Shale Gas Development in Mexico

Opportunities and Barriers

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APERC
Asia Pacific Energy Research Centre

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What we do best

- ✓ Communicate Houston-global concerns to Mexico, and Mexican sensitivities to Houston
- ✓ Add institutional, legal and policy insight
- ✓ Add sobriety
- ✓ Add scholarship
- ✓ Add a 30-year perspective on Mexican energy
- ✓ Add technical and documentation support
- ✓ Provide instruction on the fine points of Spanish and English phonology
- ✓ Offer pithy observations on Twitter: Energia_com
- ✓ Add humor

How do we do it?

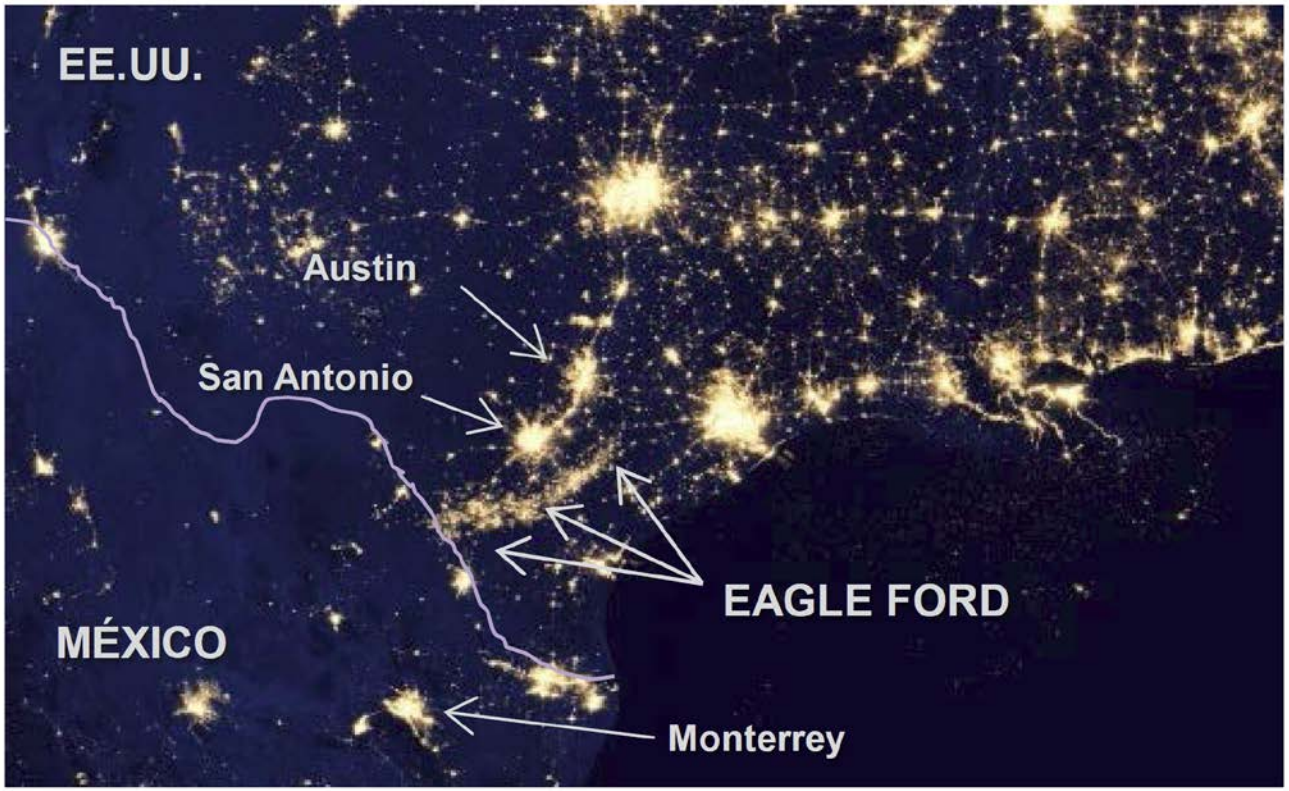
- Publish a subscriber-supported newsletter, MEXICO ENERGY INTELLIGENCE®, with some 900 reports published since 1995.
  - Subscribers are IOCs, NOCs, regulators in Mexico, pipeline companies, law firms and university libraries and research programs.
- Interviews with stakeholders & analysts posted on Energia.com
- Articles and commentary in other publications
  - 2 in REFORMA in 2013; Drilling Ahead.com (blog)
  - >500 Tweets and >185 followers (as of March 15, 2014)
- Interviews with the Mexican and international press
- Conferences, workshops, corporate briefings and other engagements.

APERC Questions

United States/Mexico**– Dr. George Baker**

- How have oil and gas firms adapted their strategies to produce from shale?
- What is your view on the main hurdles for Mexico to develop its shale gas resources?
- How will its recently passed legal reform is expected to impact shale gas development?
- Is there any interest on the United States soil to eventually venture to Mexico or to complement its capabilities in any way?
- Will the United States will ever be replicated in Mexico? If so, what will be needed?
- How might the massive leasing, dynamic organizational restructuring and merging, intensive drilling and technology dissemination characteristic of the U.S. shale industry adapt in Mexico?

Eagle Ford formation, Texas



In 2012, only 3 wells of shale oil/gas were drilled in Mexico. By contrast, in the USA that number grew to 9,100.

Topics

- INTRODUCTION
  - The U.S. experience
  - How can the U.S. learning curve be exported?
- ROCKS
  - 6 regions
  - Pemex's activities and plans
- REALITY
  - Mexican market redesign (aka, Reform)
  - Surface risks and challenges
- CONCLUSIONS

Purposes

- To comment briefly on the U.S. experience
- To introduce regional and subsurface data that shows the proximity of Mexican shale resources to the high-productivity regions in the U.S.
- To comment on the new market design for the upstream that is currently under development
- To offer our view as to the difficulties ahead in the exploration, appraisal and development of shale resources in Mexico
- To ask, at the end, how can the US experience can be exported

