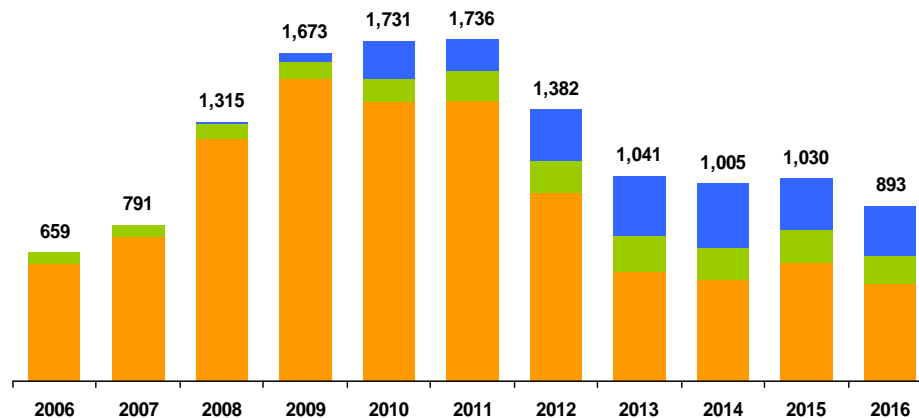


Source: Pemex Exploración y Producción.

As to the total number of wells, between 2007 and 2016 a total of 12,597 accumulated wells will be drilled. The increase as of 2008 is mainly related to Chicontepec's development. In this period 1,312 exploration wells will be drilled, while the number of wells associated to future development will be 1,810. By 2012, well drilling in the Burgos Basin and under FPWC will decrease (see Graph 12).



Graph 12
Total well drilling, outstanding scenario (number)



Source: Pemex Exploración y Producción.

4.1.4 Domestic crude oil balance, 2006-2016

The prospective domestic crude oil balance integrates the vision of this market for the next 10 years. It is presented as an exercise related to PEP' investment portfolio, containing the projects to be developed in their different phases by 2016.

The planning considers investments that will drive exploration activities and lead to greater reserve development; it would also allow production increase toward the end of the planning horizon. The diversification of the project portfolio includes the exploration and development of deep water projects recently undertaken by PEP.

The concentration of production by regions will change due to the decline of the Northeastern Marine region as a consequence of decreased production in the Cantarell project, this production will be compensated by development in other regions, supported mainly by the crude oil production increase in Chicontepec.

On the other hand, regarding the domestic processing of crude oil production, a considerable increase is expected by the end of the period, mainly as of 2015. This is due to the fact that the possibilities in this scenario contemplate a new refining facility as of that year, increasing domestic processing capacity. However, although it is contemplated in the scenario, due to the time and resources needed for the planning of a project with these dimensions, this project will depend on the market dynamics in the next years.

Increased domestic demand will translate into lower crude oil export volumes; however, if the new refining train project does not start, this volume would be destined to export.

Projects to be developed within the oil industry depend on diverse uncertain elements, all of which must be considered. This is important because this uncertainty is also related to the magnitude of hydrocarbon volumes discovered and the type of associated fluids.

PEP's project portfolio contemplates a decrease of heavy crude oil production decrease at an annual average rate of 4.3%. In contrast, lighter crude oil production increases, compensating total crude oil production on national territory.

Once production by crude oil type has been planned, there will be a higher ratio of heavy crude oil delivered to SNR. This higher demand will translate into the change of exported crude oil share ratios, reducing the share of heavy crude oil.

Chart 1
Domestic crude oil balance by type, outstanding scenario, 2006-2016
(thousand barrels per day)

Concept	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	aagr 2006-2016
Availability	3,258	3,185	3,144	3,152	3,190	3,209	3,258	3,314	3,369	3,415	3,426	0.5
Crude oil production	3,256	3,182	3,132	3,140	3,178	3,197	3,246	3,302	3,357	3,403	3,415	0.5
Heavy	2,244	2,109	2,014	1,985	1,949	1,862	1,773	1,710	1,635	1,535	1,442	-4.3
Light	831	844	883	892	926	1,018	1,155	1,273	1,388	1,523	1,640	7.0
Super-light	180	230	234	262	303	316	317	319	334	345	333	6.3
Naphthas and condensates	3	3	13	13	12	12	12	12	12	12	11	15.1
Distribution	3,234	3,133	3,130	3,137	3,174	3,191	3,238	3,294	3,348	3,394	3,405	0.5
To processing¹	1,364	1,400	1,448	1,511	1,531	1,533	1,554	1,584	1,597	1,901	1,900	3.4
Heavy	526	498	593	680	674	671	691	786	849	1,086	1,085	7.5
Light	819	884	757	732	758	764	764	699	649	815	814	-0.1
Super-light	19	17	99	99	99	99	99	99	99	0	0	-
Abroad²	1,869	1,734	1,682	1,626	1,643	1,658	1,684	1,710	1,752	1,492	1,505	-2.1
Heavy	1,569	1,512	1,411	1,372	1,396	1,359	1,276	1,241	1,140	701	640	-8.6
Light	65	56	70	74	114	142	234	129	179	245	326	17.4
Super-light	235	166	200	180	133	156	174	339	433	547	540	8.7
Variations³	25	52	14	15	17	18	19	20	21	21	21	-

¹ Includes crude oil destined to the National Refining System, to La Cangrejera and PGPB plants.

² Includes exports and crude oil to maquilas (in-bond).

³ Includes packaging, inventory movements, injections, transfers, shrinkage and statistical differences.

Source: Pemex Exploración y Producción.

4.2 Low production scenario⁴

The profile of this scenario is limited investment due to the lack of structural reforms required in the country, leading to restricted exploration, postponed exploration and deep water development beyond 2022, as well as the reduction of the production platform.

PEP's 2007 business portfolio contemplated in this scenario includes 68 projects divided into: 6 integrated exploration and exploitation projects, 29 exploitation projects, 9 exploration projects and 24 infrastructure and support projects. It is seen that the impact of restricted investment would lead to a lower number of exploration projects.

The most relevant aspects of this production scenario include:

- Average budget ceilings of 100 billion pesos in physical investment during the period, of which, 8 billion pesos will be bounded to exploration, 3 billion pesos to future development and 89 billion pesos to exploitation activities⁵;
- As to exploration activities, only the production expected from exploration wells programmed by the end of 2007 is considered, and the exploration drilling program for the Burgos project is maintained, while the rest of exploration projects are differed to 2011 in a staggered manner. This scenario does not consider deep water exploration activities and future developments.
- As to exploitation, development projects aimed at the improvement of remaining reserve recovery factors will continue, as will the same execution schemes for mature and marginal fields.

