Mexico’s natural gas demand, energy reform and gas supply projects

Analítica Energética S.C.

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Mexico’s energy to GDP

**GDP**
- 2013 = 1.1%
- 2014 = 2.7%
- 2015 = 3.7% or 4.5%?
- 2018 > 5.0%?

**Uncertainties**
- Success of 11 major reforms
- Energy prices & energy intensity
- Energy related investments
- Oil incomes (7.8% GDP in 2013)

**Careful handling of**
- National debt
- Exchange rate
- Interest rates
- Social interactions

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**GDP* growth scenarios**

- All the reforms add growth
- Effects of the Energy Reform
- Inertial growth

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* Ministry of Finance (SHCP XII/2013). Reforms: energy, telecom, finances, tax
Risk of a deficitary energy balance
(National Energy Strategy 2013-2027)

Primary Energy balance projection
(MMbdoe)
Need to increase the production of oil and gas

During the last years gas production has shown a declining trend due to low gas prices.

Lower prices yield lower returns for dry gas projects than the returns obtained from associated gas production or from crude oil projects.

Historically the price of natural gas had a behavior similar to petroleum products.

In recent years, the price of natural gas in North America has been de-linked from oil prices and it has declined to levels lower than the price of coal.
Natural gas production (forecast 2013) (high case - million cubic feet per day)

- Production at Burgos falls by 34% and Cantarell by 77%.
- Initial gas shale production starts in 2017 with 34 mmpcd, reaching 179 mmcf/d in 2027.
- Deep water gas production starts around 2015-2017 with 153 mmcf/d from Lakach. By 2023 the project Han produces 9 mmcf/d. The projects Holok, Perdido and Tlancanán manage to produce 1,592 mmcf/d in 2027.
Natural gas demand grows at 3.2% per year.

Power Generation in total gas demand passes from 46% in 2013 to 56% in 2028.

Within the power sector gas consumption grows at 4.6% per year, representing 47% of the total primary energy consumption in 2012 and 72% in 2028.

The base case scenario for domestic gas production before the Energy Reform shows an increase from 4.5 bcf/d in 2013 to 6.0 bcf/d in 2028.

Imports increase from 2.7 bcf/d in 2013 to 5.5 bcf/d, mainly through Pemex.
Programmed investments in energy infrastructure 2014-2018

### Mexican pesos in trillions = 10^12

1. Oil and gas E&P
   - 73% (2.4 trln Mx pesos)
   - 27% (0.6 trln Mx pesos)

2. Process capacity to transform oil and gas
   - 78% (0.6 trln Mx pesos)
   - 22% (0.2 trln Mx pesos)

3. Petrochemicals
   - 74% (0.05 trln Mx pesos)
   - 26% (0.01 trln Mx pesos)

4. Fuel transportation and storage projects
   - 74% (0.2 trln Mx pesos)
   - 26% (0.1 trln Mx pesos)

### Equivalent in US dollars in billions = 10^9

- **Total expected investment**: 3.9* (298*)
  - Private investment: 1.1 (81)
  - Public investment: 2.8 (217)

5. Electricity generation
   - 73% (0.3 trln Mx pesos)
   - 27% (0.1 trln Mx pesos)

6. Electricity transmission and distribution.
   - 100% public investment (0.25 trln Mx pesos)

Energy Reform

The Constitutional Articles 25, 27 and 28 were amended to make possible a substantial energy reform in Mexico. The key topics of change are defined in 21 “Transitories”.