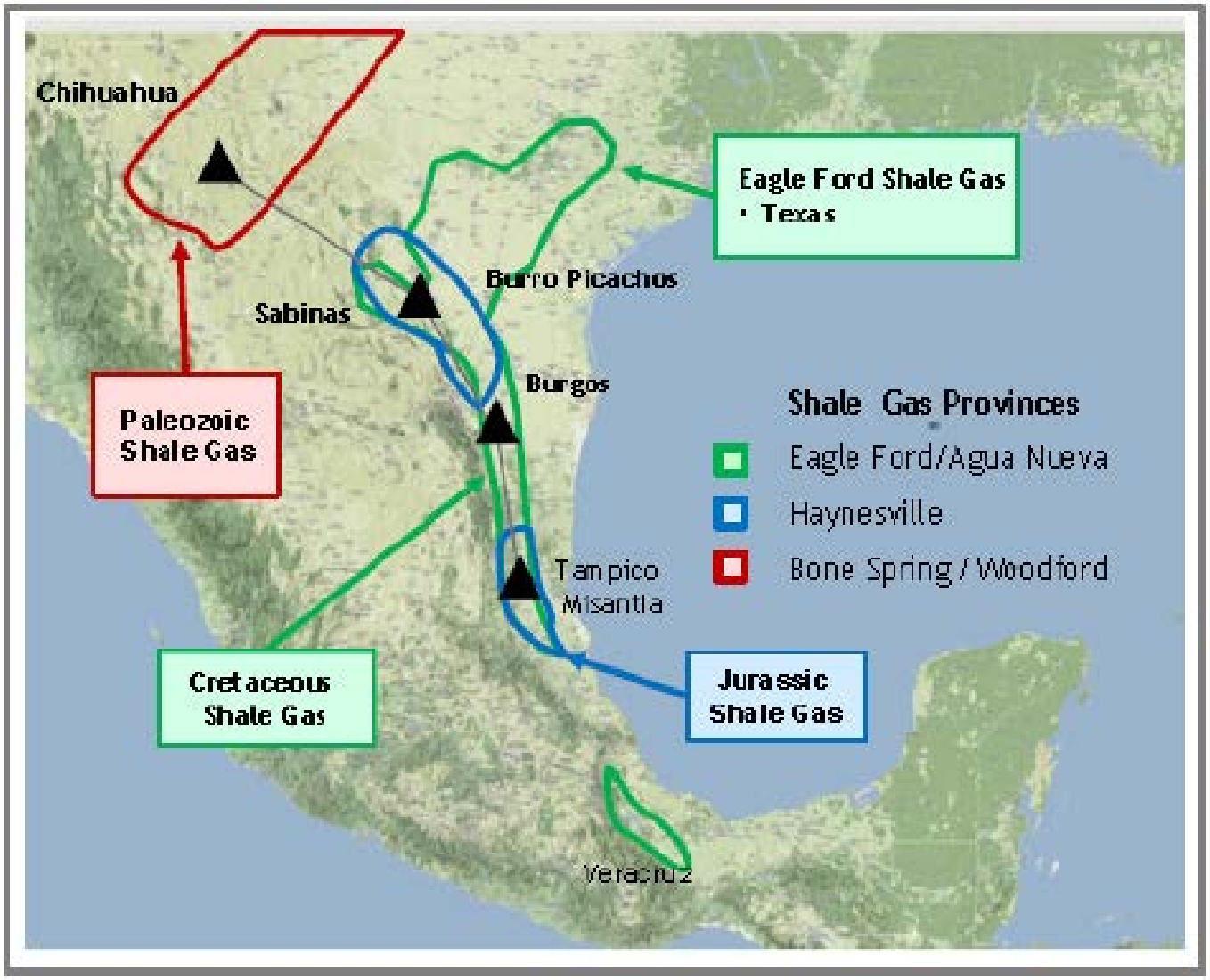
The U.S. Experience

- The legend told in Houston says it started with oilman George Mitchell who spent 10 years of trial and error before he find a solution to producing shale gas and liquids economically.
- His engineers said, “George, you’re wasting your money.” He is said to have replied, “But it’s my money! So go back to work.”

Shale revolution led by small companies

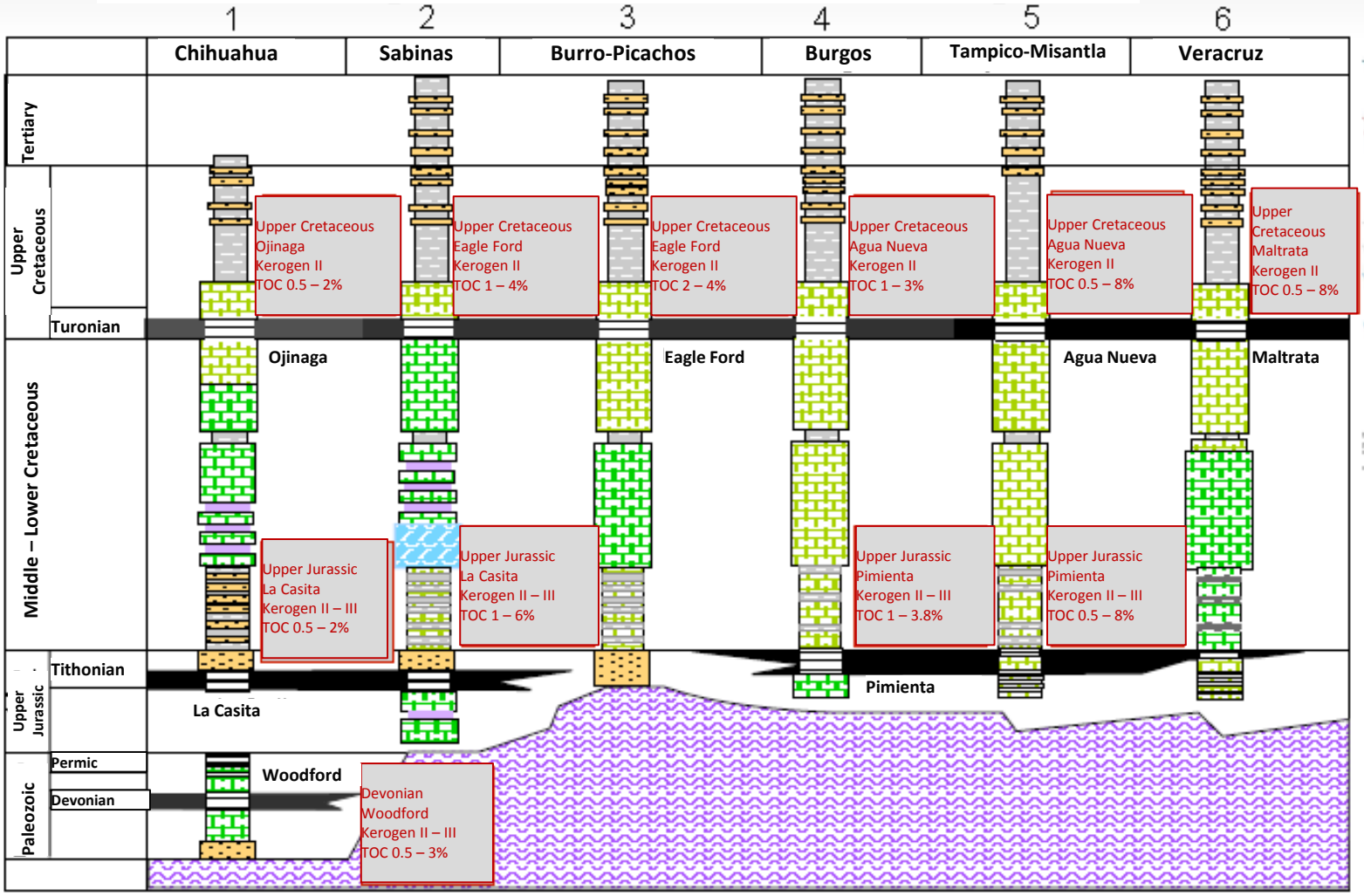
- Technological leadership has come from small companies who can be quick to experiment and learn from others.
- Some major oil companies (Shell and ExxonMobil, among others) acquired positions in shale plays; but have been followers.
  - Shell had to write down US$2 billion in shale investments

ROCKS



Source: Pemex

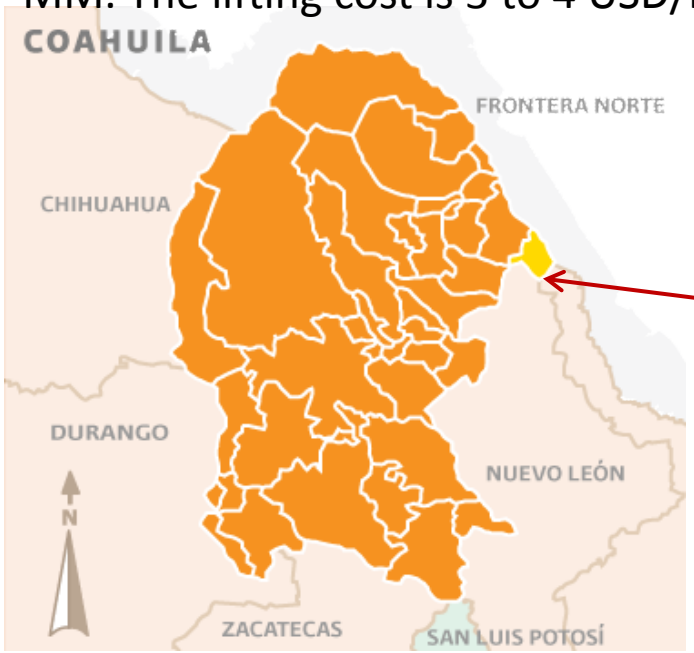
Stratigraphic Columns of Organic Shale Basins