Average crude oil production between 2006 and 2016 on this scenario will thus be 2,682 tbd. For comparison purposes, this scenario will deal with the same issues as the outstanding scenario; explaining production prospective according to activity, projects, regions and oil qualities.

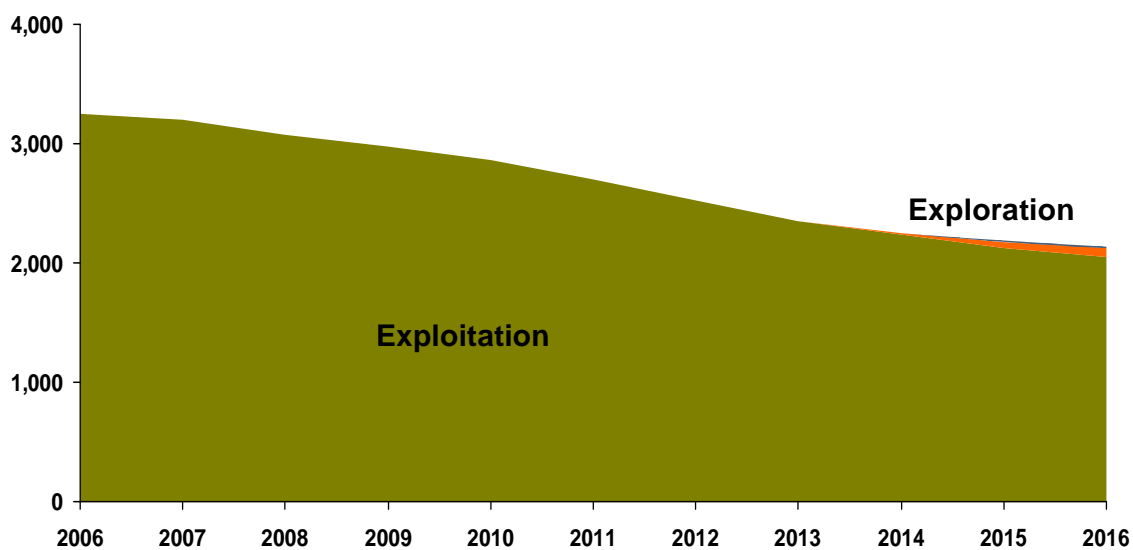
By activity

This scenario shows how activity will decrease in both, exploration and exploitation activities, leading to a reduction of the production platform throughout the period. This is associated to the expected decline of the Cantarell reservoir, which will be largely replaced by the development of Chicontepec and Ku-Maloob-Zaap. However, even with these developments, production will not be able to maintain the levels registered at the beginning of the period. It must also be considered that exploration and deep water activities require considerable maturation times for a base production; the incorporation of exploration opportunities is expected to have a marginal contribution by 2014, increasing to 3.8% in 2016.

⁴ Corresponds to the PEP scenario called "Pre-defined ceilings"

⁵ This scenario contemplates a constant debt level of Pemex

Graph 13
Crude oil production by activity type, low scenario, 2006-2016
(thousand barrels per day)



Source: Pemex Exploración y Producción.

By project category

This section will use the project classification of the previous scenario, except for deep waters, since this scenario does not contemplate considerable development in this field. According to this, the following projects will be included:

- Exploitation (without Chicontepec and Cantarell);
- Cantarell;
- Chicontepec; and
- Exploration (without deep waters)

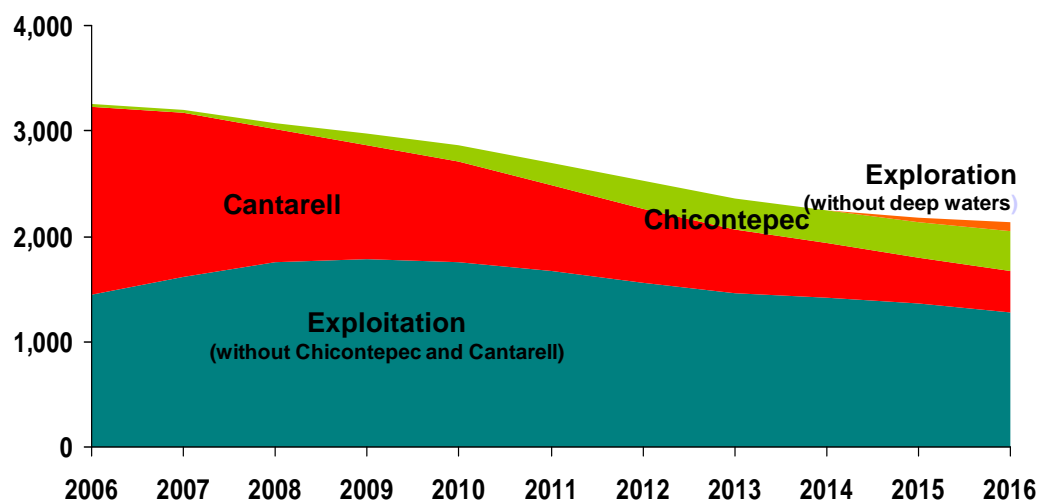
This scenario considers the production decline of existing fields due to the lack of new developments. Exploitation projects are expected to reach an average production rate of 1,554 tbd throughout the period analyzed, reaching maximum production by 2009 with 1,782 tbd and declining to 1,277 tbd toward the end of the period, with an annual average decrease rate of 1.2%.

Another relevant factor throughout the period will be the expected production decline of Cantarell. In this project, decline management will be very similar to that of the outstanding scenario. Average production of this asset team is expected to reach 917 tbd and its average annual decline rate will be 14.1%. This means a reduction of 1,399 tbd versus production in 2006.

Part of this production decline will be compensated by a production increase in Chicontepec, a project where production is expected to increase at an annual rate of 32%. However, in volumetric terms, increase by 2016 will represent 360 tbd versus the production volume in 2006, meaning that the Chicontepec project would be incapable of compensating production decrease in exploitation projects and in Cantarell.

The contribution of exploration projects will be minimum and only by the end of the period: There will be no contribution from deep water projects.

