

The Upstream in México Under the New Energy Reform*

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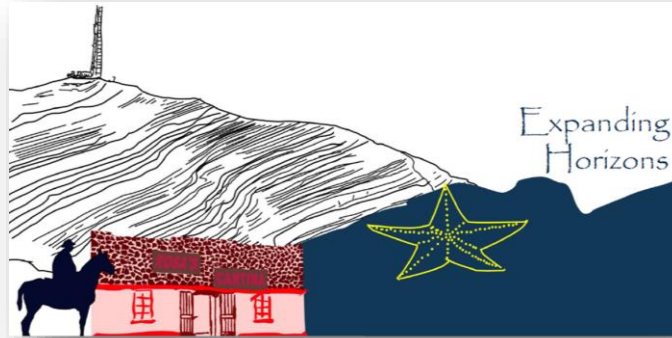
Abstract

After 2004, Cantarell, the world's largest offshore oil field that supplied two thirds of the 3.4 MMbpd production of México, started declining and Pemex, the national oil company, was unable to continue supplying that amount of oil. In late 2013 the Mexican Congress passed legislation that modified the national constitution in order to allow private participation in the upstream oil and gas business of Mexico. This had not happened before because Pemex was producing enough oil and gas to cover the domestic needs and have additional export volumes, but by the end of the decade those volumes and income started declining.

In 2014 secondary laws and regulations were enacted and the agencies necessary for overseeing the new industry were created, and Bid 1 of Round 1 was tendered. Since then 3 Bid Rounds have taken place covering a total of 10 Bids, two for deep water blocks, four for shallow water blocks, and four for onshore blocks. The process has been successful, to date 192 blocks have been tendered, 84 have been awarded, while 72 are still in the bidding process. Capital investment commitments to explore, develop and produce these blocks amount to over \$175 Billion US, and new rules and regulations for the industry have been enacted, agencies to manage the process created, and a well regarded transparent bidding and awarding process has been put in place.

Results of all this effort has yet to increase the output of the country's oil and gas production which has continued declining, now to 1.925 MMbpd and at 4.876 Bcfd, and will not increase in the short term since 90% of the areas awarded are in deep waters or frontier shallow waters where first oil is not expected before 2022. México could have avoided the loss in national output and reserves had the Ministry of Energy tendered traditional onshore areas at the same time of the offshore and dry gas prone areas onshore.

There are two oil producing onshore basins in Mexico, the Sureste Basin that was almost all reserved for Pemex, and the Tampico-Misantla Basin, a superbasin with more than 140 Bb of original oil equivalent in place of remnant conventional and unconventional resources but where only 8 blocks have been tendered under the new reform. The basin includes the Chicontepec Subbasin which has similar characteristics of the Midland Subbasin in the Texas Permian Basin. In the future the Tampico-Misantla Basin will provide the largest volumes of hydrocarbons for Mexico, just as the Permian will do for the USA.



The Upstream in México under the New Energy Reform

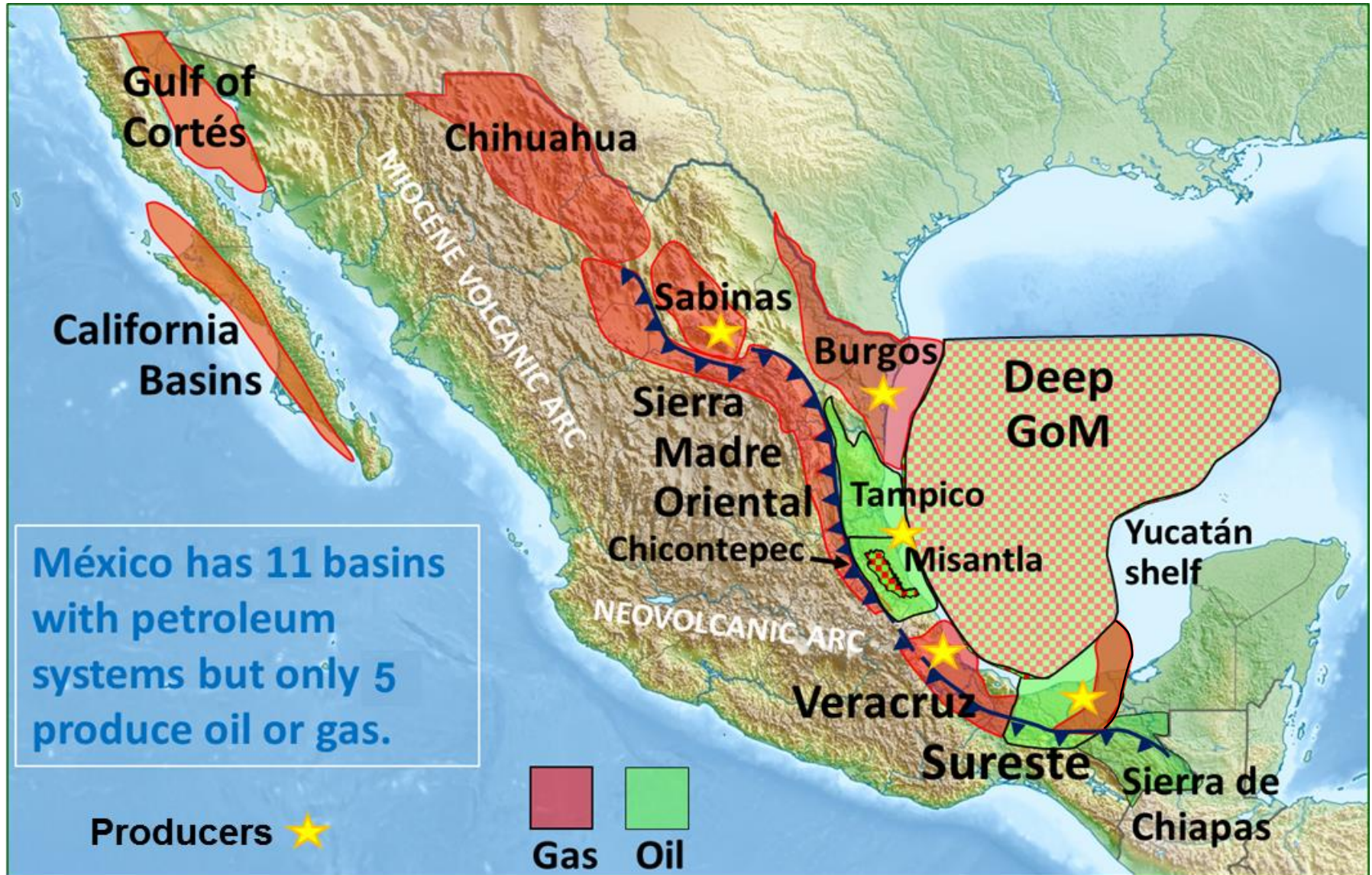
AAPG Southwest Section Convention
El Paso, Texas

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April, 2018

México's Oil and Gas Basins



Total hydrocarbons endowment

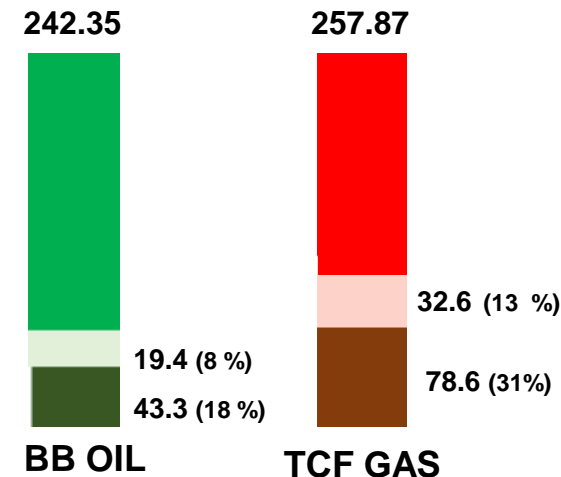
México has large volumes of discovered and undiscovered Oil & Gas

Since 1904, 242 Bbo and 256 Tcf have been discovered, including Chicontepec, but not the deep water GoM and the unconventional. Of these, only 43 Bbo and 79 Tcf have been produced. Additionally, Pemex considers there are 53 Bboe in yet to be found conventional reservoirs and 60 Bboe in unconventional yet to be booked.