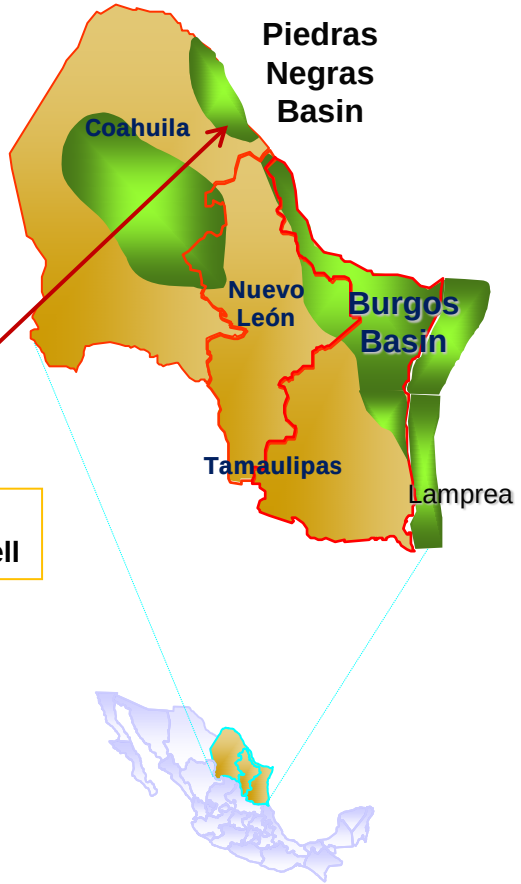
Total Carbon	
% Carbonic	Potential
0.01 – 0.2	Very Poor
0.21 – 0-5	Poor
0.51 – 1.0	Regular
1.01 – 3.0	Rich
<3.0	Very Rich

Emergente –1 the First Shale Gas Well in Mexico

The first shale gas wells from Pemex are located at the municipality of Hidalgo, Coahuila. The Emergente-1 well, officially drilled by Pemex in February 2011, produced 2.9 MMCFD and one year later dropped to 1.37 MMCFD. The well has a depth of 2,485 meters (8,200 ft) and a 1,364 meter (4,501 ft) lateral; being fractured in 17 stages with a cost between US$20 – 25 MM. The comparable U.S. cost is $6-8 MM. The lifting cost is 3 to 4 USD/MMBTU.



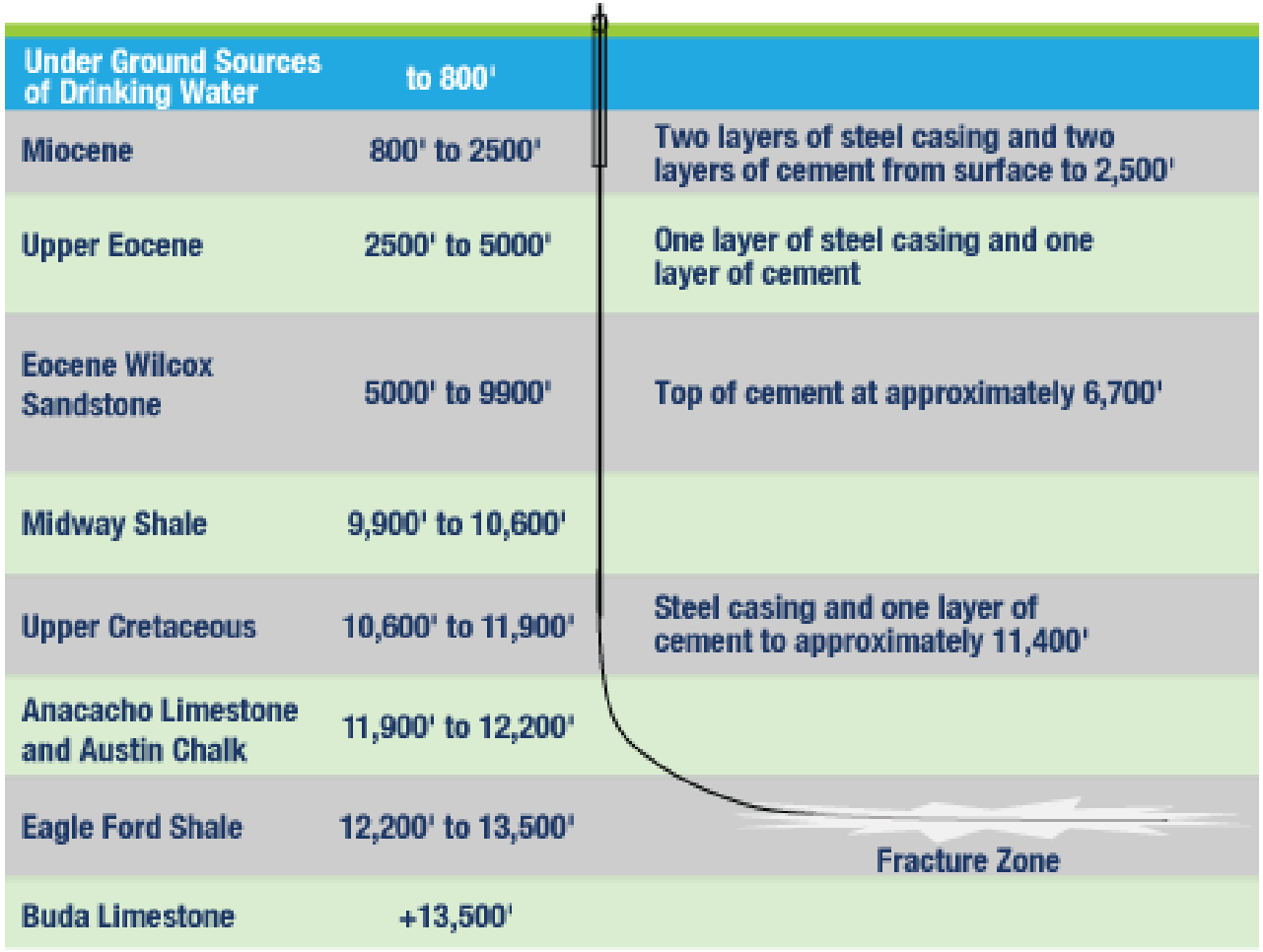
Location of the Play and the Emergente-1 well



Source: Guillermo Suárez: The Eagle Ford Extention in Mexico (slide pack, Jan. 2014)