To comply with the Constitutional mandate, the Federal Executive proposed nine initiatives:

- Hydrocarbons (Arts. 27, 28, Transtories 4, 5, 7, 8, 16)
- Electricity (Arts. 27, 28, Transtories 4, 11)
- Geothermal (Art. 25, Transtories 11, 17, 18)
- State Productive Enterprises (Art. 28, Transtories 3, 20)
- Federal Administration and regulators (Art. 28, Transtories 10, 12, 13)
- Oil and gas taxation (Art. 27, Transtories 4, 5, 9, 11, 14)
- Mexican Petroleum Fund (Art. 28, Transtories 14, 15)
- Budget (Art. 27, Transtories 14, 21)
- Safety & Environmental Protection (Art. 25, Transtories 17, 19)

- 9 new laws were created
- 12 existing laws were modified
- 7 laws on renewable energy will soon be presented by the Executive

- 8 enabling laws have been published
- Guidelines, procedures and standards are being prepared
Organizational change in the energy sector

Energy sector coordination

Regulatory agencies

State and private actors

Research Institutes

CENACE

CENAGAS

System operators

State productive companies

Oil, gas, electricity, renewable, transportation, distribution, refining, and others

Private companies

ANSIPA: National Agency for Industrial Safety and Environmental Protection in the Hydrocarbons Sector

SEMARNAT
New natural gas market architecture

Natural gas BTU

- PEMEX
  - MGI
  - PEP
- OTHER PRODUCERS AND IMPORTERS

CENAGAS AS OPERATOR OF THE NATIONAL INTEGRATED TRANSPORTATION NETWORK

- CENAGAS AS PERMITTEE

PRIVATE PERMITTEES

Open access rules

Supply contract

Final users capacity reservation

Btu purchase

TRADING COMPANIES

Gives the trading company the temporary management of its capacity

FINAL USERS

- Industry
- Power generation
- Self supply
- Local gas utilities

Gives the trading company the temporary management of its capacity
Oil and gas exploration and production

- Gives PEMEX the right to E&P based on the CNH’s opinion
- Approves the E&P plans
- All contracts can be signed through tenders based on the criteria established by the Ministries of Energy and Finances.
- State Productive Companies (including PEMEX) and private companies can participate.
- Establishes the Contract Model: Services, Profit sharing, Production sharing or License.

### MINISTRY OF ENERGY
- Selects the areas with the support of the CNH
- Approves the 5 year plan for tenders
- Plans and announces the rounds of tenders

### MINISTRY OF FINANCES
- Defines the fiscal terms of the tenders
- Defines the variable to choose the winner
- Manages and audits the contracts

### CNH
- Defines the terms and conditions for the tenders
- Proposes the 5 years plan for the tenders
- Subscribes, manages and supervises the contracts
Round Zero: PEMEX share in E&P

It includes
- All producing fields and areas where there are commercial discoveries.
- The main producing areas are in the Southeast.
- Chicontepec, many areas with significant activity, maintaining the “Integral Services Contracts”.
- A minor share of shale resources.

Assignments granted on August 13, 2014

<table>
<thead>
<tr>
<th>Type</th>
<th>Volume granted (mmboe)</th>
<th>Granted/Applied (%)</th>
<th>Area Granted (Km2)</th>
<th>Reserves/Production (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserves 2p</td>
<td>20,589</td>
<td>100</td>
<td>17,010</td>
<td>15.5</td>
</tr>
<tr>
<td>Prospective resources</td>
<td>22,126</td>
<td>67</td>
<td>72,897</td>
<td>5.0*</td>
</tr>
<tr>
<td>Conventional</td>
<td>18,222</td>
<td>70.9</td>
<td>64,489</td>
<td></td>
</tr>
<tr>
<td>Non-Conventional</td>
<td>3,904</td>
<td>51.6</td>
<td>8,408</td>
<td></td>
</tr>
</tbody>
</table>

With this volume Pemex could produce 2.5 mmbd during 20.5 years.
Pemex: joint ventures

Pemex will put for tender several *Farm Outs* in fields and exploration areas that were assigned by the CNH

- The goal is to accelerate the development and to increase production.
- To have access to better practices and technologies.
- To liberate capacity and to reduce capital requirements.

**Priority fields for immediate *Farm-outs***

- Fields that could have a significant impact in Mexico’s oil and gas production.
- Fields that arise strong interest among possible partners.

**Identified fields**

- Mature fields that need to optimize the recovery factor and the rate of return.
- Groups of fields with extra heavy crude in offshore areas.
- Giant deep water gas fields.
- Crude oil discoveries in the Perdido Areas.
# Migration from old contracts to new contracts and farm outs

The migration from older CIEP* and COPF* contracts to new contractual schemes, as well as the *farm out* proposed by Pemex will require large financial and operational capacities.