	Orig. Vol.		Cum. Prdn.		3P Reserves		Resources	
	OOIP Bb	OGIP Tcf	Bb	Tcf	Bb	Tcf	Conv. Bboe	Unconv. Bboe
TAMPICO - MISANTLA	90.83	81.31	5.82	8.26	4.53	11.64	2.40	34.80
SURESTE OFFSHORE	109.81	65.78	26.41	21.27	12.95	11.72	16.80	
SURESTE ONSHORE	40.14	76.27	10.90	31.28	1.88	5.44		
BURGOS (+ SABINAS)	0.33	27.59	0.04	13.91	0.00	3.10	3.40	24.80
VERACRUZ	1.23	6.92	0.09	3.91	0.09	0.67	1.40	0.60
G. DE MÉXICO PROFUNDO							27.10	
YUCATÁN							1.50	
TOTAL	242.35	257.87	43.26 18 %	78.64 35 %	19.45 8 %	32.57 13 %	52.60	60.20

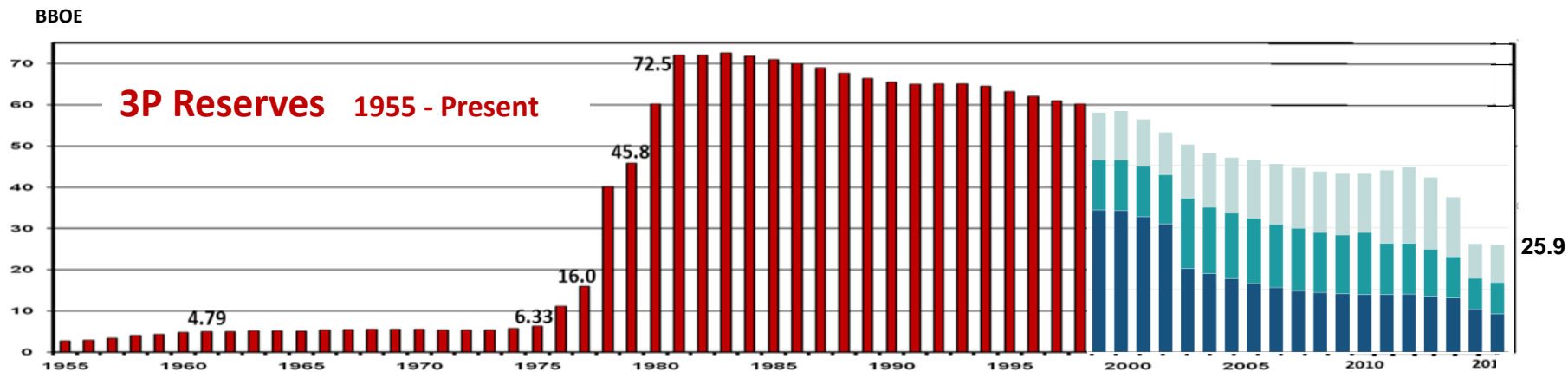
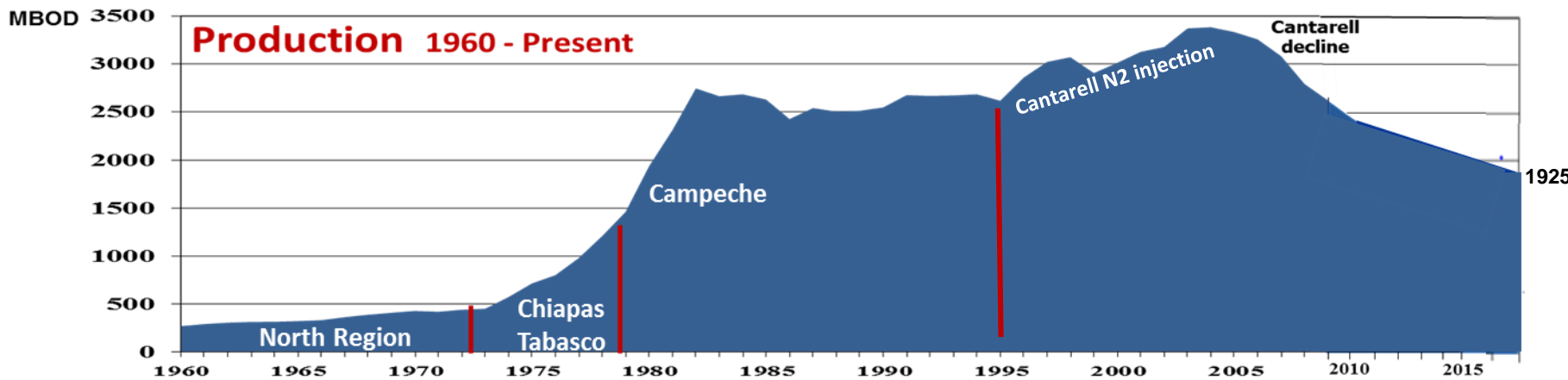
The expected EUR is:

- 26 % of the OOIP
- 44 % of the OGIP



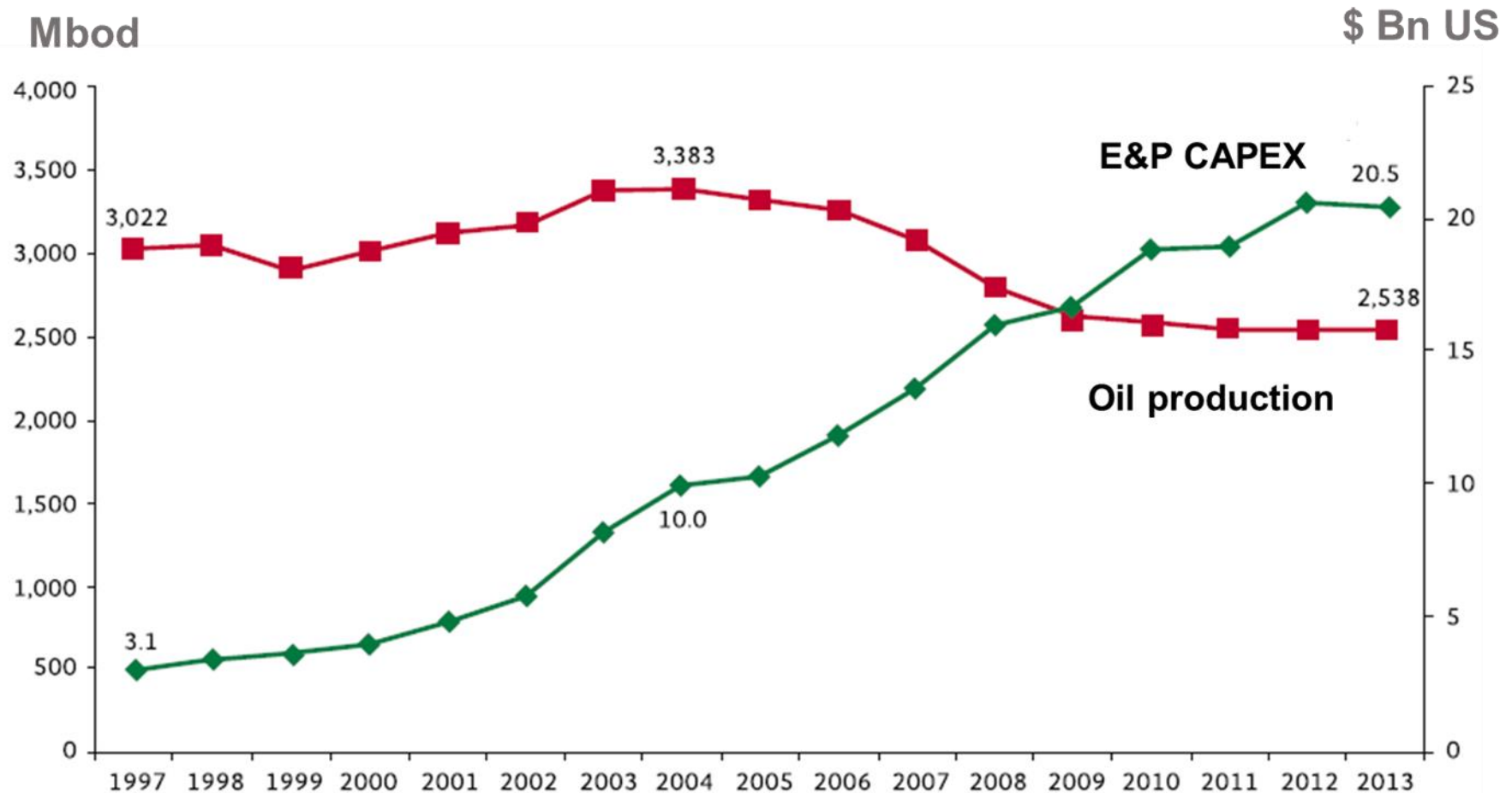
A success story gone sour

After the mega discoveries in Southeastern México in the 1970's and 1980's exploration was all but abandoned. The results in the reserves were immediate, for the production it became clear when Cantarell started declining in 2004.



Reasons for the Energy Reform

With Cantarell declining total oil output decreased, regardless of incremental investments in E&P. Cantarell was responsible for 65% of the total production of Mexico. It became impossible for one oil company to satisfy the O&G needs of the whole nation.



The Energy Reform

So, on December 20th 2013, the President of México signed into law seminal constitutional modifications in the energy sector having to do with oil, gas and electricity:

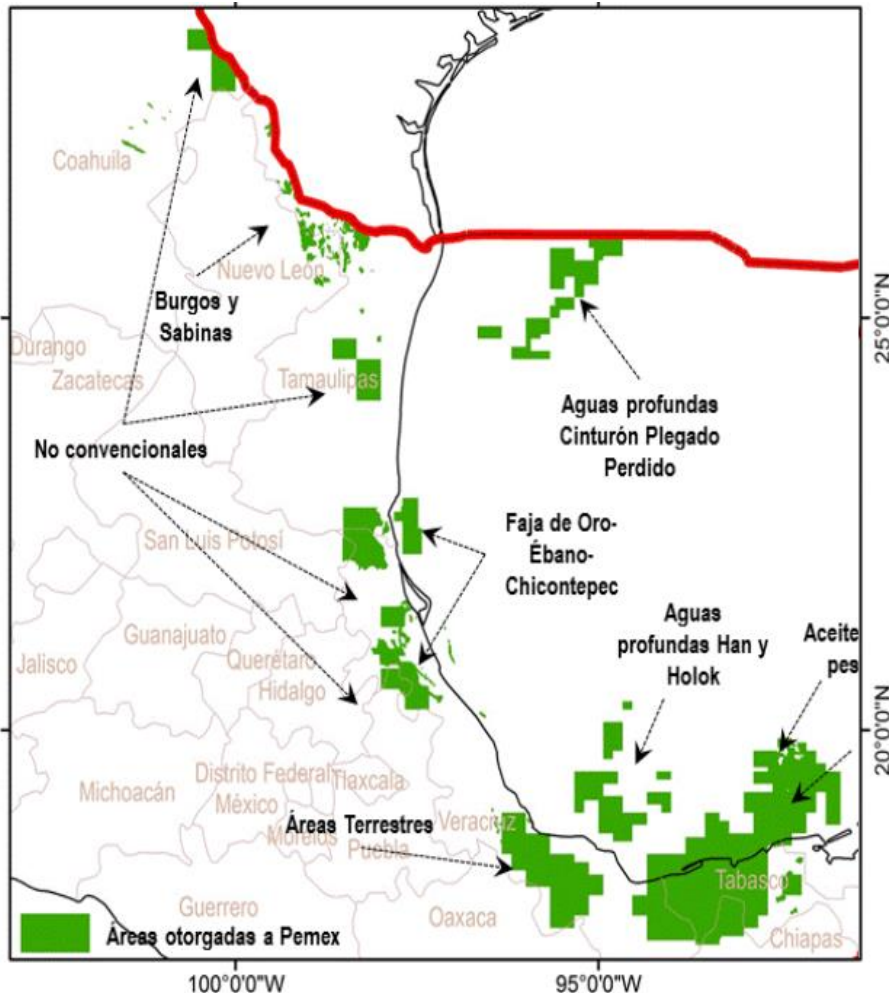
Article 25	Article 27	Article 28
<ul style="list-style-type: none">• Creates "State Productive Enterprises"• Pemex will operate as any international oil enterprise able to do JV's and contracts as it sees fit to fulfill its charter.	<ul style="list-style-type: none">• Oil and gas resources belong to the Nation. Hydrocarbons in the subsurface also belong to the Nation.• The State may contract with third parties for their exploration and production.	<ul style="list-style-type: none">• E&P activities will no longer be carried out as a monopoly.• A sovereign trust fund will manage after tax profits generated by the licenses and contracts.