Graph 14
Crude oil production by project category, low scenario, 2006-2016
(thousand barrels per day)



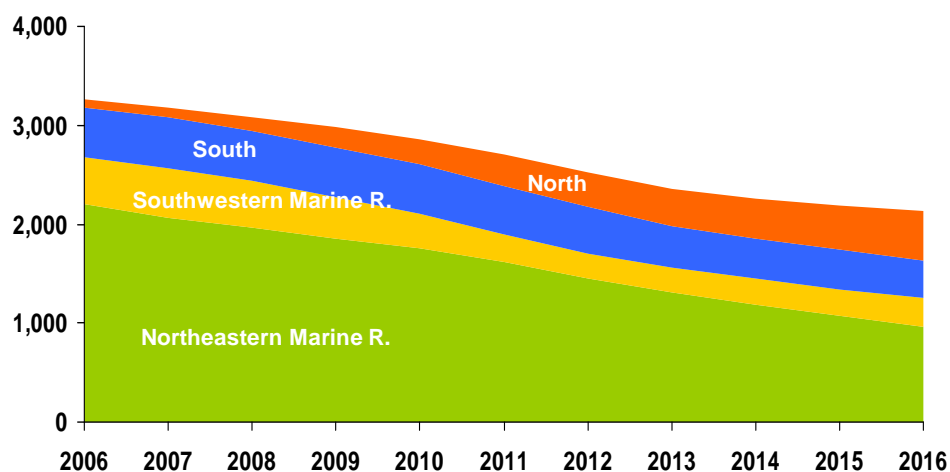
Source: Pemex Exploración y Producción.

By region

This scenario presents a more pronounced production decline in the Northeastern Marine Region compared to the outstanding scenario. The Southwestern and Southern Marine Regions will also reduce their production volumes, the first by 40% and the second, by levels above 20%.

Even though by the end of the prospected period the Northern Region will displace the Southern Region as second most important in view of its production levels, under these conditions the increase expected in this region's production levels (around six times the production volume of this region in 2006) will not be capable of compensating the decline of other regions.

Graph 15
Crude oil production by region, low scenario, 2006-2016
(thousand barrels per day)



Source: Pemex Exploración y Producción.

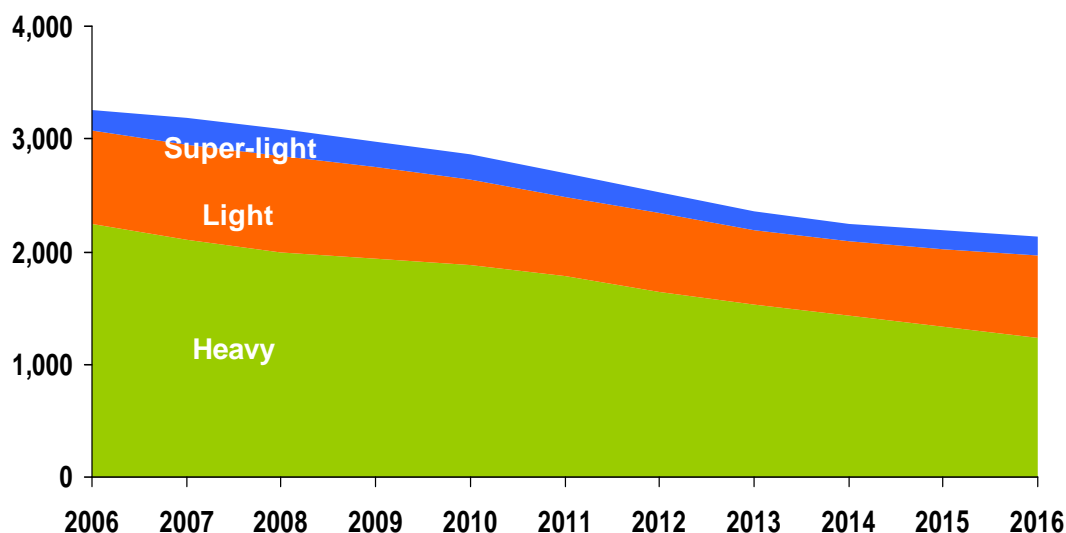
By oil quality

This scenario considers a reduction in production volume of the three crude oil types produced at national level, being heavy crude oil the one with the highest production decrease. This is also related to the decline of Cantarell and Ku-Maloob-Zaap, whose main production is heavy crude oil. Broadly speaking, heavy crude oil production will be reduced by 44.8% in 2016 versus 2006.

Light and super-light crude oils will face reductions of 12.5 and 6.1%, respectively, by the end of the period, contrasting with the outstanding scenario where the production of these crude oil types increases throughout the period. Nonetheless, these differences are explained by that fact that, while the outstanding scenario considers the development of fields producing mainly these crude oil quality types, in this scenario such developments are delayed. Even so, the share of these crude oil types in total production will increase, mainly as a consequence of heavy crude oil production decrease.

Mexican mix will thus become lighter, and since the production of the three crude oil types would decrease, there is a possibility of them becoming scarce *commodities*, having an impact on the expected price behavior of that mix.

Graph 16
Crude oil production by quality, low scenario, 2006-2016
(thousand barrels per day)



Source: Pemex Exploración y Producción.

4.2.1 Domestic crude oil consumption, 2006-2016

This scenario considers the same domestic crude oil demand volume as the outstanding scenario. However, due to the decrease of the production platform on national territory, it will be necessary to import crude oil to fulfill oil qualities required by domestic demand.

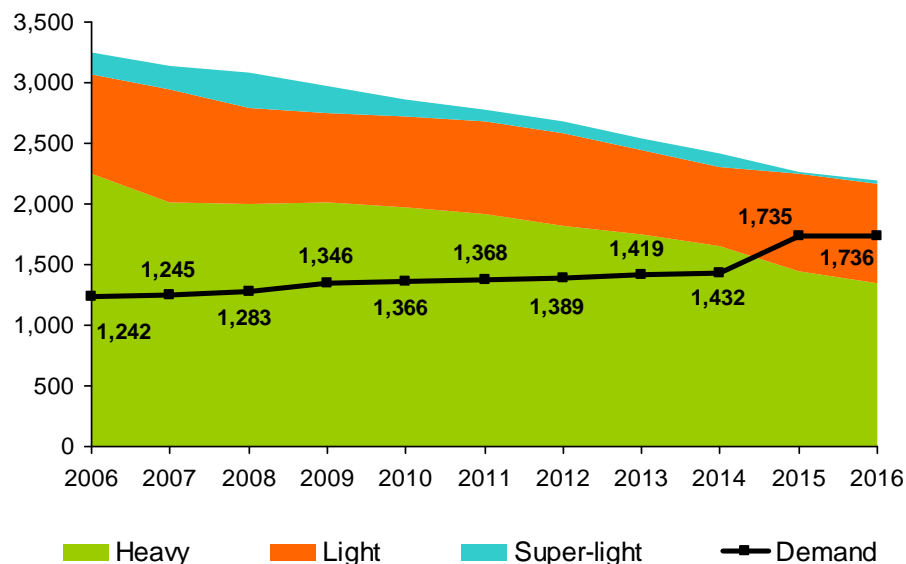
It is important to point out that, like in the case of SNR, demand by La Cangrejera Petrochemical Complex will remain unaltered with respect to the outstanding scenario, demanding the same volumes on both scenarios.