<table>
<thead>
<tr>
<th>Type</th>
<th>Stage</th>
<th>Area Km²</th>
<th>2P reserves mmboe</th>
<th>3P reserves mmboe</th>
<th>Investment mm US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migration from Assignments to</td>
<td>First (11</td>
<td>11,440</td>
<td>569</td>
<td>1,083</td>
<td>11,380</td>
</tr>
<tr>
<td>Contracts</td>
<td>contracts)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Second (11</td>
<td>8,626</td>
<td>1,639</td>
<td>3,439</td>
<td>32,780</td>
</tr>
<tr>
<td></td>
<td>contracts)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm Outs</td>
<td>(High Priority)</td>
<td>612</td>
<td>1,556</td>
<td>2,664</td>
<td>32,295</td>
</tr>
<tr>
<td>Dic-14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dic-15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>20,678</td>
<td>3,764</td>
<td>7,186</td>
<td>76,455</td>
</tr>
</tbody>
</table>

* CIEP: Integral E&P contracts; COPF: Financed Public Works Contracts
Natural gas and liquids.
Remaining reserves at January 1st 2013

Gas natural
(miles de millones de pies cúbicos)

<table>
<thead>
<tr>
<th>Probadas</th>
<th>Probables</th>
<th>2P</th>
<th>Posibles</th>
<th>3P</th>
</tr>
</thead>
<tbody>
<tr>
<td>17,075</td>
<td>17,827</td>
<td>34,902</td>
<td>28,327</td>
<td>63,229</td>
</tr>
</tbody>
</table>
Large potential resources in deep water and non conventional areas

Prospective resources (billion barrels of oil equivalent)

<table>
<thead>
<tr>
<th>Area</th>
<th>Prod.</th>
<th>Reserves</th>
<th></th>
<th></th>
<th>Prospective resources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1P</td>
<td>2P</td>
<td>3P</td>
<td>Conv.</td>
</tr>
<tr>
<td>Sureste</td>
<td>45.4</td>
<td>12.2</td>
<td>18.2</td>
<td>25.1</td>
<td>20.1</td>
</tr>
<tr>
<td>Tampico Misantia</td>
<td>6.5</td>
<td>1.0</td>
<td>7.0</td>
<td>17.7</td>
<td>2.5</td>
</tr>
<tr>
<td>Burgos</td>
<td>2.3</td>
<td>0.4</td>
<td>0.6</td>
<td>0.8</td>
<td>2.9</td>
</tr>
<tr>
<td>Veracruz</td>
<td>0.7</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>1.6</td>
</tr>
<tr>
<td>Sabinas</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.4</td>
</tr>
<tr>
<td>Aguas profundas</td>
<td>0.0</td>
<td>0.1</td>
<td>0.2</td>
<td>0.7</td>
<td>26.6</td>
</tr>
<tr>
<td>Plataforma Yucatán</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Total</td>
<td>55.0</td>
<td>13.9</td>
<td>26.2</td>
<td>44.5</td>
<td>54.6</td>
</tr>
</tbody>
</table>

Development and production projects

Exploration projects

Recent achievements in Deep Water E&P

- Perdido area and Holok – Exploration wells PEP-1, Vespa-1, Ahawbil-1, Trion-1, Supremus-1.
- The last well in Perdido was Exploratus-1 with a water depth of 2,500 meters plus other 3,600 meters into the ground.
- The Maximino-1 well ratifies the existence of an active system with extra-light oil and gas.