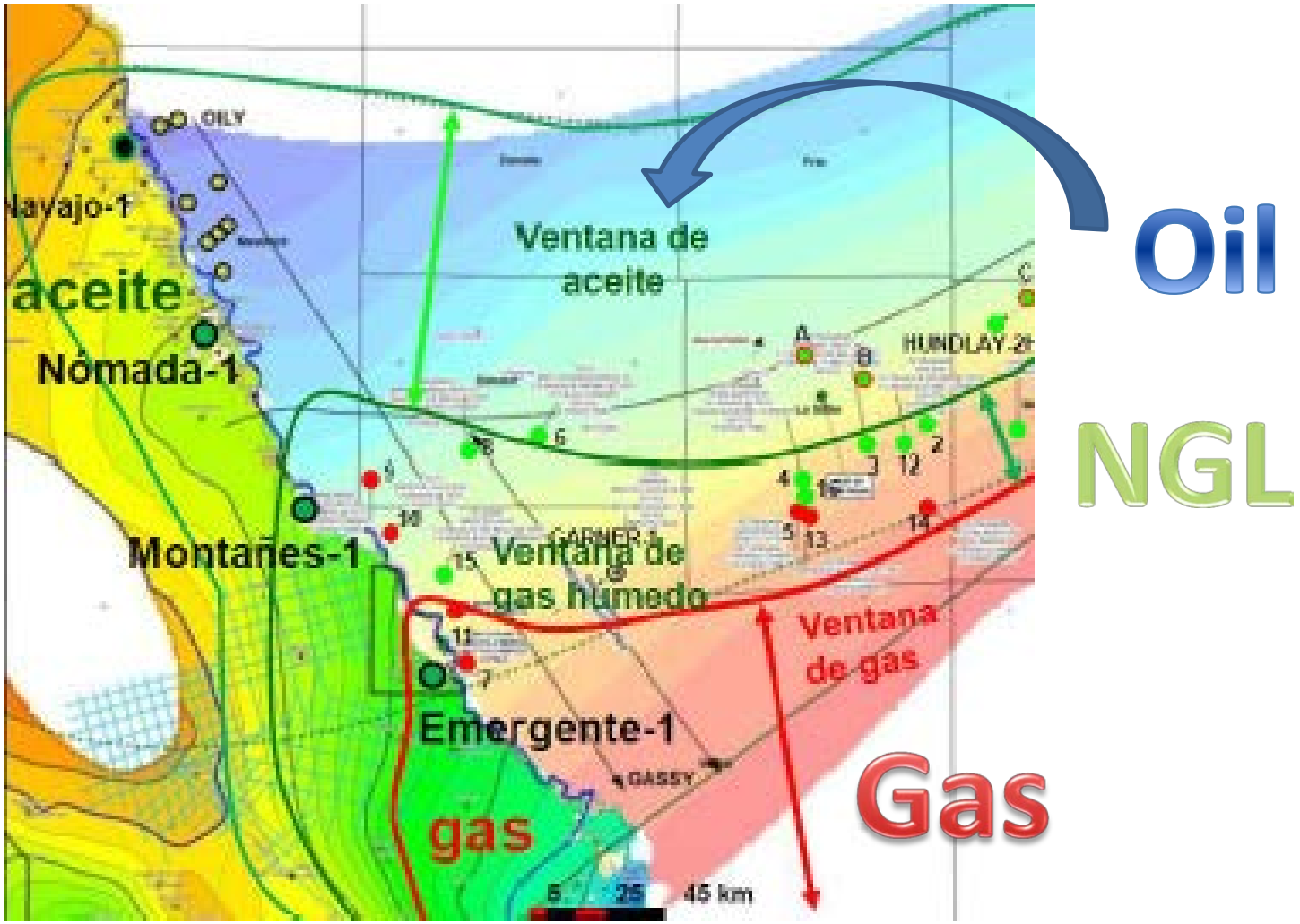
Geological Analogy of the Emergente – 1 Well and the Eagle Ford Stratigraphy

Stratigraphical Look at Eagle Ford Well



Source: Petrohawk

Gas & Liquid Windows



Source: Carlos Morales, Estrategia de Shale Gas de Petróleos Mexicanos (Nov. 2011)

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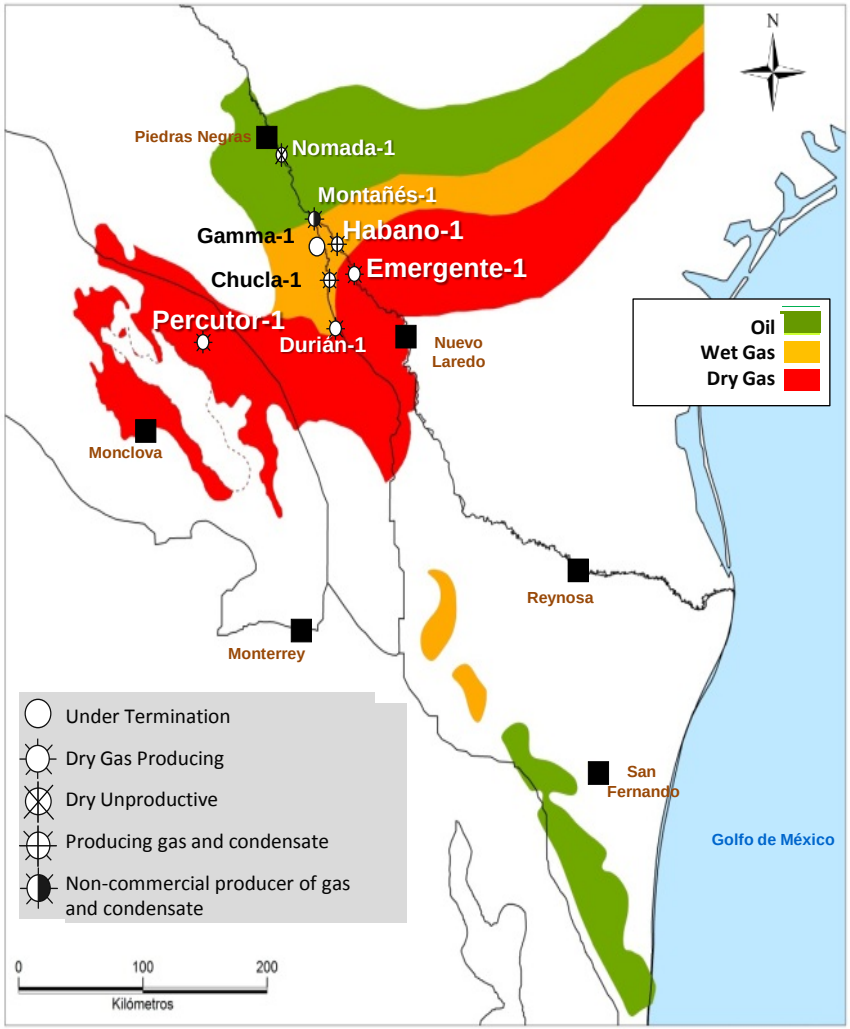
Advances in the Sabinas – Burro-Picachos – Burgos Basins (1)

Distribution map of the hydrocarbon types expected at the Upper Cretaceous Play (Eagle Ford – Agua Nueva)