National Refining System

On this scenario, SNR is still the country's main crude oil consumer. Just like on the outstanding scenario, the behavior expected from SNR for the period between 2006 and 2016 is marked by the crude oil demand increase of national refineries as a result of the conclusion of upgrading projects and the possible start of operations of a new refining capacity.

The year when this new capacity will start operations will have an important impact upon the domestic production and demand ratio. While crude oil volume demanded by SNR in 2014 will represent 59% of the total crude oil available for domestic distribution, by 2015 this ratio will rise to 77%. By 2016, SNR's share in demand will continue to increase, reaching 79%.

Graph 17
SNR's demand vs. domestic crude oil availability, low scenario, 2006-2016
(thousand barrels per day)

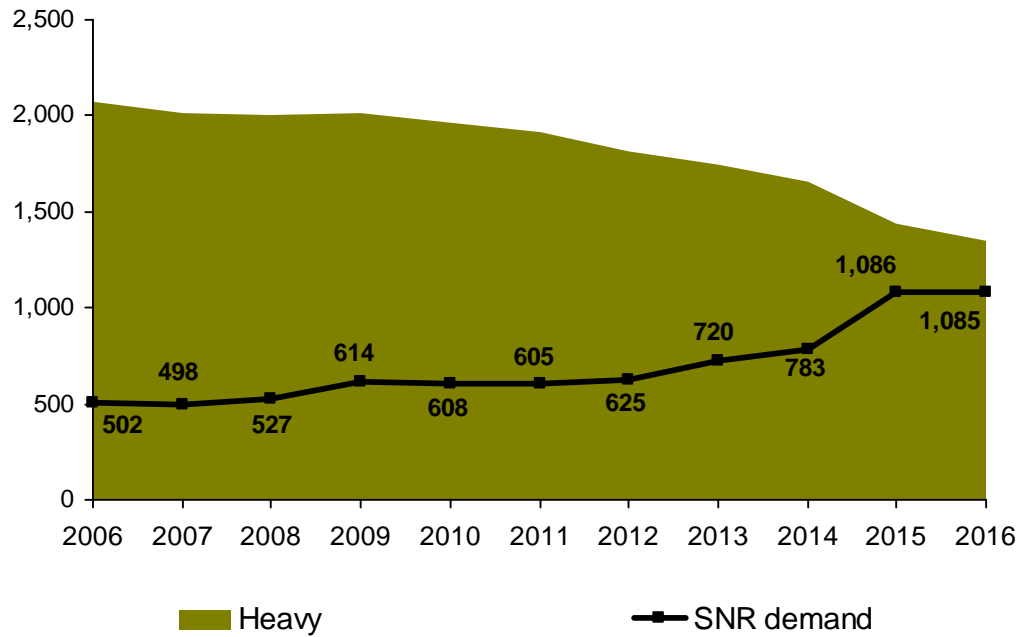


Source: Pemex Exploración y Producción.

The conclusion of the upgrading projects will lead to an increased share of heavy crude oil in the mix processed at national refineries. Considering that this crude oil type is expected to show the highest production decrease levels, it can be deduced that, as time goes by, SNR's share in demand regarding heavy crude oil production on national territory will be increasingly higher. By the end of the prospected period, SNR is expected to absorb 80% of the total of heavy crude oil available in the country.

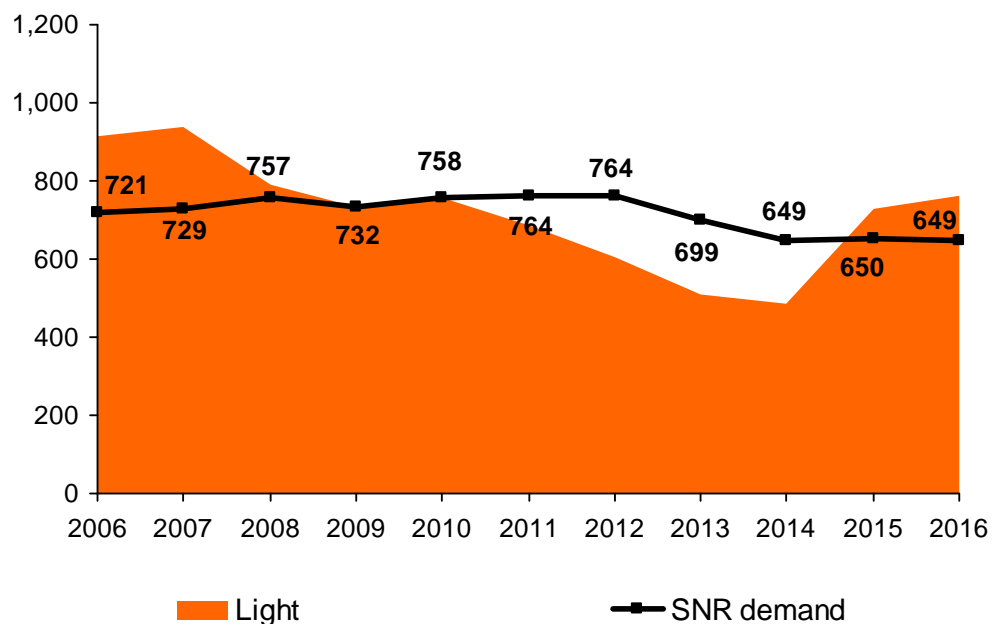
As to light crude oil, between 2011 and 2014 SNR's demand will exceed domestic available volumes, requiring imports. As upgrading projects will start operations, light crude oil demand will decrease, returning to production ranges. This translates into the situation that, by the end of the period, SNR's share in demand with respect to production will reach 85%, a figure that is higher than the figure at the beginning of the prospected period, even if demanded volumes are lower.

Graph 18
Heavy crude oil demand by SNR vs. domestic availability, low scenario, 2006-2016
(thousand barrels per day)



Source: Pemex Exploración y Producción.

