

## Case Study From



## The Deer Park Refinery: Pemex-Shell Joint Venture <sup>1</sup>

*In the last decade, Mexico, one of the world's largest oil producers, has begun to import growing amounts of oil products. In 2001, Mexico imported about 374,000 barrels per day, up from 365,000 b/d in 2000. The reason a large producing country like Mexico imports large amounts of oil products is lack of refining investment. As stated by Reuters, Petroleos Mexicanos (Pemex) refining operations reflect years of underinvestment as officials opted to sink money into more lucrative drilling projects. But Mexico also wants to create value for its heavy crude, with minimal cost and risk. This is an issue shared by many oil producing countries, as heavier, more difficult to refine oils*

*gradually become more prevalent in world markets. Finally, refining investment is an issue in the drive to increase natural gas use for electric power generation. The questions that arise are the following:*

- *How is Mexico dealing with this refinery problem?*
- *Is Mexico's approach adequate?*



## Background <sup>2</sup>

Mexico has the second largest proven crude oil reserves in the Western Hemisphere after Venezuela, at 28.3 billion barrels. In 2001, Mexico produced about 3.2 million barrels per day (b/d) of oil, down from about 3.5 million b/d in 2000, with net oil exports of roughly 1.8 million b/d (as compared to 1.5 million b/d in 2000). Mexico generally ranks among the world's top five largest oil producers (including crude, lease condensate, natural gas liquids, and refinery gain) and ten largest oil exporters, with almost all of Mexico's exports bound for the United States. The value of Mexican oil exports increased from \$6.4 billion in 1998 to an estimated \$10.4 billion in 2000, and oil exports account for more than one-third of government revenues. Pemex is Mexico's single largest source of general funds for the treasury and the single largest producer of hard currency for the country.

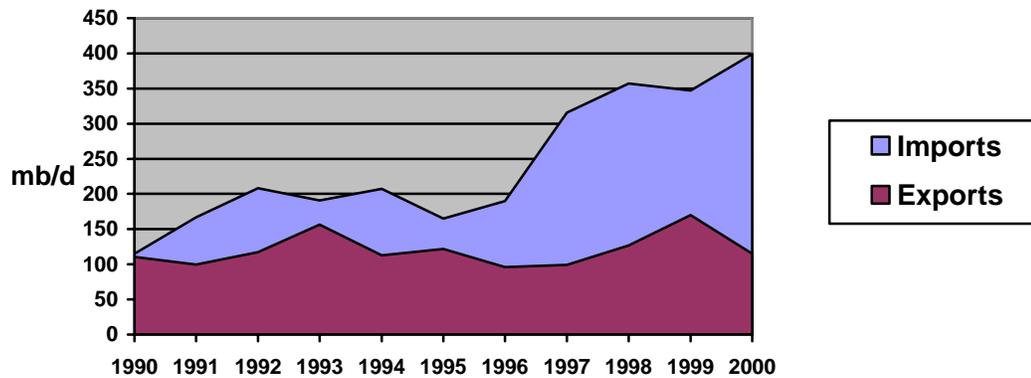
<sup>1</sup> This case study was prepared using publicly available information.

<sup>2</sup> From [www.eia.doe.gov](http://www.eia.doe.gov)

Mexico produces three grades of crude oil: heavy Maya-22, which accounts for more than half of total production; light, low-sulfur Isthmus-34, accounting for less than one-third of total production; and extra-light Olmecca-39, which is about one-fifth of total production. About three-quarters of Mexican production comes from the Campeche Bay in the Gulf of Mexico. Production at the largest field, Cantarell (located in the Gulf of Mexico of the Yucatan coast), is expected to increase in the next two years. Recent investment in the oil sector has focused more on enhancing production at existing fields than on exploration for new fields. Mexico is expected to add as much as 200,000 bbl/d of production capacity in the first half of 2001.

The Mexican oil industry was nationalized in 1938. *Petroleos Mexicanos* (Pemex), the state oil company, is one of the world's largest oil companies, the single most important entity in the Mexican economy, and a symbol of Mexican sovereignty and independence. Pemex is the only company in the Mexican oil market, upstream and downstream.