Play Eagle Ford / Agua Nueva

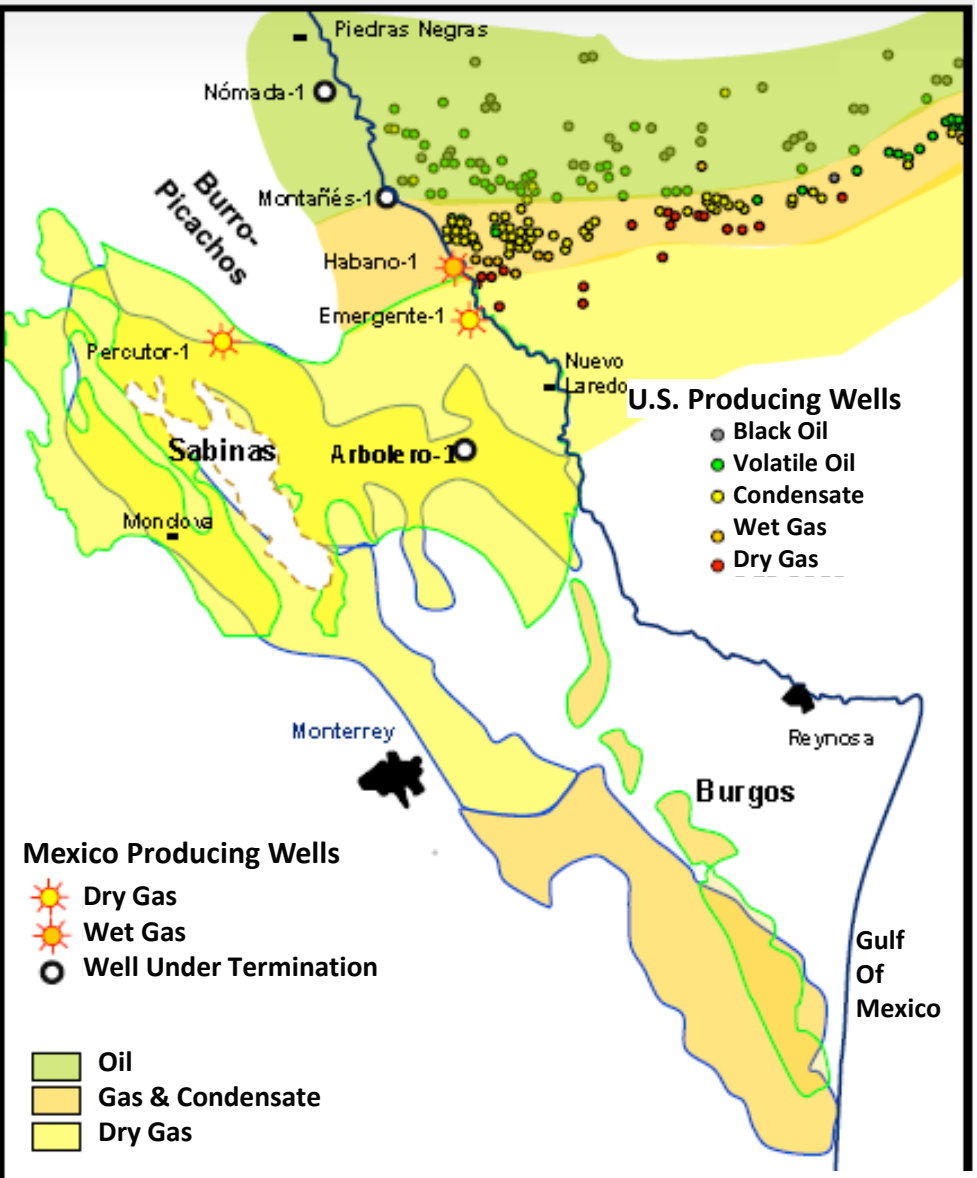
- Prospective Area : 34,700 km^2 (9,537 mi^2)
- The expected hydrocarbon types are: dry gas, wet gas and oil.
- The technically recoverable resources estimated are 8.5 Trillion BOE.

Results

- Seven wells have been drilled to verify the continuity of the dry gas fringe in southern Texas, with a commercial success rate of 71%, and the incorporation of total 3P reserves by 63 Trillion BOE. Presently, there is one well under termination.
- The Emergente-1 and Habano-1 wells tested the dry gas and wet gas zones from the Eagle Ford play.
- The Percutor-1 well, producer of dry gas, proved the extension of this play towards the Sabinas Basin.

CNH February 5, 2014 Shale Gas Potential in Mexico

PEP Exploration of the Shale Oil & Gas Potential in Mexico – Preliminary Results



- **Prospective area 43,000 km² (16,602.3 mi²).**
- **The Upper Cretaceous Eagle Ford contains resources between 27 to 89 with a mean of 55 TCF.**
- **133 exploratory opportunities have been identified to provide certainty to the evaluated resource.**

Results

- **At the Eagle Ford play, dry gas and wet gas zone continuity has been proven by drilling the Emergente-1 and Habano-1 wells respectively.**
- **Besides, in the Sabinas area, Percutor-1 well proved the Eagle Ford play extension by producing dry gas.**
- **The Nómada-1 and Montañés-1 wells are under termination in the zones for oil and wet gas respectively.**
- **The Arbolero-1 well was drilled to test the Jurassic play in search for gas.**

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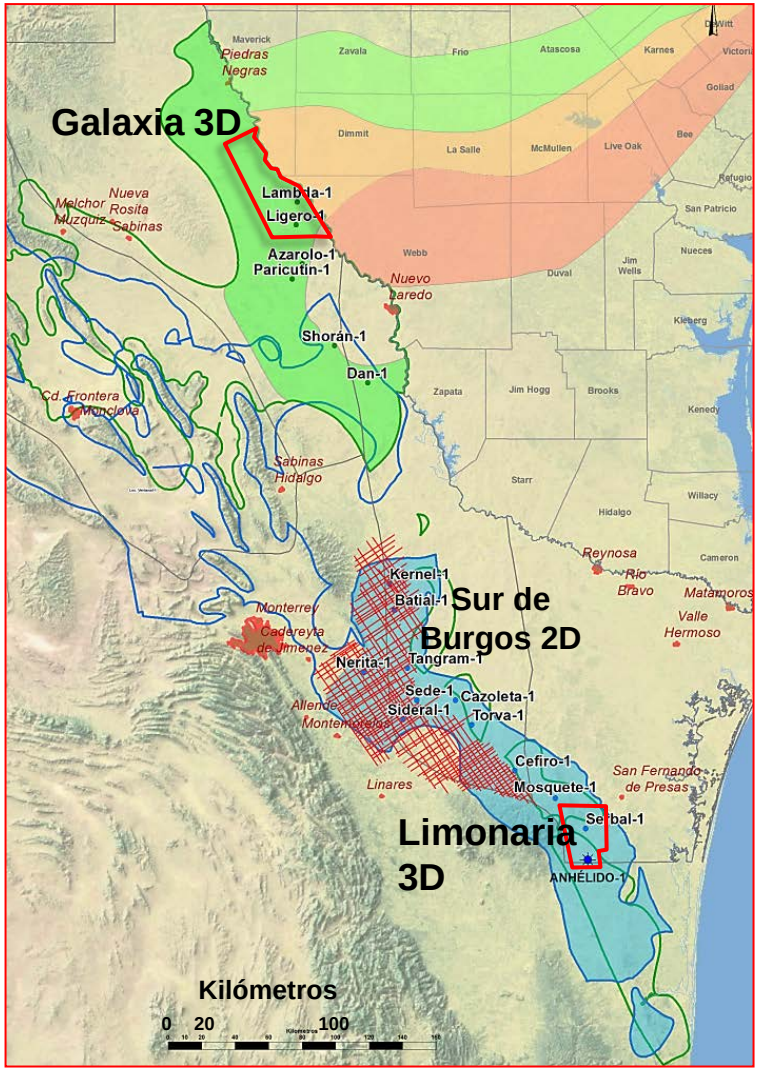
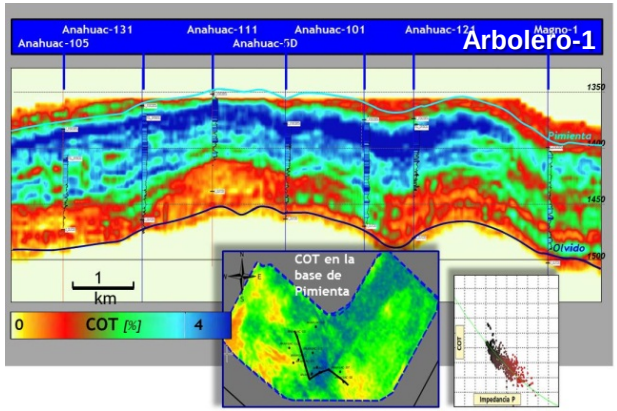
Seismic Studies are Being Made at the Burro-Picachos and Southern Burgos Areas to improve Geologic Understanding.



Objective: Obtain seismic data in the unconventional Pimienta, Eagle-Ford and Agua Nueva plays, to allow the mapping and resource definition and hierarchize areas.

In addition, AVO azimuth studies are being made to:

- Identify and map ductile and frail zones,
- Predict organic richness.
- Define the quantity, well position and their geo-navigation.
- Support and establish the number and spacing of hydraulic fractures.



Properties of the Unconventional Reservoir (TOC)

REALITY

- Paraphrasing Winston Churchill:

The Mexican government can always be counted upon to do the right thing in energy policy—*after* having explored all alternatives.