Graph 19
Light crude oil demand by SNR vs. domestic availability, low scenario, 2006-2016
(thousand barrels per day)



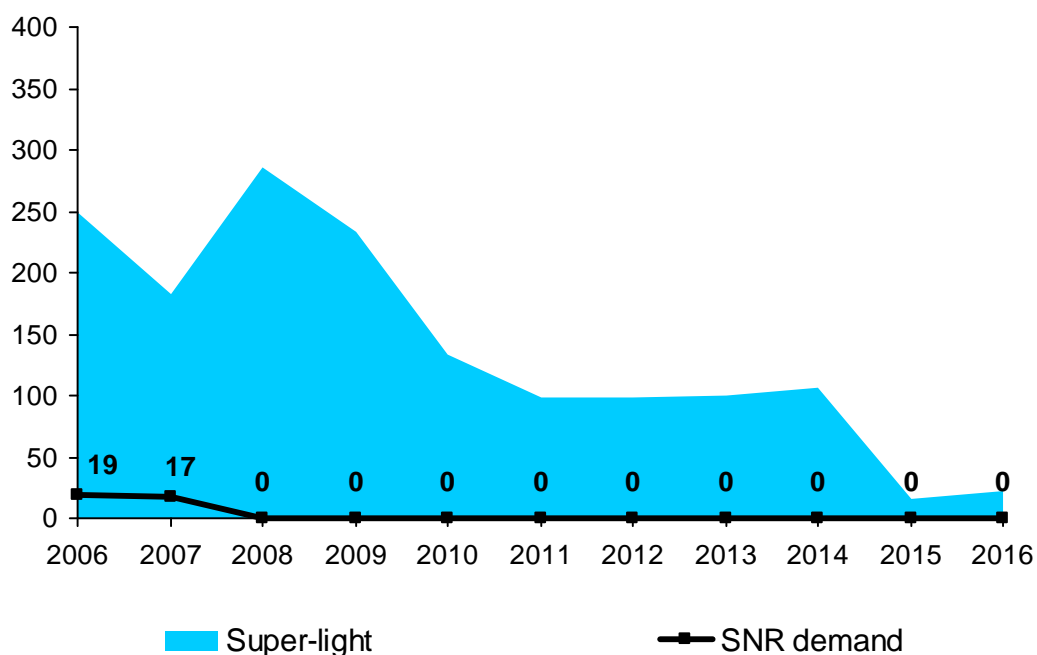
Source: Pemex Exploración y Producción.

Super-light crude oil demand by SNR shows an atypical behavior since, although demand on this scenario will be marginal in the first two years of the prospected period and null during the remaining eight years, this crude type will be destined to produce the mixes to increase the quality of heavier crude oils, obtaining larger volumes of light crude.

This situation, combined with the lower production of light crude oil, will lead to the reduction of this crude oil type's available volumes for other purposes, even becoming zero for those few years when light crude oil demand exceeds its production.

Investment levels associated to the start of operations of the new refining capacity in 2015 are not included in this prospective, thus this refining scenario will be subjected to the availability of these resources upon which this industry segment depends⁶.

Graph 20
Super-light crude oil demand by SNR vs domestic production, low scenario, 2006-2016
(thousand barrels per day)



Source: Pemex Exploración y Producción.

4.2.2 Foreign trade, 2006-2016

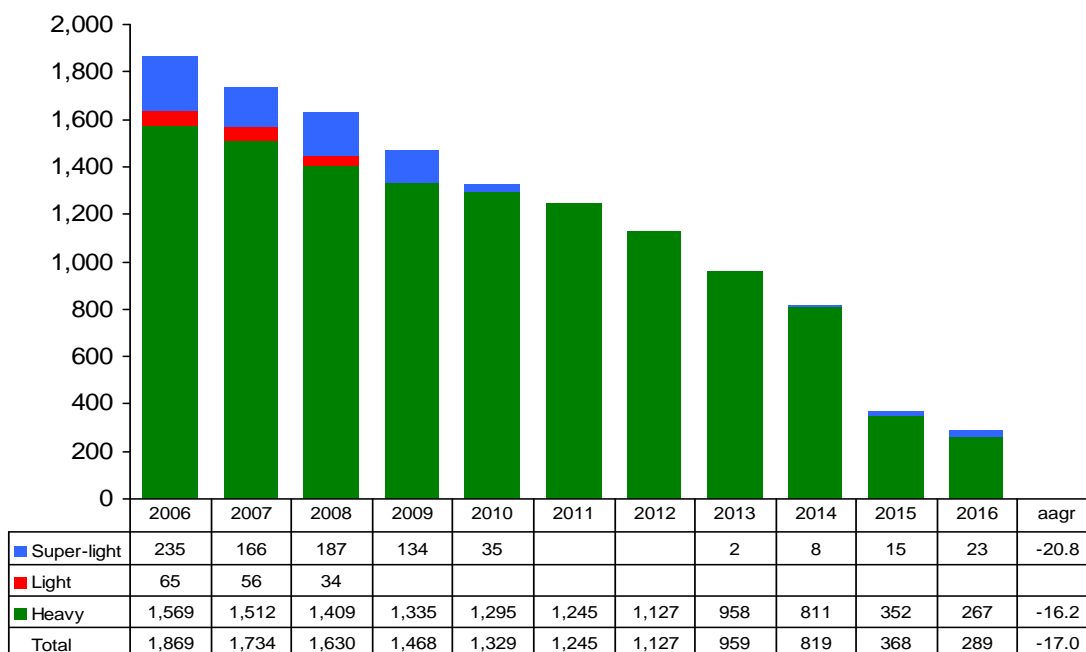
Crude oil exports will face the highest reduction levels among the diverse destinations of domestic production. Domestic demand increase and production reductions will have a considerable impact on the volume destined for export. Throughout

⁶ For more details, see *Oil-derived product outlook for 2007-2016*.

the prospected period, decreases expected on this scenario will gather 85% of the average volume compared to those in 2006, leading to exports of 289 tbd by the end of the period.

As to the quality of crude oil destined for foreign trade, heavy crude oil will experience the greatest reduction, from 1,569 tbd in 2006 to 267 tbd by the end of the prospected period. Even so, this crude oil type will contribute 92% of total exports in 2016, maintaining the highest share within exports.

Graph 21
National exports by crude oil type, low scenario, 2006-2016
(thousand barrels per day)



Source: Pemex Exploración y Producción.

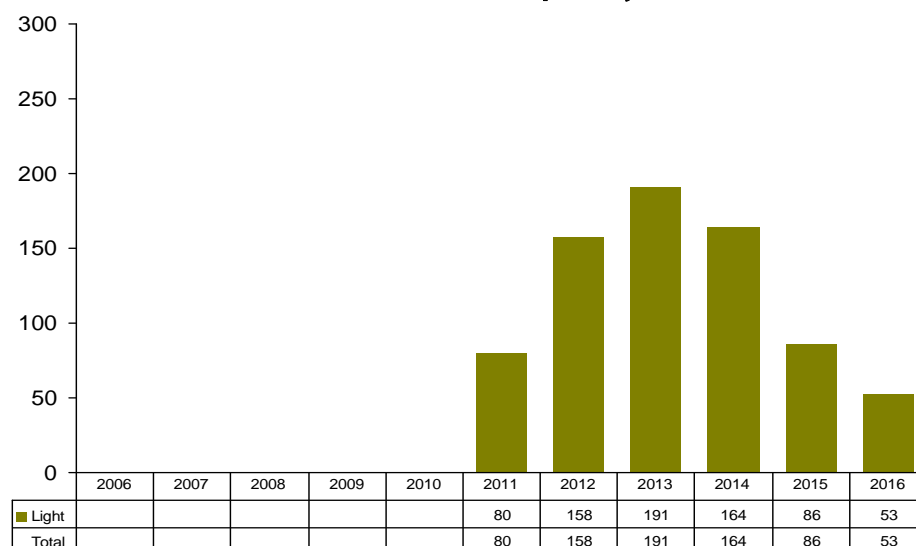
On this scenario, light crude oil exports will cease as of 2009; this situation is consequence of the low production expected from this crude oil type along the period and to the increase of its domestic demand.