Several state agencies were created to manage and regulate industry's activities

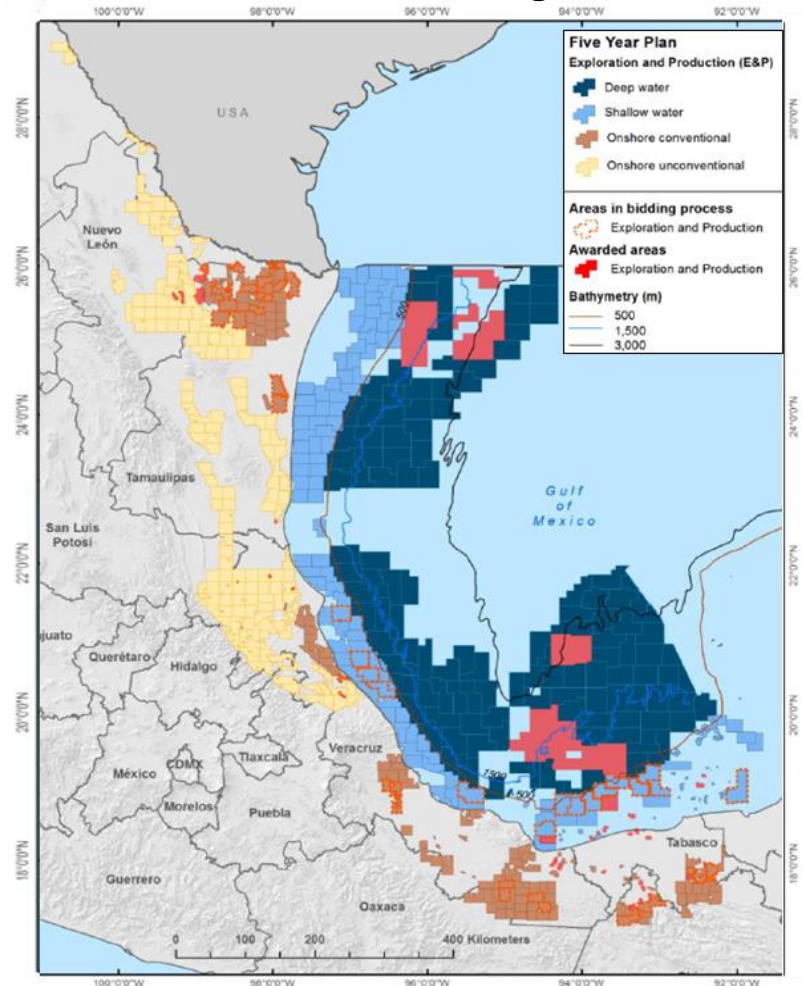
Bid Rounds

In early 2014 the government awarded Pemex the assets and areas where it had most of its investments and started competitive bid rounds for the areas not awarded to Pemex.

Round "0" Areas Awarded to Pemex



2015-2019 Bidding Plan

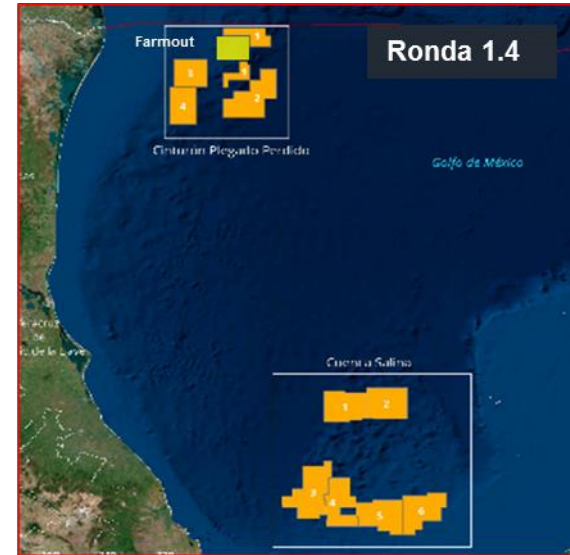


Round 1

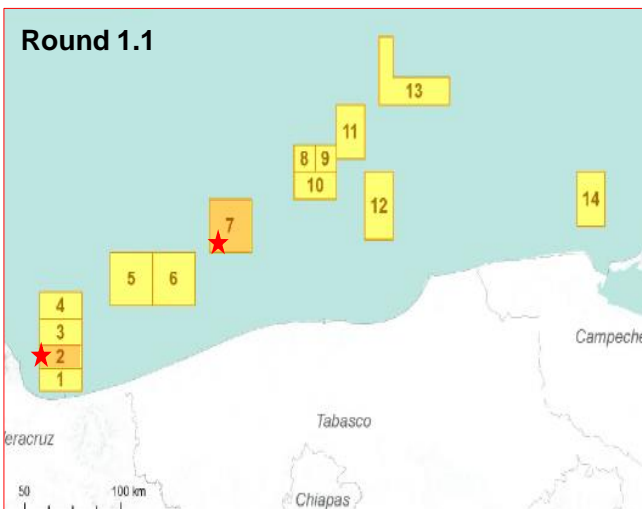
In Round 1, 38 blocks were awarded of 54 tendered:

- Bid 1.1:** 2 of 14 blocks awarded
 - Bid 1.2:** 3 of 5 blocks with fields awarded
 - Bid 1.3:** 25 of 25 blocks with fields awarded
 - Bid 1.4:** 8 of 10 blocks awarded
- One Pemex farmout was awarded

Exploration, deep waters



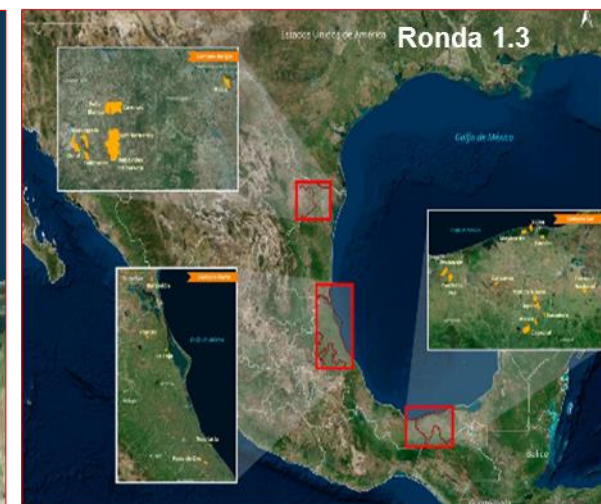
Exploration, shallow waters



Extraction, shallow waters



Extraction, onshore

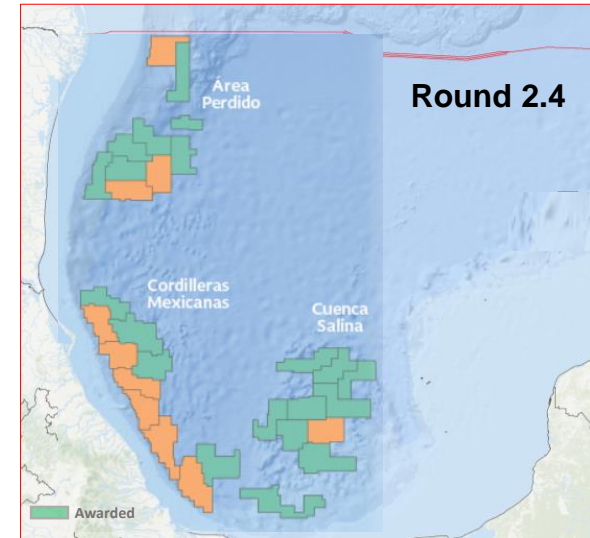


Round 2

In Round 2, 46 blocks were awarded of 70 tendered:

- Bid 2.1:** 6 of 15 blocks awarded
- Bid 2.2:** 7 of 12 blocks with fields awarded
- Bid 2.2:** 14 of 14 blocks with fields awarded
- Bid 2.4:** 19 of 29 blocks awarded