Source: Antonio Escalera “Potencial y Recursos Prospectivos en México”. November 5, 2013
Recent achievements in Deep Water E&P

- First development wells in the Lakach field
  - 9 years to develop with marginal returns
  - Gas reserves 850 mmmcf, of which 75% are recoverable
  - 131 km northeast of Coatzacoalcos, Veracruz
  - Investments 2.5 mmm US$. First production in 2017 to reach 400 mmcf/d
  - The project: six wells; subsea installations and two manifolds. Long tie back. Processing close to trunkline.
  - Other discoveries: Noxal, Lalail, Leek. Piklis (2P reserves: 791 Tcf), Nen (2P reserves: 442 Tcf) and Kunah (prospective resources = 1,800 Tcf)
  - 5.0 Tcf in non-associated gas reserves (3P) have been certified. Prospective resources = 5.5 to 16.5 Tcf.
Mexico’s non conventional oil and gas

Mexico’s shale gas resources will play a key role to cover long term supply requirements.

However, a careful approach as to the size and availability of these resources is required to calculate their development, investments and environmental conditions.

Water resources in Mexico’s northern states could slow down the initial projects.

<table>
<thead>
<tr>
<th>Shale gas Play</th>
<th>US Estimates (EIA)a</th>
<th>Pemex estimates (ilower, central, upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cretácico superior</td>
<td>507</td>
<td>54-106-171</td>
</tr>
<tr>
<td>Cretácico medio</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Jurásico superior</td>
<td>166</td>
<td>95-190-285</td>
</tr>
<tr>
<td>TOTAL</td>
<td>681</td>
<td>150-297-459</td>
</tr>
</tbody>
</table>

Regulations will play a key role in the development of shale resources
The 11 areas for tenders in the Perdido area range from 224 to 409 km². Eight of these areas are located in the Perdido Fold Belt.

The blocks in the Cordilleras Mexicanas province have an area of 390-960 km², depending on the maturity of exploration and ocean depth in the Gulf of Mexico.

The contractual areas for non-conventional resources such as shale, have an extension between 112 km² and 120 km².

<table>
<thead>
<tr>
<th>Area</th>
<th>Type</th>
<th>Volume (mmbpce)</th>
<th>Blocks / Fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep water Perdido Area</td>
<td>Prospective Resource</td>
<td>1,591</td>
<td>11</td>
</tr>
<tr>
<td>Deep water south</td>
<td>Prospective Resource</td>
<td>3,222</td>
<td>17</td>
</tr>
<tr>
<td>Chicontepec and non-conventionals</td>
<td>2P Reserves Prospective Resources</td>
<td>2,678</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>2P Reserves Prospective Resources</td>
<td>8,927</td>
<td>62</td>
</tr>
<tr>
<td>Land, shallow water and extra heavy crudes</td>
<td>2P Reserves Prospective Resources</td>
<td>1,104</td>
<td>32</td>
</tr>
<tr>
<td>Non conventional</td>
<td>Prospective Resource</td>
<td>142</td>
<td>8</td>
</tr>
</tbody>
</table>
Round One areas
Schedule for tenders and Pemex Farm Outs

Terms and Conditions, Contract model and prequalification requirements

- November
- December
- January
- February
- March
- April
- May

Participants’ registration

- Data room opening
- January
- February
- March
- April
- May

New areas and fields

- Shallow Water
- Extra-heavy Oil
- Chicontepec and Unconventional
- Onshore
- Deepwater

Farm-outs

- SW: Bolontiku, Siman and Ek
- EHO: Ayatsi-Tekel-Utsil
- Rodador, Ogario, Cárdenas-Mora
- Kunah-Piklis, Trón, Exploratus

- Shallow Water
- Extra-heavy Oil
- Chicontepec and Unconventional
- Onshore
- Deepwater

Publication of Terms and Conditions
Participants registration and data rooms opening
Awarding of contracts
Social Impact Assessment performed by SENER
The trunk line system has shown several points of congestion that have restricted the supply of natural gas and its potential for growth.

- Import increases
- Production declines in the south-southeast region
- Limited expansion of the national gas trunk line system

The consequences of these restrictions have been:

- Reduced consumption among industrial users
- Substitution by other more expensive and polluting fuels.
- In the power sector it was necessary to use other less efficient and more expensive fuels as well as imported LNG.