This scenario also considers a reduction of super-light crude oil volumes for export. In this case, export reductions, mainly between 2010 and 2014, are associated to the low production rates of this crude oil type and to the fact that it is used for the mixes that improve the quality of heavier crude oils to be processed either by national refineries or by La Cangrejera Petrochemical Complex. Once light crude oil demand decreases on national territory, and returns to the domestic production levels, there will be no need for mixing superlight crude oil to cover the amount of crude quality demanded by the SNR leaving a certain volume of this crude oil for export purposes.

Mexican mix prices will decrease since, on one hand, light crude exports would cease, and on the other hand, super-light crude oil share would be reduced, making the mix heavier and thus, with lower price in the market. In this case, the share increase of heavy crude oil would be a consequence of light and super-light crude oil volume reductions, and not a result of export volume increases.

On a low production scenario, considering that demand remains constant, it will be necessary to import light crude oil by 2010 in order to fulfill domestic supply. The export platform will also be adjusted downward.

Graph 22
Imports by crude oil type, low scenario, 2006-2016
(tho usand barrels per day)



Source: Pemex Exploración y Producción.



4.2.3 Investment program

This scenario considers decreasing investment resources in comparison with those observed in recent years, as a result of decreased oil incomes.

Investment levels associated to this production platform will account for an average of 100 billion pesos of 2007 throughout the period between 2006 and 2016, divided among exploration, exploitation and future development.

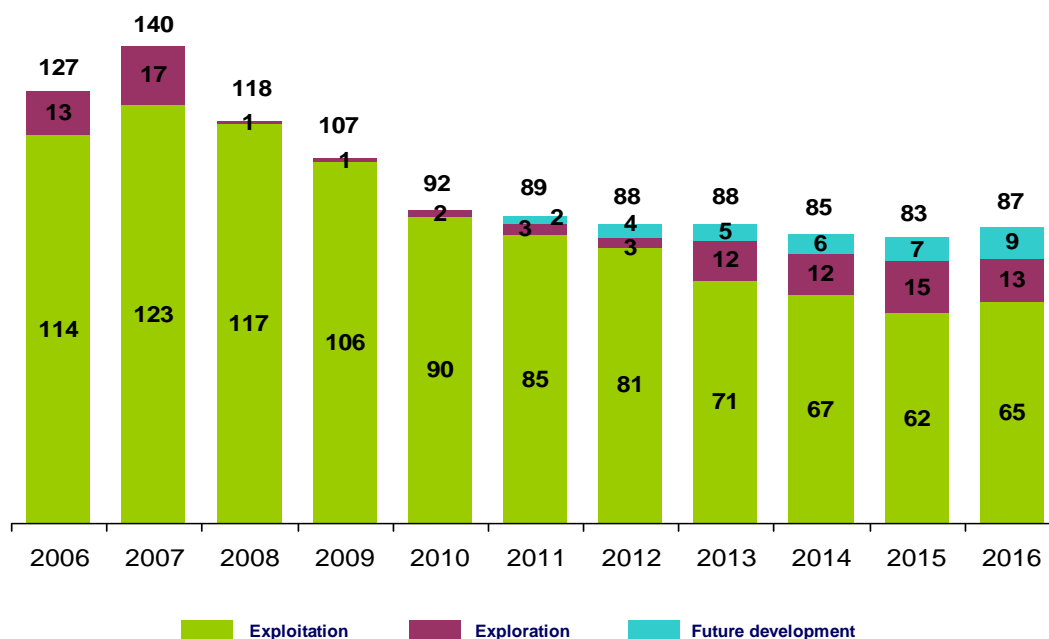
Under these investment conditions, production volume and investment ratios will be as follow: in the first years, production platform will remain at levels above 3,000 tbd, while, with the decrease of investment levels, production will show the same tendency and will reach 2,136 tbd in 2016.

Investment levels for the exploitation of existing fields account for 89% of the investments in the period; 8% for investments in exploration, and the remaining 3% will be destined for future development. The strategy proposed on this scenario generates a minimum impact on exploitation, with the exception of Chicontepec.

The Chicontepec, Ku-Maloob-Zaap, Cantarell, Burgos and Crudo Ligero Marino projects will gather 61% of the investments in exploitation activities; throughout the period, no investments will be made in deep water projects, and investment for the rest of exploration projects will be limited.

88% of investments will be channeled to exploitation projects in order to maintain, as much as possible, production levels. Exploration will be minimum and there will be no deep water activities.

Graph 23
Total physical investment, low scenario, 2006-2016
(billion pesos of 2007)



Source: Pemex Exploración y Producción.

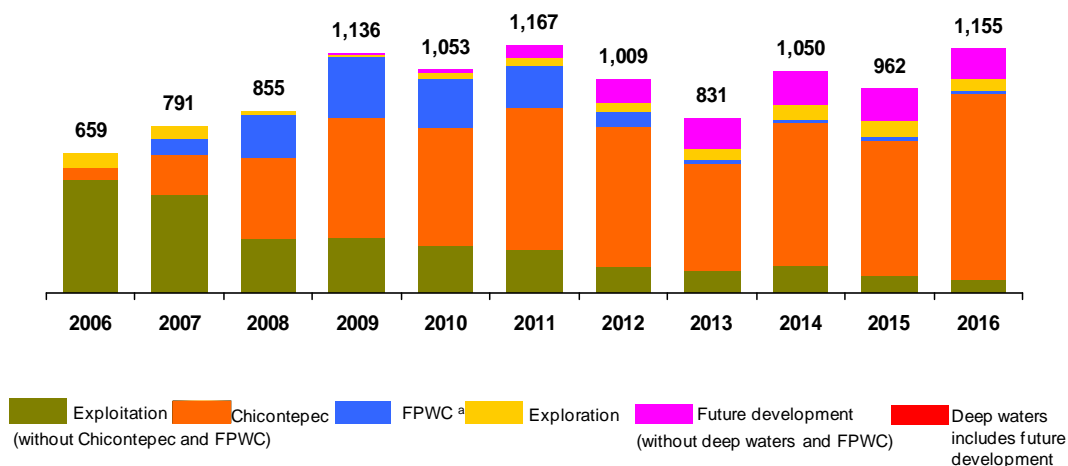
Physical investments in exploitation consider infrastructure and support projects accounting for 41% of the investment. 50% of investments will be destined for onshore projects that demand lower investment level than offshore projects. Investment in offshore projects will only represent 9%, mainly for the Ku- Maloob-Zaap, Cantarell and Crudo Ligerio Marino projects.