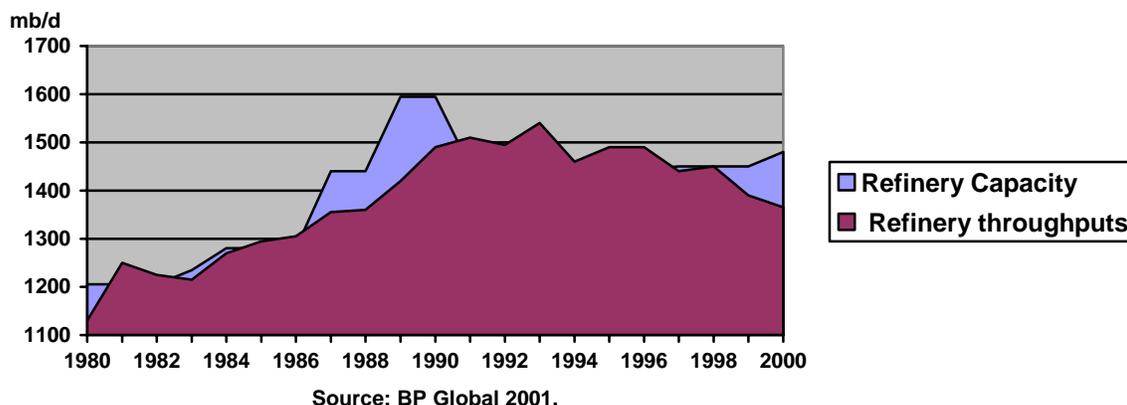
In the 1990s, Mexican imports of oil products grew faster than exports due to the high demand for transportation fuels following the economic crisis of the late 1980s. Pemex refineries have not been able to fulfill Mexico's demand for oil products, especially gasoline. Due to projections of strong economic growth in Mexico, domestic gasoline demand is forecast to reach 808,000 b/d by 2010, while demand for diesel fuel is predicted to climb to 460,000 b/d.



Source: PEMEX 2001

### Downstream

Mexico's downstream oil sector was nationalized in the 1950s. Privatization of refining in Mexico is not planned (nor is privatization of exploration and production). Although Mexico is one of the world's largest oil producers, about a quarter of the gasoline consumed in Mexico is imported due to insufficient refinery capacity. The country has six refineries, with a total throughput capacity of 1.5 million bbl/d. Major upgrades on the refineries begun in 1998 aim to: increase the percentage of gasoline and light products refined; allow refineries to process heavier crudes, such as Mexican Maya; meet clean fuel specifications; and increase overall refining capacity by 690,000 bbl/d. Work is underway at four refineries, while contracts for work at the two remaining refineries remain in the bidding process. All work is expected to be completed by 2004 (see additional information below).



Pemex refineries and their prior capacities are shown in the following table:<sup>3</sup>

Refineries	Capacity (b/d)	Catalytic Cracking (b/d)	Catalytic Reforming (b/d)
Salina Cruz	330,000	80,000	50,000
Tula Hidalgo	320,000	80,000	65,000
Salamanca	245,000	60,000	25,000
Cadereyta	275,000	60,000	25,000
Minatitlan	200,000	40,000	31,000
Ciudad Madero	195,000	43,000	33,000
<b>Total</b>	<b>1,565,000</b>	<b>368,000</b>	<b>226,000</b>

### Other Considerations for Refining in Mexico

Many producing countries export their best grades of crude oil, and consume the poorest grades at home. In Mexico, the lack of refining modernization over the years meant that large amounts of residual fuel oil or “resid” are produced. With the heavier Mayan crude as feedstock, the resid that was produced is particularly high in sulfur and other components. Without an export market for this commodity, Pemex provided resid to Comisión Federal de Electricidad (CFE) – Mexico’s national electricity organization – at very low prices. Electric power generated from this resid has contributed greatly to the extremely poor urban air quality in Mexico’s cities. Thus, in order for Mexico to displace this resid with cleaner burning natural gas, Pemex needed to find strategic solutions for refining its crudes, especially Mayan, to reduce the amount of resid produced, increase the volume and quality of oil products and instill value in its crudes that are not competitive in the world market.

<sup>3</sup> Source: EIA 2001

## The Shell-Pemex Joint Venture

In 1993, Shell sold half its interest in its Deer Park refinery near Houston to Pemex, establishing a joint venture. Pemex's \$1 billion contribution was used to upgrade and convert the plant to run medium sour crude oil with initial volumes of 140,000-160,000 barrels per day of Mayan crude oil from Mexico. The thirty-year secured supply of crude oil allows Shell to run cheaper, heavier crude oil in order to make the same product slate it has in the past. The venture also sells 35,000 to 45,000 bbl/d of unleaded gasoline to Pemex, which is about half of its import requirement. With the refining industry falling into declining margins this venture reduces its risk by leveraging investment across two participants.