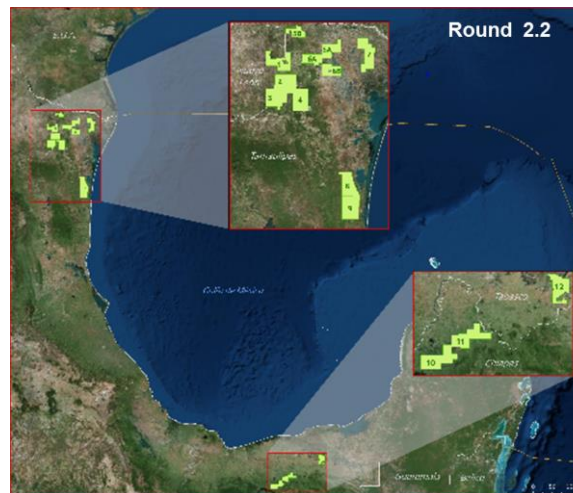
Exploration, deep waters



Exploration in shallow waters

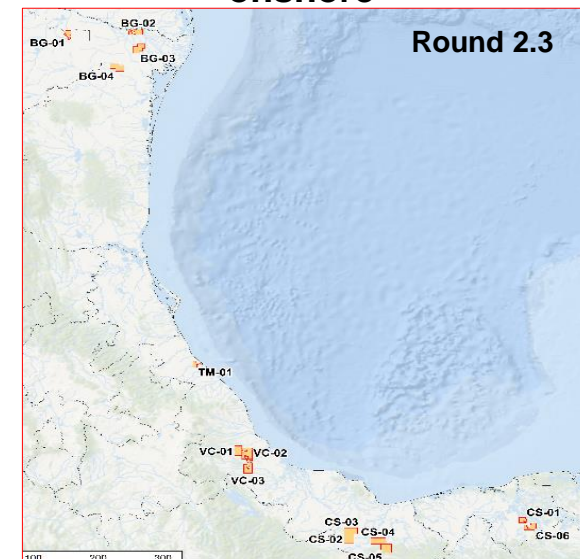


Exploration and extraction onshore



Source: CNH

Exploration and extraction onshore



Round 3

In Round 3 (ongoing), 81 blocks have been tendered:

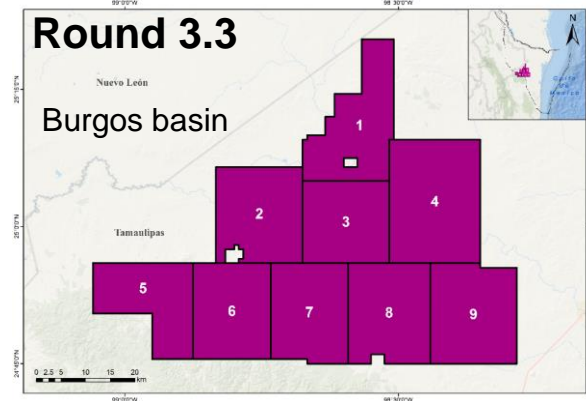
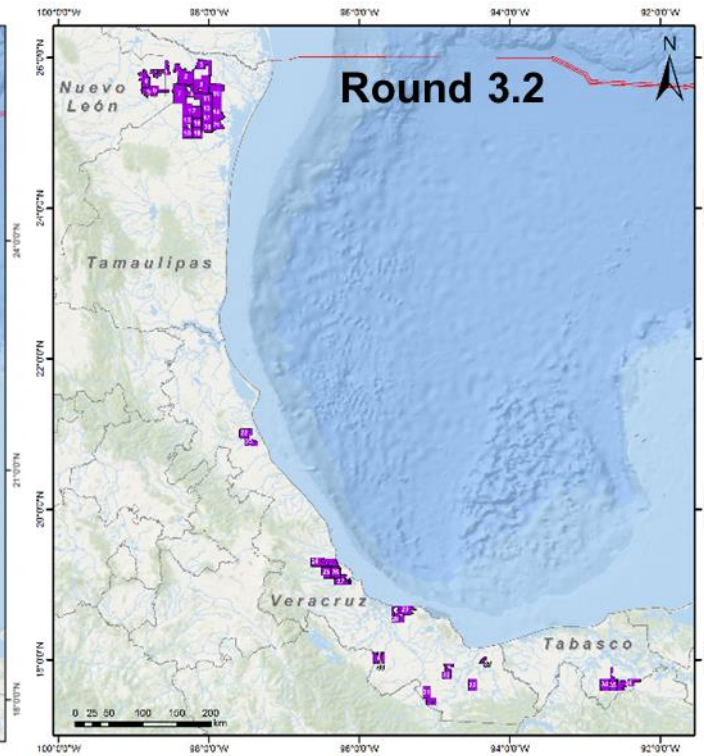
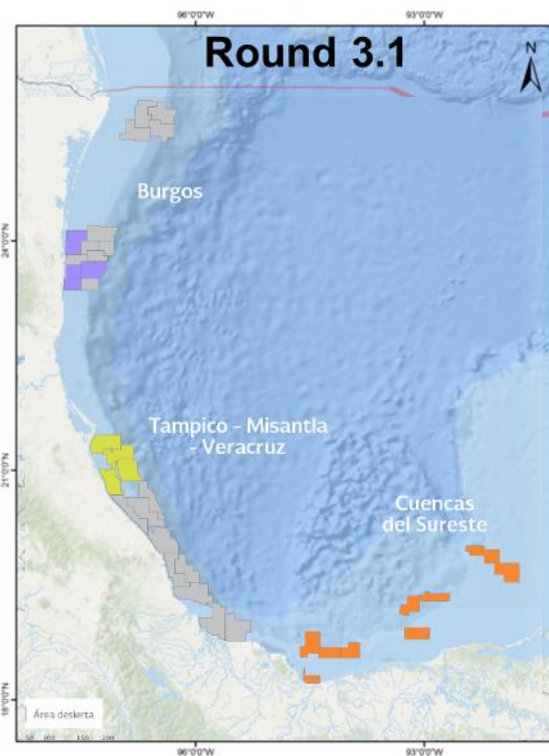
Bid 3.1: 16 of 35 blocks were awarded in shallow waters for Exploration.

Bid 3.2: 37 blocks onshore for Exploration and Extraction (July 2018)

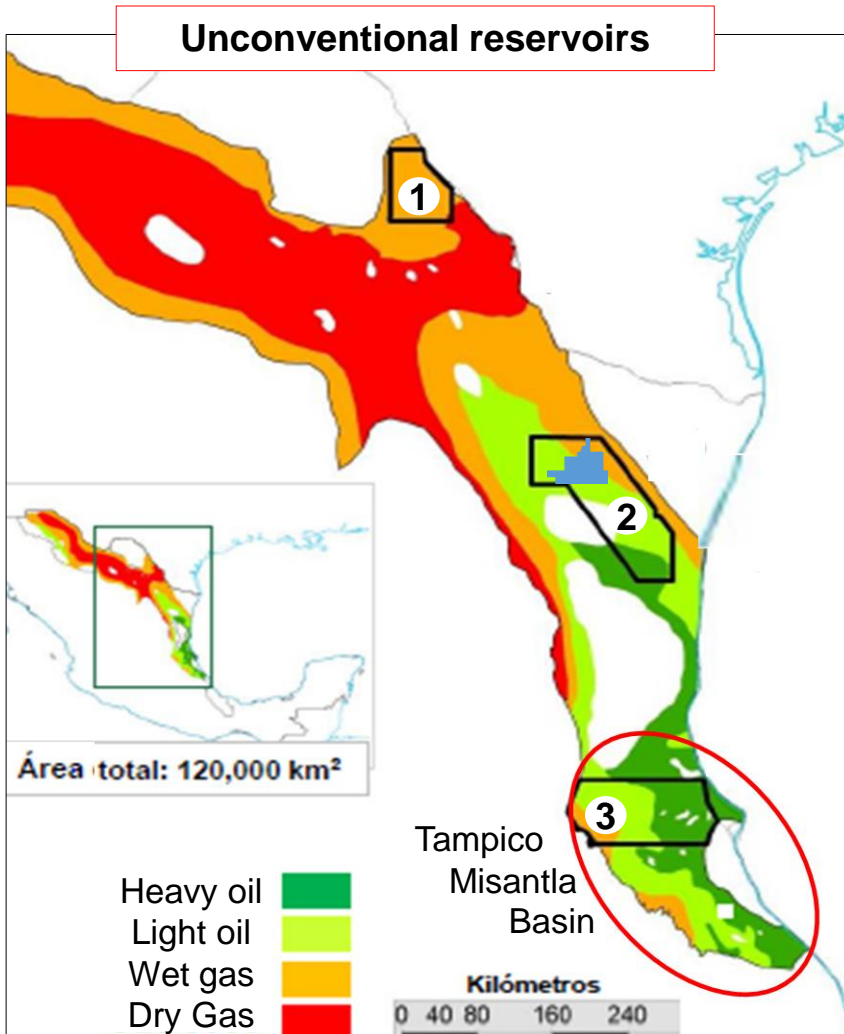
Bid 3.3: 9 blocks onshore for Extraction of unconventional oil and gas (Sept. 2018)

Additionally, 4 bids have been carried for Pemex JV's with third parties.