Reduced investment levels force exploration activities to be postponed, maintaining them only during the first years in Burgos. As of 2013, other projects, such as Crudo Ligerio Marino, Sardina and Reforma, will also start undertaking exploration activities. There will be no deep water exploration throughout the entire period. Along the period, 33% of the total of these investments will be focused for onshore projects, while 67% will be related to shallow water projects.

Investment in future developments will start in 2010 and only in Burgos, while future development activities in other projects like Reforma, Crudo Ligerio Marino, Sardina and Macuspana would start by 2015. Like in exploration, there would be no deep water activities on the entire prospective timeframe. Investments ratios would represent 71% in onshore projects and 29% in shallow water projects.

The number of wells expected to be drilled between 2007 and 2016 is 11,124. The greatest well drilling activity will take place in Chicontepec and under FPWC, accounting for 73% of the total number of wells. Exploration wells will only represent 13% of the total number of wells drilled.

Graph 24
Total well drilling, low scenario
(number)



Source: Pemex Exploración y Producción.

Exploitation well numbers will decrease from 531 wells in 2006 to 58 in the last year of the prospected period. Wells in Chicontepec, in contrast, will increase constantly from 64 wells to 885 by the end of the period. Wells associated to FPWC will increase halfway through the period, reaching their maximum in 2009 with 283 wells and starting their reduction as of that year.

4.2.4 Domestic crude oil balance, 2006-2016

This planning scenario gathers a limited investment and reduced exploration activities. These factors, along with the production decline of Cantarell, will lead to an important fall of the domestic oil production platform throughout the period analyzed. This scenario does not consider deep water activities by PEP, having a greater impact on production forecasts by the end of the period.

This scenario considers production decrease in three of the four regions into which the country is divided regarding hydrocarbon exploration and exploitation activities, being the Northern Region the only one that avoids this tendency. However, due to the low investment levels associated to this scenario, production increase in the Northern Region will not be significant.

As to the diverse destinations of domestic crude oil, the scenario is very similar to the outstanding scenario. Volumes destined for refining are also very close. Nevertheless, this scenario is rather peculiar insofar as, since domestic light crude oil production is insufficient, super-light crude oil production will have to be destined to produce mixes that improve the quality of heavier crude oils in order to better exploit SNR's refineries. Volumes destined to the petrochemical complex are the same on both scenarios.

The above situation leads to the considerable reduction of the export platform throughout the period. On this scenario, even if the new refining train does not start in the timeframe considered, export volumes would not reach 50% of the current volume.

As to international trade, the forecasts of this scenario include a light crude oil import volume that complements domestic supply, with a maximum of 191 tbd in 2013 and a minimum of 53 tbd in 2016.

PEP's project portfolio associated to this scenario faces production volume reductions in all crude oil types, being heavy crude oil the one with the highest reduction rates with an annual average of 5.8%. In this case, reduction is associated to the decline of Cantarell. Light and super-light crude oil production will also be reduced, though at a lower rate; reduction in this case is a result of lower exploration activities that do not allow the incorporation of reservoirs into the extraction phase.

Chart 2
Domestic crude oil balance by type, low scenario, 2006-2016
(thousand barrels per day)

Concept	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	aagr 2006-2016
Availability	3,258	3,185	3,093	2,992	2,873	2,791	2,692	2,554	2,426	2,280	2,200	-3.9
Crude oil production	3,256	3,182	3,080	2,980	2,861	2,699	2,522	2,351	2,250	2,183	2,136	-4.1
Heavy	2,244	2,109	2,000	1,942	1,887	1,782	1,646	1,533	1,432	1,327	1,239	-5.8
Light	831	844	854	807	746	704	691	659	664	692	727	-1.3
Super-light	180	230	227	230	228	212	186	159	155	164	169	-0.6
Naphthas and condensates	3	3	13	13	12	12	12	12	12	12	11	15.1
Imports	-	-	-	-	-	80	158	191	164	86	53	-
Light	-	-	-	-	-	80	158	191	164	86	53	-
Distribution	3,234	3,133	3,079	2,979	2,861	2,779	2,681	2,543	2,415	2,269	2,189	-3.8
To processing¹	1,364	1,400	1,448	1,511	1,531	1,533	1,554	1,584	1,597	1,901	1,900	3.4
Heavy	526	498	593	680	674	671	691	786	849	1,086	1,085	7.5
Light	819	884	757	732	758	764	764	699	649	815	814	-0.1
Super-light	19	17	99	99	99	99	99	99	99	0	0	-100.0
Abroad²	1,869	1,734	1,630	1,468	1,329	1,245	1,127	959	819	368	289	-17.0
Heavy	1,569	1,512	1,409	1,335	1,295	1,245	1,127	958	811	352	267	-16.2
Light	65	56	34	-	-	-	-	-	-	-	-	-
Super-light	235	166	187	134	35	-	-	2	8	15	23	-20.8
Variations³	25	52	14	14	13	12	12	11	11	11	11	-

¹ Includes crude oil destined to the National Refining System, to La Cangrejera and PGPB plants.

² Includes exports and crude oil to maquilas (in-bond).

³ Includes packing, inventory movements, injections, transfers, shrinkage and statistical differences.

Source: Pemex Exploración y Producción.

Mexico's Prospective Resources

Unlike reserves, which are volumes of discovered and commercially recoverable hydrocarbons, prospective resources are hydrocarbon accumulations estimated on a specific date; however, these accumulations have not been discovered yet but rather inferred, and it is considered they can be potentially recovered. The quantification of these prospective resources is based on geological and geophysical information inside the area of study and on analogies of areas where a specific original volume of hydrocarbons has been actually discovered.