In 1998, the refinery underwent a modernization effort that raised output by 60,000 b/d in 2001. The refinery improvements enable the Deer Park refinery to process 240,000 b/d of heavy Mayan crude, making Mayan crude 70% of the crude oil used at the facility. Currently, the roughly 240,000 b/d processed at the facility is more than 10% of Mayan crude oil production. Also Pemex signed a long-term deal with Clark USA in March 1998 to supply Clark's Port Arthur, Texas refinery. Clark completed a coking unit that enables the facility to process 200,000 b/d of Mayan crude.

There were several motivations for Mexico to enter into these refining agreements with foreign partners. First, it guaranteed a favorable market and price for heavy Maya crude, which only some refinery operations are able to process successfully. According to a recent analysis<sup>4</sup>, "Pemex, meantime, was finding prices unexpectedly soft for Maya crude. Though only a fraction of world oil production, supplies of heavy crude exceeded capacity of refineries to process it. As a result, Pemex was seeking ways to bolster prices for heavy crude while at the same time solidifying Mayan crude's position on world markets." Additionally, Pemex gained the opportunity to benchmark its own operations against those of the Deer Park refinery and transfer knowledge to its own operations.

The Joint Venture approach taken by Pemex was, in the company's analysis, the most cost-efficient option. The main goal was to share in the cost of refinery modernization in a way that could bring value to Pemex's Mayan crude production, rather than face the full cost of modernization at Pemex's own facilities in Mexico. Thus, instead of spending money to modernize the local refineries, as well as spending money in taxes, Pemex joined forces with Shell to minimize costs. In the meantime, Pemex is also doing minor improvements to its refineries to avoid future dependence on foreign oil products.

As to its own facilities, in 1996, Pemex committed \$5.8 billion through 2004 to modernize its six refineries. In this timeframe, Pemex anticipates increasing capacity by 690,000 b/d. A \$1.6 billion upgrading project is underway on the Cadereyta refinery. Pemex initiated the project in 1997 when it signed a contract with South Korea's Sunkyong Engineering and Construction, Germany's Siemens AG, and Mexico's Grupo Tribasa to carry out the upgrading work. Cadereyta, now 87% completed, has made the most progress of all Pemex refineries with regard to upgrades. The upgrades will increase sharply the refinery's capacity to produce jet fuel, diesel, and gasoline. Originally scheduled for completion in late 2000, the Cadereyta modernization efforts were delayed until 2002. A contract covering a \$1.2 billion modernization of the Ciudad Madero refinery was awarded to the same group in February 1999. The work includes construction of 10 new facilities and improvement to five existing ones. The Ciudad Madero refinery is located in the Gulf Coast state of Tamaulipas, and serves the Gulf Coast and central regions. Work on the Madero refinery was completed in 2002. Contracts worth \$155 million were awarded (although eventually cutback) for upgrades to the Tula refinery and \$110 million for the Salamanca refinery, both going to

---

<sup>4</sup> *Oil and Gas Journal*, [U.S. refiners find benefits in JVs with foreign partners](#)

Samsung Engineering. The Tula refinery serves Mexico City and central Mexico, while output from the Salamanca refinery goes to western and central Mexico. Salamanca is also the center for lubricant production. Both the Tula and Salamanca refinery upgrades are scheduled for completion in 2002. Mexico's ICA won a \$211 million construction contract for five sulfur plants at the Minatitlan refinery in July 1999. Just six months later the government announced it would likely freeze its improvement plans for Minatitlan, Mexico's most obsolete refinery, serving the south and the Yucatan Peninsula. The Salina Cruz refinery, located on the southern Pacific coast, is the country's largest refinery. While the government initially had plans to modernize this refinery, it eventually was postponed.

A potential drawback to the Deer Park joint venture is in the opportunity for Mexico to nominally increase oil product exports without actually lowering its net imports. In 1998 Mexico signed a pact with OPEC to limit its exports. Pemex reported the sales of crude to the Deer Park refinery as internal sales because it bought back the oil products. The catch is that Pemex sometimes sent more crude oil and received back the same fixed amount. For example, in June 1998 about 160,000 b/d of heavy Maya were processed at the Deer Park refinery. In turn, Mexico imported about 45,000 b/d in unleaded gasoline.

Source: <http://www.fe.doe.gov/international/mexiover.html> (updated Feb 2002)