A total of 107 contracts have been awarded covering 88,650 Km² (21,905,892 acres)



Unconventional oil and gas



Unconventional resources are considered to be:

Shale gas:

545 Tcf (EIA)

141 Tcf (Pemex)

Tight oil:

13 Bboe (EIA)

32 Bboe (Pemex)

Most of these resources are, for the oil in the Tithonian and Lower Cretaceous and do not consider the tight oil in Chicontepec. The gas is mostly in the Eagle Ford although there could be good plays in the Paleozoic of Chihuahua.

Areas in the oil bearing rocks of the Tampico – Misantla basin have not been tendered.

Best areas (Pemex):

1. Liquids rich gas

2. Light oil

3. Light and heavy oil



Chicontepec, another Midland basin?

SPE 74407

Comparison of Reservoir Properties and Development History: Spraberry Trend Field, West Texas and Chicontepec Field, Mexico
 Chris J. Cheatwood, Pioneer Natural Resources Company and Alfredo E. Guzman, Pemex E&P



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Abstract

The Spraberry and Chicontepec fields are both giant oil fields contained within areally extensive, low porosity and low permeability submarine fan reservoirs. Each field has a gross interval of approximately 1,000-1,500 feet (300-450 m) with multiple reservoirs less than 10,000 feet (3,000 m) deep. Sand-prone intervals are laterally extensive and can be correlated regionally, but do have localized channeling. Both fields produce from solution-gas drive.

The Spraberry Trend Field, located in the Midland Basin of West Texas, was discovered in 1948. The field is estimated to contain over 10 billion barrels of original oil in place in a series of stacked Permian-age reservoirs covering over 2,500 square miles (6,475 sq. km). Cumulative production from the Spraberry is approximately 850 million barrels of oil and 3 trillion cubic feet of gas or approximately 8% of the original oil in place.

The Chicontepec Field, located in the Sierra Madre Oriental foothills in east-central Mexico, was first drilled in 1931. The field is estimated to contain 140 billion barrels of original oil in place and 35 trillion cubic feet of associated gas in a series of stacked Late Paleocene to Eocene-age reservoirs covering approximately 1,440 square miles (3,731 sq. km). Cumulative production from the Chicontepec Field is just over 140 million barrels of oil-equivalent or 0.1% of the original hydrocarbons in place.

However, the fields do differ significantly in their development history. Over 18,000 wells have produced some oil and gas from the Spraberry (over 10,000 currently producing) as compared to less than 1,000 in Chicontepec. Managing drilling costs, fracturing technology and controlling production costs along with economies of scale have allowed

the Spraberry, once known as the world's largest uneconomic field, to be developed. Developing the Chicontepec field using similar methods would add significant reserves and production volumes for Mexico.

Introduction

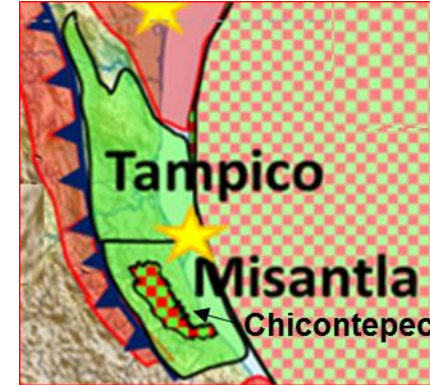
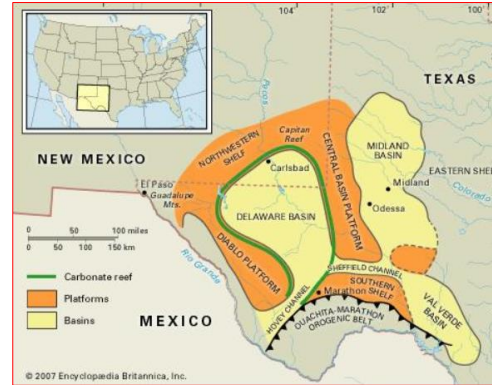
As we all know, finding new giant accumulations of oil and gas through exploration, especially in areas close to markets and existing infrastructure, is becoming increasingly difficult. An alternative is to look at previously discovered fields in these "mature" areas that are underdeveloped because of their historically low margin economics. Often through the use of new technology and by creative cost-cutting methods significant new production and reserves can be developed to u quickly meet consumer demand even without higher commodity prices.

This paper is a high-level comparison of two such fields; discussing the reservoir properties which have caused them to be deemed "uneconomic" and contrasting the development histories to suggest significant new reserves can be economically produced near-term from one that is underdeveloped.

The two fields are the Spraberry Trend Field located in the Midland Basin in West Texas and the Chicontepec Field located in east-central Mexico (Fig. 1). Both are located in mature producing regions where numerous other fields, including fields with significantly less original hydrocarbon in place, but with better reservoirs, have produced millions of barrels of oil and billions of cubic feet of gas.

Reservoir Properties

Spraberry. The Spraberry Trend Field produces from an elongate, submarine fan system deposited within the Midland Basin during Permian time approximately 250 million years ago (Fig. 2). The sands and silts were derived from the erosion of mainly sedimentary rocks primarily north to northwest of the Midland Basin shelf, transported parallel to basin axis and deposited as areally extensive sheets in the basin center. Overall, sand and silt content of the submarine fan system decreases from north to south, supporting the northern source of the sands (Fig. 3). Perpendicular to the transport direction, sand content is highest along the basin center suggesting the fan channel systems were focussed along