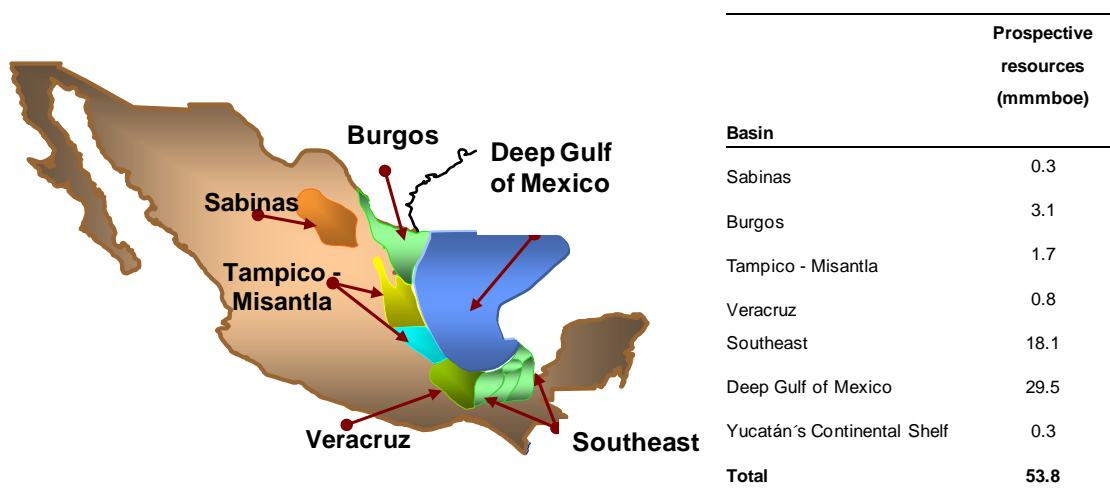
The exploration effort performed up to date has provided a better understanding of the prospective resources possibly found in Mexican sedimentary basins, whose oil potential is mainly located in the following basins: Sabinas, Burgos, Tampico-Misantla, Veracruz, the Southeast and Deep Gulf of Mexico basins.

National prospective resource

The prospective resource as estimated by PEP adds up to a total of 53.8 mmmboe, which is distributed according to the following figure:

Figure 1

Mexico's prospective resources, estimated to 2007



Source: Pemex Exploración y Producción.

Since most of the prospective resources are found in the Deep Gulf of Mexico and the basins of the Southeast and Burgos, some of the characteristics of these basins are described in the following section.

Deep Gulf of Mexico Basin

The Gulf of Mexico Basin, under water depths greater than 500 m, covers an approximate surface of 575,000 square kilometers. Based on the information acquired up to the present, nine geological provinces have been identified distributed in three exploration projects: Golfo de México B, Golfo de México Sur and Área Perdido.

Geochemical analyses performed, as well as hydrocarbon presence on the surface and ocean bottom sampling results, indicate that the hydrocarbon type expected would be oil and non-associated gas.

Drilling activities started in 2004 in the Golfo de México B project where five exploration wells have been drilled so far; four of them have been producing wells: Nab-1 is an extra-heavy oil producing well, and Noxal-1, Lakach-1 and Lalai-1 are non-associated gas producers.

Prospective resource studies performed in this basin indicate that it holds the greatest oil potential, and an average prospective resource of about 30 billion barrels of oil equivalent has been estimated; this represents 55% of the country's total resource that accounts for 53.8 billion barrels of oil equivalent.

Prospective resources

The Deep Gulf of Mexico Basin has a total prospective resource for 29.5 billion barrels of oil equivalent; from this figure, 8.5 billion barrels of equivalent crude oil have been identified through 135 exploration opportunities.

Prospective resources identified per hydrocarbon type

Southeast Basins

They cover an approximate extent of 65,100 square kilometers, including its offshore portion. These have been the main oil producing basins in Mexico since the mid-70's. They include the provinces of: Chiapas–Tabasco–Comalcalco, Salina del Istmo, Macuspana, Sonda de Campeche and Litoral de Tabasco.

The Southeast Basins bear a total prospective resource of 18.1 billion barrels of oil equivalent, out of which 5.4 billion barrels of oil equivalent have been identified through 456 exploration opportunities.

Prospective resources identified per hydrocarbon type

Burgos Basin

This basin covers a surface of 70,000 square kilometers including its continental shelf. The Burgos Basin has a total prospective resource of 3.1 billion barrels of oil equivalent, out of which 2.8 billion barrels of oil equivalent have been identified through 681 exploration opportunities.

Future investments

The yearly average investment estimated for exploration activities during 2008-2016 is of more than 27 billion pesos; while the yearly average investment associated to the possible development of the discoveries resulting from the exploration activities is of almost 29.5 billion pesos, considering the cost structure of 2007's first quarter.

From the exploration point of view, investment will be devoted to the acquisition of more than 125,000 km² of 3D seismic data and the drilling of more than 1,200 exploration wells in the studied period. Likewise, the activities to exploit discovered reserves assume the drilling of 1,570 development wells and the construction of the necessary production and transportation infrastructure.

It must be noted that exploration and production in deep waters imply major technological challenges, long maturity times and costs significantly greater than current ones. The cost of exploration and production in deep waters is subject to an important variability depending on many factors such as water depth, recovery factor and associated geological complexity. The infrastructure cost for this type of fields is also greater than for those fields currently exploited in Mexico.

Relevant exploration technologies

To fulfill the characterization of the prospective resources and their possible evolution to reserves, it is necessary to access state-of-the-art technologies which have proven their efficiency, mainly those that directly influence the enhancement of the opportunity portfolio quality and exploration operational results.

Main key technologies considered are:

- 3D *Wide Azimuth* seismic acquisition.- Its application enhances sub-salt seismic image and thus enables the identification of exploration opportunities that could contain important volumes of prospective resources below bodies of salt, where traditional seismic has not identified them.
- Geochemical modeling- The strengthening of this technology will help knowing expected hydrocarbon types with greater certainty, especially in deep waters where boundaries between gas, light oil and heavy oil have not been defined.
- Depth migration.- This seismic data processing will enable the creation of more reliable structural and stratigraphic models where possible clastic or carbonate reservoirs can be identified with more certainty.

- Pore pressure.- High drilling costs, especially in water depths greater than 500 meters, require all wells drilled to have a design based on this type of analysis, enabling the identification of zones with abnormal pressures. This pursuits to optimize drilling times, associated costs and prevent risks of accidents while drilling.
- Electromagnetic studies.- These studies, complemented with seismic, help reduce exploration risk in areas of complex geology, mainly in the Deep Gulf of Mexico Basin.

Relevant exploitation technologies

The application of new technologies to exploitation activities will contribute to increase field recovery factor. Some of these required technologies are:

- Crude oil dehydration and desalting.- The use of state-of-the-art procedures in the surface treatment of produced oil contributes to increasing the efficiency of flow assurance tasks.
- Floating storage and production systems.- One of the main advantages offered by this type of systems is the flexibility to mix oils with the purpose of delivering export blends of higher quality. They also offer additional storage capacity, that allows changes in operations under harsh weather conditions.
- Recovery methods for extra-heavy oils.- Reservoirs that hold crude oil with low quality require injecting solvents to increase the ultimate recovery factor from 30 up to 50%.
- Subsea production systems.- Low temperature and low pressure conditions found in deep water environments require the application of these systems to optimize hydrocarbon flow. The main components are: subsea tree, manifolds, subsea flow lines and completion units.