Mexican incentive:

Regain legal and contractual flexibility

Fig. 1

A graphic representation of the goal of energy reform

The rewriting of the laws and regulations of commerce will be deferred to 2014

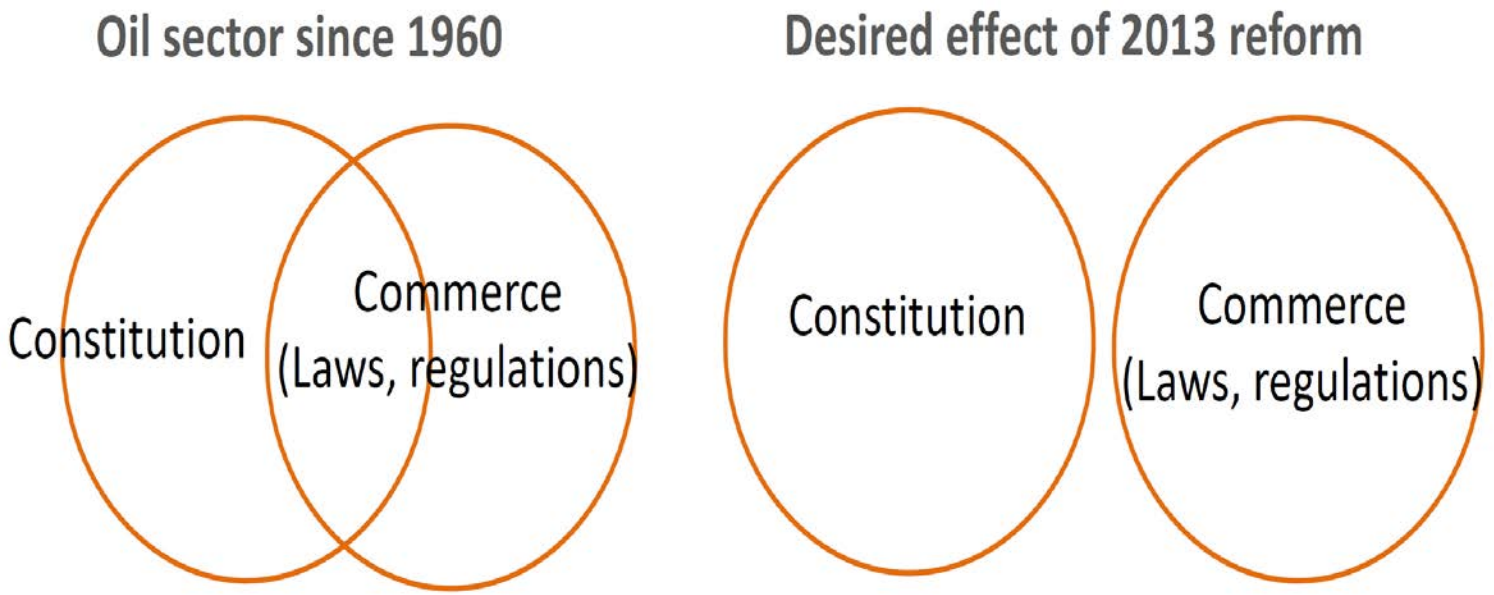


Chart: MEI

Mexican incentives

Abandon market design of 1958-2013

- Unmistakable
  - Intent to regain policy flexibility by
    - Removing commercial constraints in the constitution
    - Creating new institutions to execute policy and provide public oversight (Safety Agency, Sovereign Fund)
    - Expanding mandates of existing regulatory agencies
  - Return to pre-1958 when direct contracts between the State and oil companies were permitted
  - Empower Pemex via JVs and farm-outs

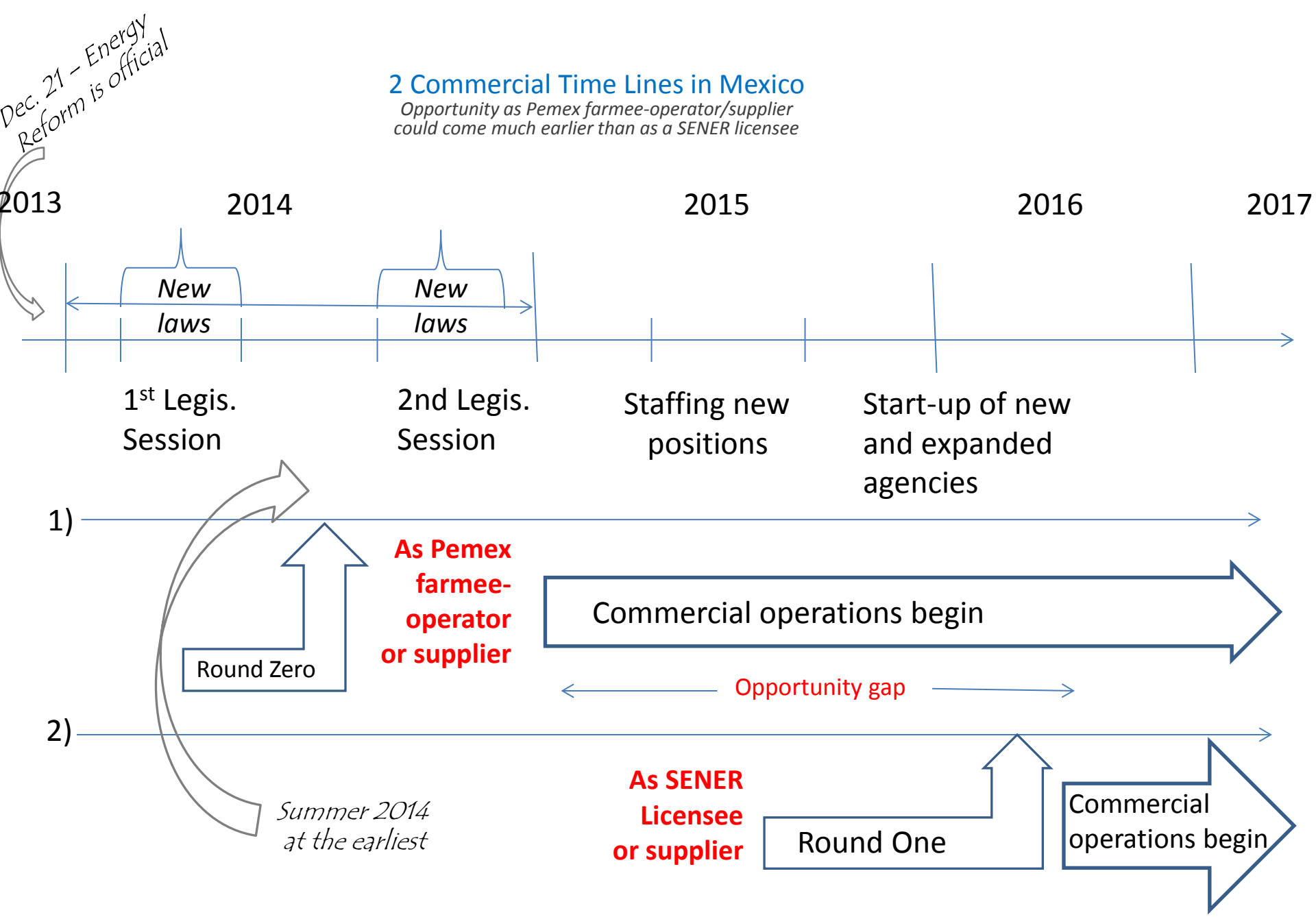
Understanding the Time-Line

Ambiguities in the Roll-out

- **2014**
  - Spring legislative session – Modifying 28 laws
    - ✓Expanding mandates of CNH and CRE
    - ✓Creating a Mexican BSEE / Norwegian PSA
    - ✓Creating a National Oil Fund
  - Fall legislative session -- Staffing new positions
- **2015**
  - Spring – First blocks and T&C announced
  - July – Elections for a 100% new Lower House
  - Summer/fall - Initial awards under new oil regime to operators other than Pemex

2 Commercial Time Lines in Mexico

Opportunity as Pemex farmee-operator/supplier could come much earlier than as a SENER licensee