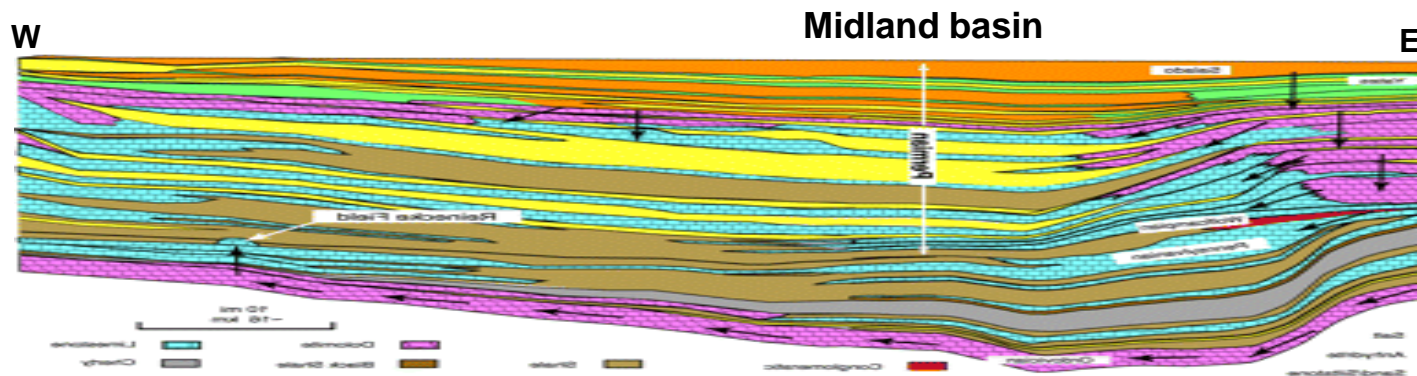
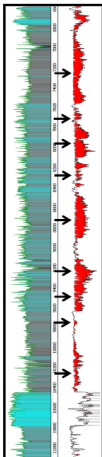
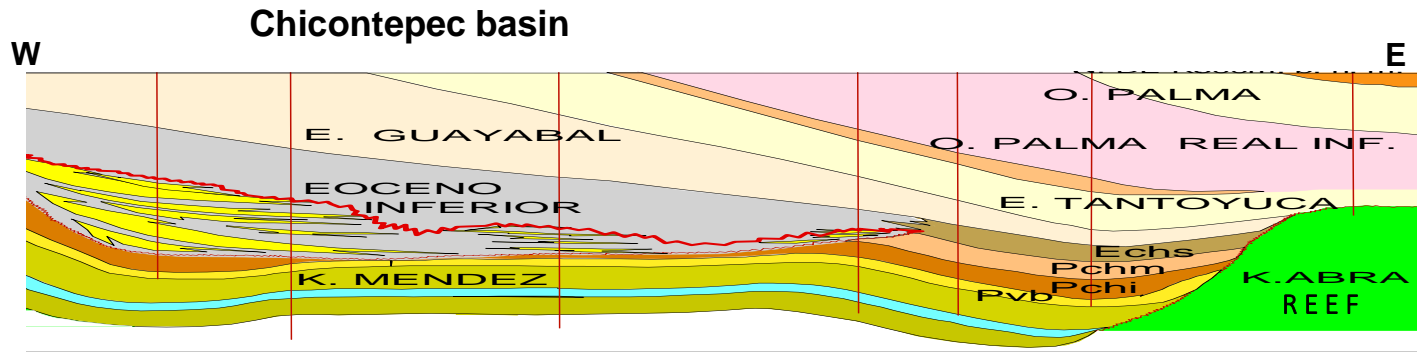
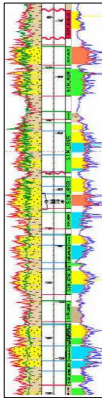
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Chicontepec and Midland basins

Both have stacked sands, silts and shales of turbiditic origin saturated with oil.

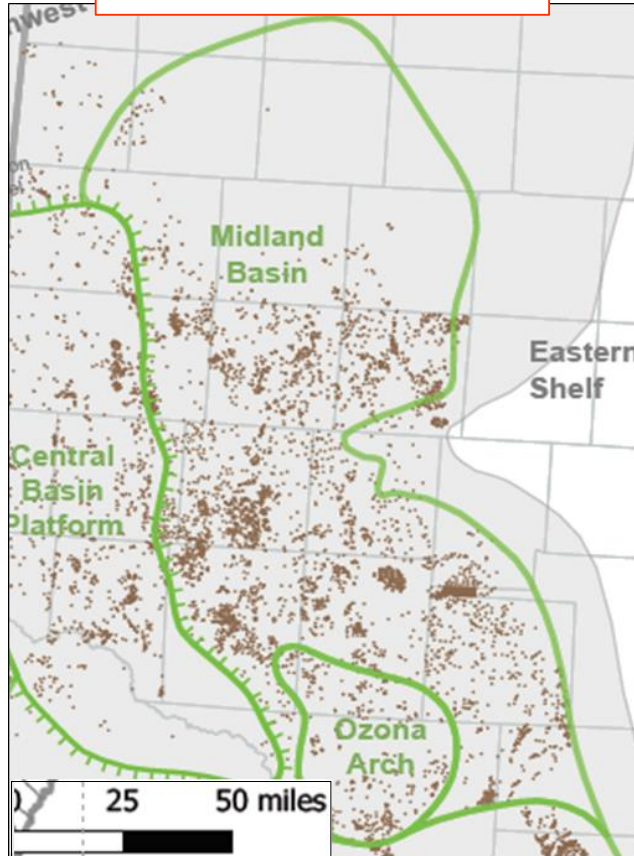


Source: PXD



Comparison of the two basins

**Permian basin
Midland sub basin**

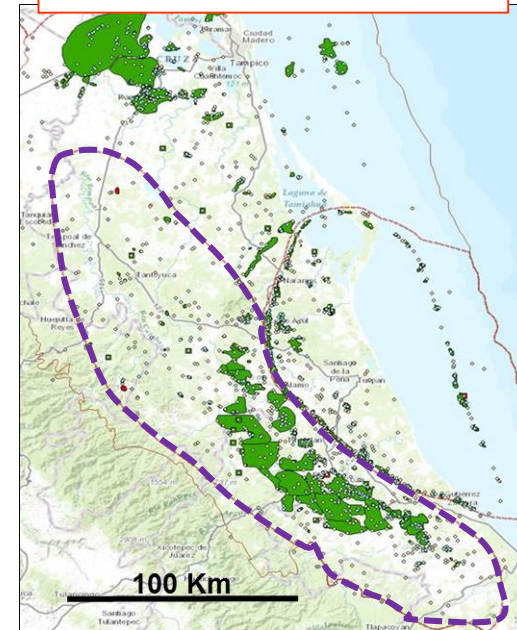


Permian basin	Tampico – Misantla basin
Cum. prdn. 35 Bboe	Cum. prdn. 7 Bboe
OOIP ? Bboe	OOIP 107 Bboe
Recoverable oil 150 Bboe	Recoverable oil 42 Bboe
Production 3 MMbod	Production 0.1 MMbod
Midland sub basin	Chicontepec sub basin
Recoverable oil 75 Bboe	Recoverable oil 41 Bboe ★
Production 1.9 MMboe/d	Production 0.05 MMboe/d
Cum. Prdn. > 2 Bboe	Prdn Acum. < 0.3 Bboe.
Total wells > 500,000	Total wells < 3,000