Transportation system 2013
Transportation system 2028

Pipelines
1. Nuevo Pemex-Cd. Pemex
2. Los Ramones I
3. Los Ramones II
4. Agua Dulce-Frontera
5. Tucson-Sásabe
6. Northern Routes
7. Poza Rica-Punta Piedra
8. Matapionche-Medellín
9. Jáltipan-Salina Cruz
10. Morelos
11. Tamazunchale-El Sauz
12. North-Northeast
13. Aguascalientes-Zacatecas

Storage
- LNG storage Altamira.
- An additional storage container with a capacity of 3,200 mmcf to start operations in 2017.
- Underground storage with 2,000 mmcf capacity, starting operations in 2016

Liquefaction at Salina Cruz

Source: Jorge De la Huerta Moreno, “Proyectos de Infraestructura de Gas Natural”. Pemex-PGPB. May 2014
LNG liquefaction, regas and compressed gas plants

<table>
<thead>
<tr>
<th>Existing LNG regasification plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regas capacity (mmcfd)</td>
</tr>
<tr>
<td>Altamira</td>
</tr>
<tr>
<td>Ensenada</td>
</tr>
<tr>
<td>Manzanillo</td>
</tr>
</tbody>
</table>

**LNG Salina Cruz**
- PEMEX recently announced a liquefaction project for exports to Asia, with a regasification capacity of 250 mmcfd and an estimated value of US$ 6 million in investments. Deliveries starting in 2020.
- Gas from PEMEX’s East coast fields through a new pipeline (Jaltipan-Salina Cruz across the Isthmus). The project is the second phase of the Transoceanic belt from Dos Bocas in Veracruz, to the refinery in Oaxaca.
- The project is still at an early stage of design and it will require ventures partners.

**LNG vs. Compressed gas in Topolobampo**
- The project will be based on supplies from new pipelines crossing from to Sinaloa. The plant is to initiate deliveries in 21017-2018. The National Infrastructure Program does not specify details such as economics, size, design, technology and site.
- The plant will supply Baja California South to replace the fuel oil and diesel used for power generation. This year the CFE should make a call for tenders for gas transportation from Topolobampo to La Paz. The estimated investment is $7,740 million pesos (US$ 600 million).
In 2013 the CRE completed three processes for public international tenders for the permits to distribute natural gas in the areas of Occidente, Veracruz and Morelia.

Many other populated cities have been identified as having the potential to conform a natural gas distribution area. The areas are expected to be announced from 2014.

<table>
<thead>
<tr>
<th>Zona</th>
<th>Estados</th>
<th>Localidades</th>
<th>Kilómetros</th>
<th>Inversión* (més)</th>
<th>Usuariños (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonora-Chihuahua-Sinaloa</td>
<td>Sonora, Chihuahua y Sinaloa</td>
<td>17</td>
<td>9527</td>
<td>412</td>
<td>476.3</td>
</tr>
<tr>
<td>Nuevo León-San Luis Potosí</td>
<td>Nuevo León, San Luis Potosí y Guanajuato</td>
<td>7</td>
<td>995</td>
<td>43</td>
<td>49.5</td>
</tr>
<tr>
<td>Tabasco-Campeche-Yucatán-Quintana Roo</td>
<td>Tabasco, Campeche, Yucatán y Quintana Roo</td>
<td>9</td>
<td>10,057</td>
<td>435.0</td>
<td>502.8</td>
</tr>
</tbody>
</table>
Concluding remarks

- Mexico is struggling to increase its oil and gas production to remain a net energy exporter.
- The Energy Reform was needed to attract investments and to update the technologies in use.
- The Energy Reform is large and it covers all the sectors.
- Several State Agencies have been created.
- Natural gas demand is growing but the country is lagging behind in natural gas production.
- There are large 3P reserves and plenty of shale gas resources.
- Today the focus is on oil, while for gas the priority is placed on imports from the USA.
- Large investments in natural gas pipelines and other facilities are being made.
- There are three LNG regasification plants but the owners are considering the possibility to adapt them for liquefaction.
- Two sites are being evaluated to build natural gas liquefaction plants: Topolobampo and Salina Cruz. It is still too early to predict when and how are they going to be built.
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