Tale of 3 scenarios

1) **Pemex über Alles**
   - Round Zero as early as summer 2014
   - Operators and service companies become Pemex's upstream partners, not just their contractors
2) **Round 00 – Mexican insiders jump in**
3) **Opportunities for 3rd parties**

   Pemex on a short leash

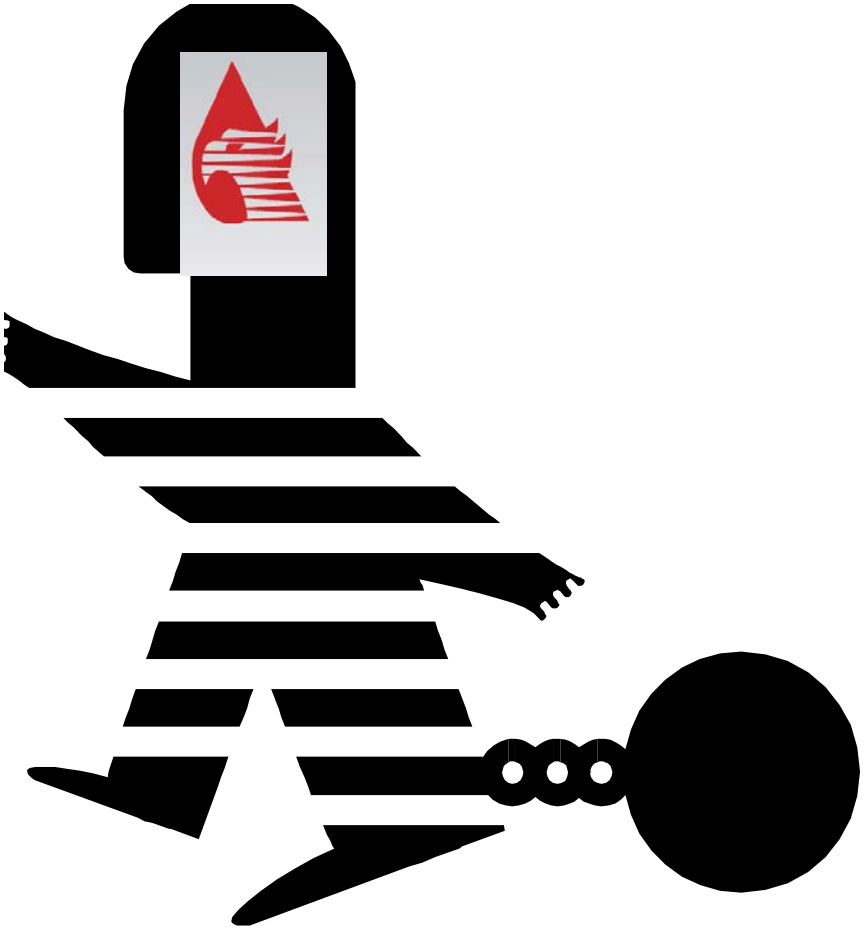
   Acreage with good prospectivity offered in open auction

What am I worried about?

Lack of commitment to changing the National Narratives for oil and power

Innovation in Pemex is blocked

The obsession with “lowest price” is driven by fear of reprisals from LFRSP



Conclusions - 1

- A key element of the US success comes from the surface owner having a financial incentive from oil and gas operations on his property.
- Replicating this incentive will be difficult in Mexico (and in other countries) where the State is always the legal owner of oil and gas in situ.
- Mexico will have to offer terms that compete with those of the U.S. in order to attract small U.S.-side oil and service companies to cross the border.
  - Physical security and the scarcity of water and a qualified oilfield service sector are issues.

Conclusions - 2

- Mexico's redesign for the energy sector will put new demands for natural gas if a wholesale power market is made possible by the redesign of the market.
- But the government has to watch export oil revenue, so Pemex's attention will be focused on oil, not gas. Right now, the cost of a shale well @$25 million each is too costly when gas <$5 Mcf.
- But . . . the gov't is counting on shale oil and gas contributions to national supply.

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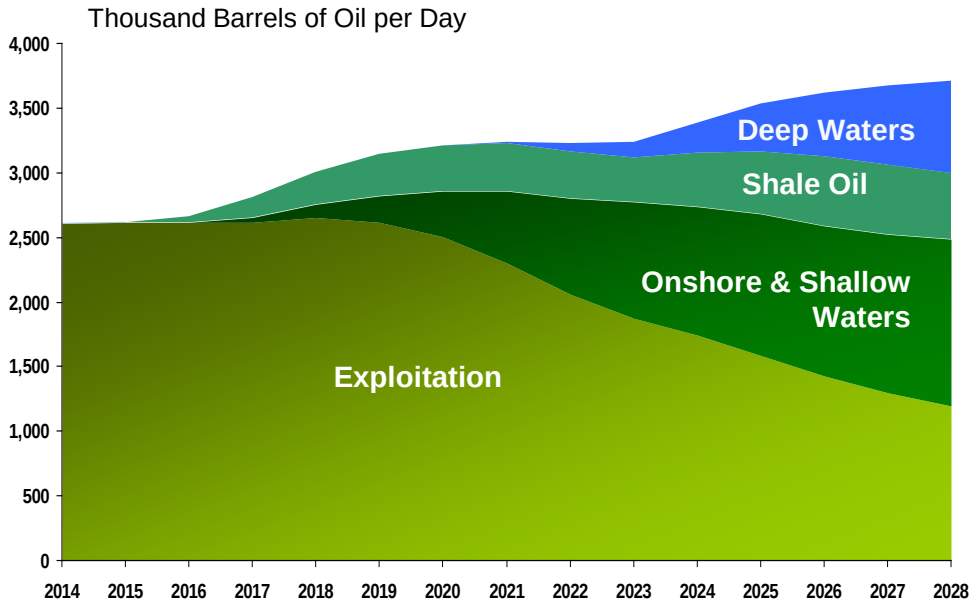
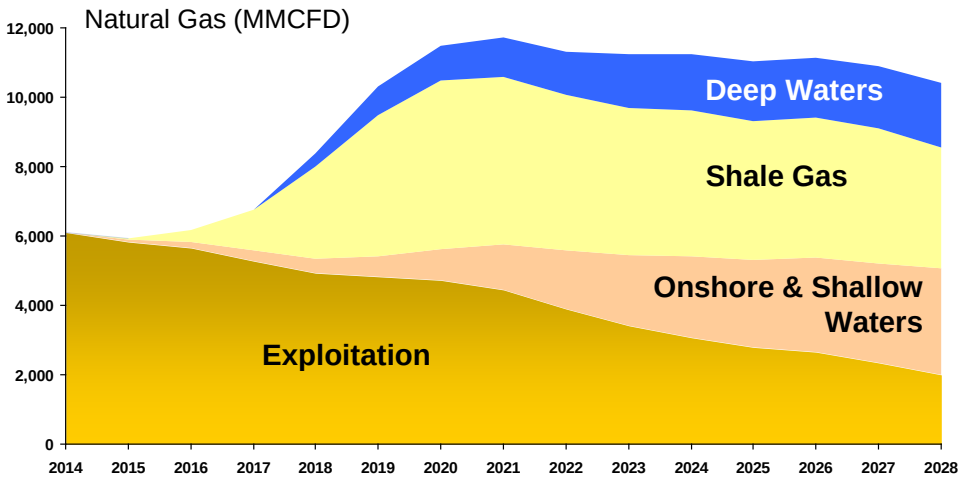
Natural Oil & Gas Production Post-Reform (2014 – 2028)





- During the next years oil production will come mainly from South-eastern Basins, while supply in the middle and long terms is estimated to come from the Deep Gulf of Mexico and unconventional plays.
- **The implementation of the Energy reform to assign blocks to Mexican and international companies, together with a favorable fiscal regime will promote the supply of shale gas in the near future.**