EIA / Pioneer

Pemex / CNH

**Tampico – Misantla basin
Chicontepec sub basin**



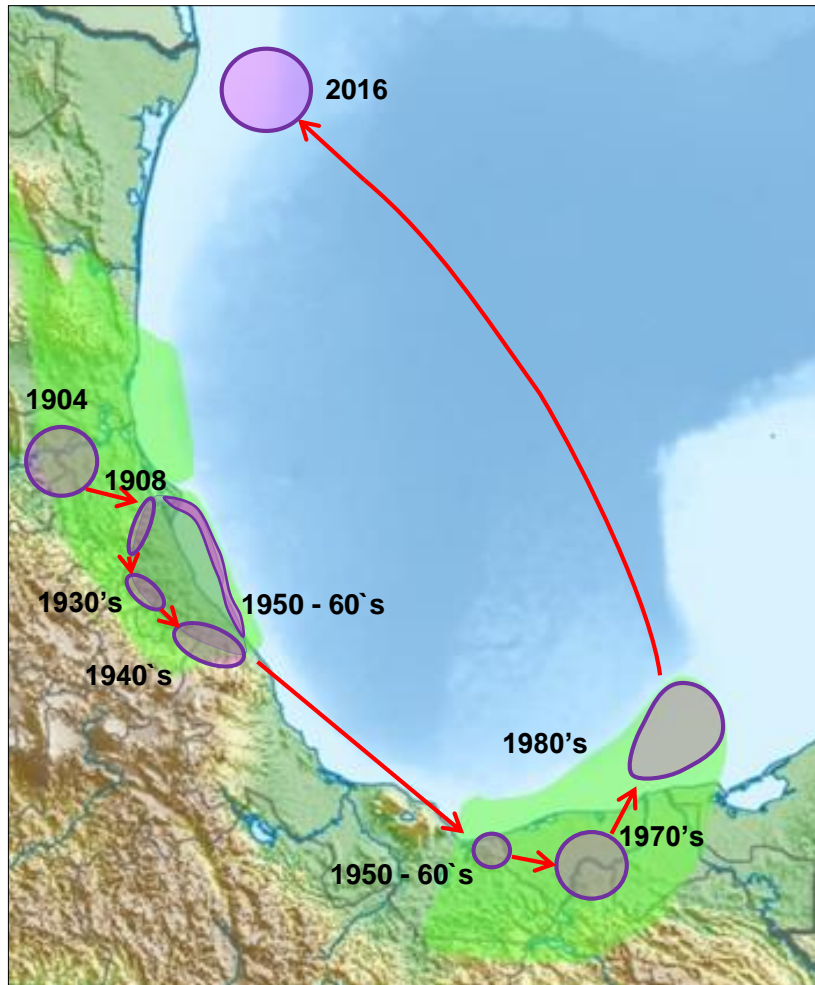
It is very important to note that the 41 Bboe just refer to the Tertiary sub basin and do not consider the recoverable tight oil resources in the Mesozoic.

Why is the Tampico- Misantla basin under exploited



The “Bitten Apple” Syndrome A. Lajous

Every time a new more productive province was discovered the previous ones were pretty much abandoned. Valid for an individual oil company but not for the total of an oil rich country.



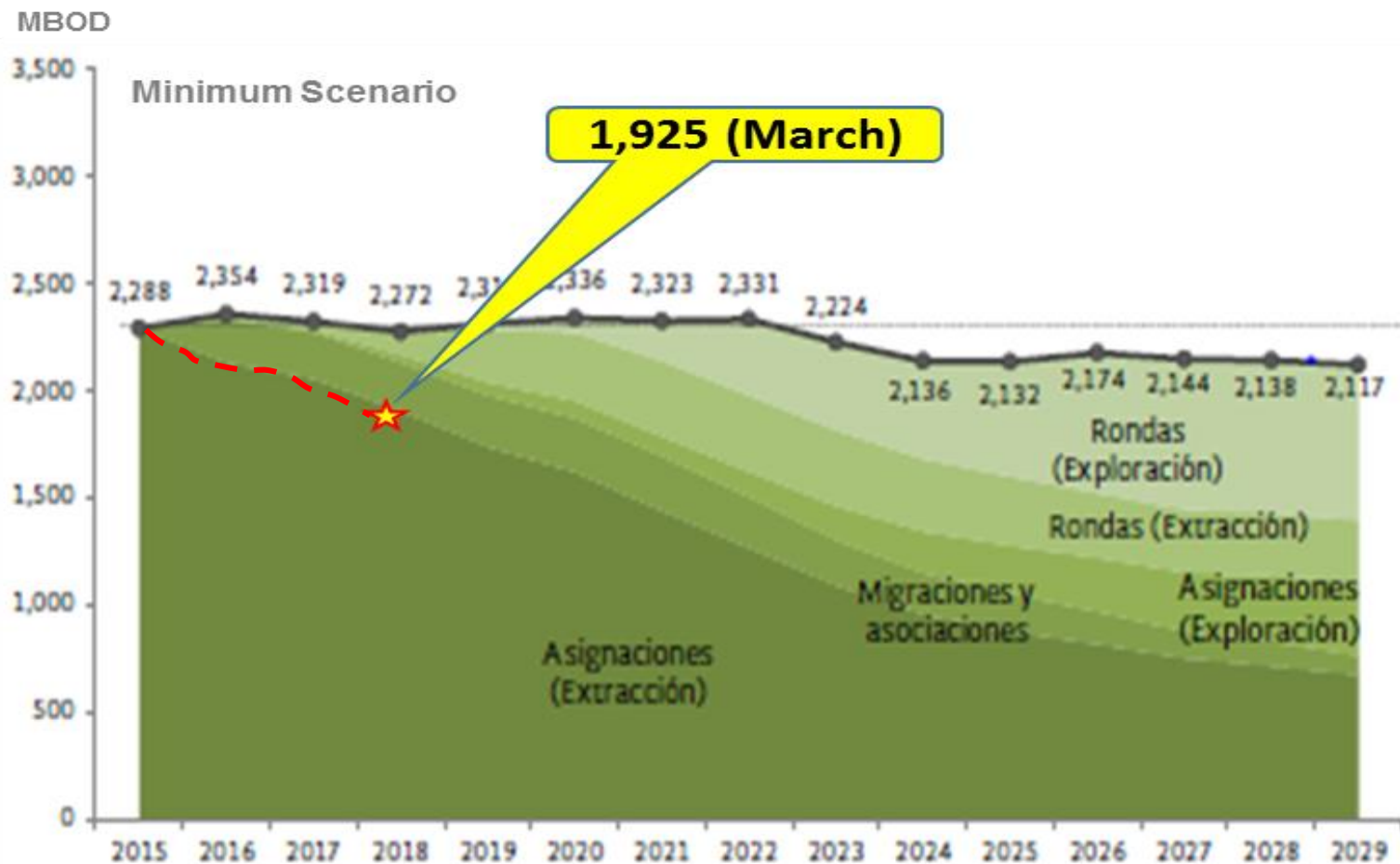
After the big discoveries of the late 1970's and 1980's exploration was also abandoned!



Final considerations

In 2015 the expectations were to extract under a *Minimum Scenario* an average of 2.3 MMBOD until 2022 and 2.1 MMBOD from 2022 to 2029.






Onshore exploration and development would have allowed to meet the *Minimum Scenario*.





Final considerations

The upstream under the Energy Reform has mixed results:

-  – Several agencies were created to manage the new industry ecosystem.
-  – 107 blocks have been awarded of 166 tendered through 10 competitive transparent bid rounds, companies from at least 20 countries will operate them.
-  – 46 additional blocks are been tendered in two additional bid rounds.
-  – Tenders covering offshore deep and shallow waters and onshore gas are extensive and with good potential but those for onshore oil are few and with little materiality.
-  – After five years, no results of the reform are evident to the people, regardless of future commitments for investments for over \$200 Bn US.
-  – Offshore production will not come online before 2021 or 2022.
-  – Pemex is now able to enter into JV's and farmout some of its fields. So far it has done 11 associations and 5 farmouts and is in the process of doing several more.
-  – Only six small, depleted fields and two exploration areas for conventional onshore oil have been tendered in the extremely prolific Tampico – Misantla super basin.
-  – Had México tendered since 2014 large portions of this basin it would have made up for a good part of the 1.5 MMbod of lost production since 2004.
-  – No tenders for unconventional oil in the Tampico - Misantla basin have been put out even though the potential is likely to be as large as that of the Permian basin.

**El Tajin
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Veracruz**

Thank you



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