Source: CNH 2014-02-05 Shale Potential in Mexico Portfolios 2013 – Upper Scenario, Includes the development of discovered non-associated deep water fields

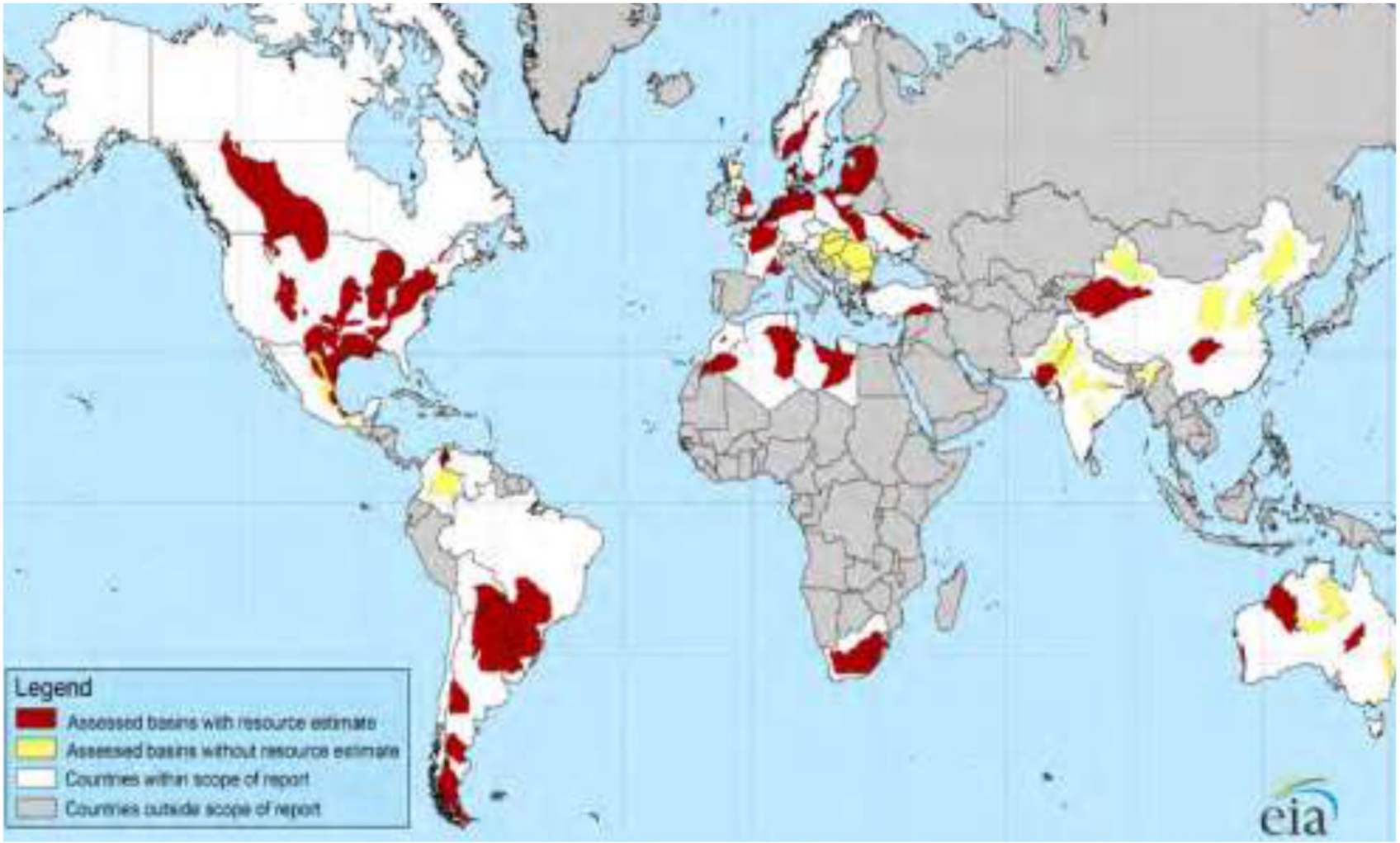
CNH February 5, 2014 Shale Gas Potential in Mexico

Can the US learning curve be exported?

- Shale revolution in the U.S.
  - Led by small companies
  - Using trial-and-error technology
  - On private lands with private mineral-owners
  - No prior federal permitting required
  - Making use of extensive, existing infrastructure
  - Commerce via a liquid market at Henry Hub
  - Available, trained workforce
  - A large, diverse and competitive oilfield service sector
  - Available water
  - In Texas, pro-industry regulatory and legal frameworks
  - Confidence in the legal system
  - Security of personnel and facilities an insignificant concern
- In Mexico, today, most of these elements are missing.
  - Which doesn't mean they will be missing 5 or 10 years from now.

Shale Basins Worldwide

Markets for U.S. learning curve?



Q&A

- If you think of a question later, send it to me by email: g.baker@energia.com
- Or by text +1 (832) 434-3928
- I return to Houston on March 29, 2014

Slides in reserve

Additional worries

The ambiguities

1) Posting reserves: “Expected benefits”
2) Role of the Sovereign Fund: Pays what?
3) Legal character of “State Enterprise”: Sovereign immunity
4) Arms-length relationship with the State?
5) Continued presidential appointments?
6) Continued innovation-blocking federal employee accountability law (LFRSP)

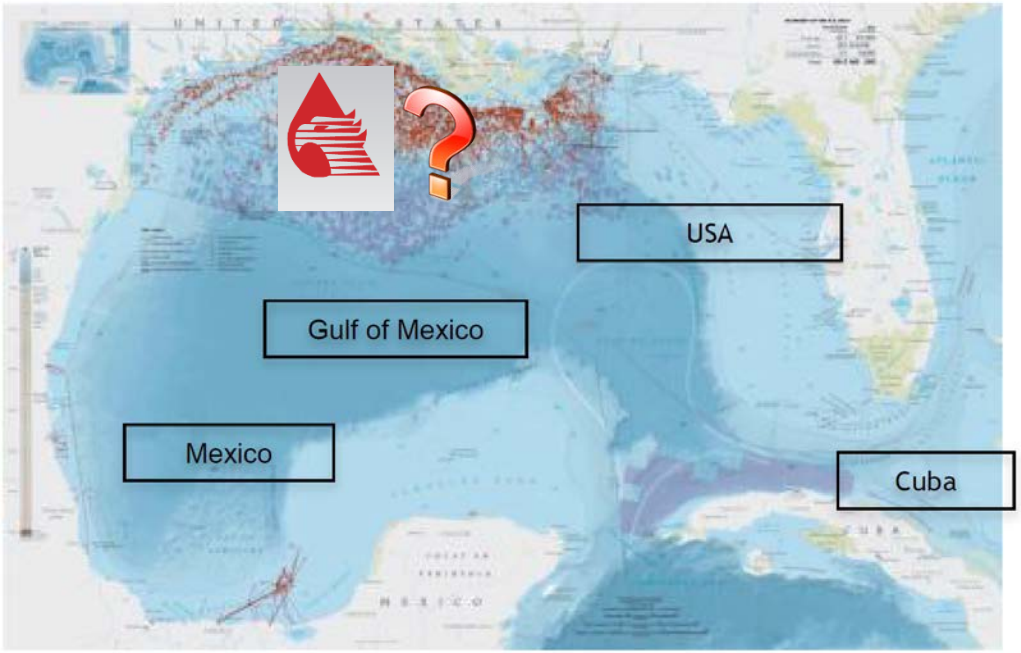
Premature involvement of Mexican start-ups

- Best to have initial awards w/o Pemex or locals

Vision of Pemex 2.0 – To operate outside of Mexico

Pemex 2.0

Deepwater and ultra deepwater drills in the Gulf of Mexico



While there were only 6 wells drilled in deepwaters and ultra deepwaters in Mexico during 2012, in the USA that number was 137.