[PS]Non-Geologic Factors Necessary to Develop a Shale Industry in Mexico*

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Abstract

In 2013, the U.S. Energy Information Administration (EIA) ranked Mexico 6th and 8th in technically recoverable shale gas and oil resources, respectively. These resources are distributed in the northern, central, and southern parts of the country. Mexico's challenging geology requires a better understanding by drilling more wells in areas that are most promising on the basis of reliable geologic data. Lessons learned in the U.S. indicate that a better understanding of the geology is not a guarantor of success in developing Mexico's shale resources. The purpose of this work is to understand the non-geologic factors that led a rapid emergence of the U.S. shale resources, in order to identify the main gaps, uncertainties, and challenges that Mexico must overcome to succeed. The study area comprises northeast and east Mexico where the Eagle Ford and equivalent formations (late Cenomanian-Turonian) were deposited. This work presents a brief geographic context of these areas and discusses water resources, some population facts, socio-economic conditions, and road and pipeline infrastructure. Presented then is an explanation of the crucial roles that will play in Mexico's shale industry, the legal and regulatory framework, and the land and mineral ownership. In terms of geography, water resources, population facts, socio-economic conditions, and road infrastructure, northeast and east Mexico present specific and serious technical and operational challenges for companies, including water resources, insufficient road infrastructure, and the ability to deal with people with strong cultural and social roots. Regarding mineral and law ownership, although the law provides compensation for landowners and a process to negotiate, companies should consider that prioritization of energy sector activities over any other economic activity has raised concerns among civil, environmental, landowner, and indigenous groups and communities about the impacts of the law. Mexico is making considerable efforts to reinforce its pipeline capacity; however, it has a road ahead to ensure supply. Therefore, a shale industry in Mexico could be developed if the companies overcome the technical, infrastructure, social and cultural challenges. First and foremost, geology should permit commercially viable production in sufficiently large area to support the development of a shale supply chain.

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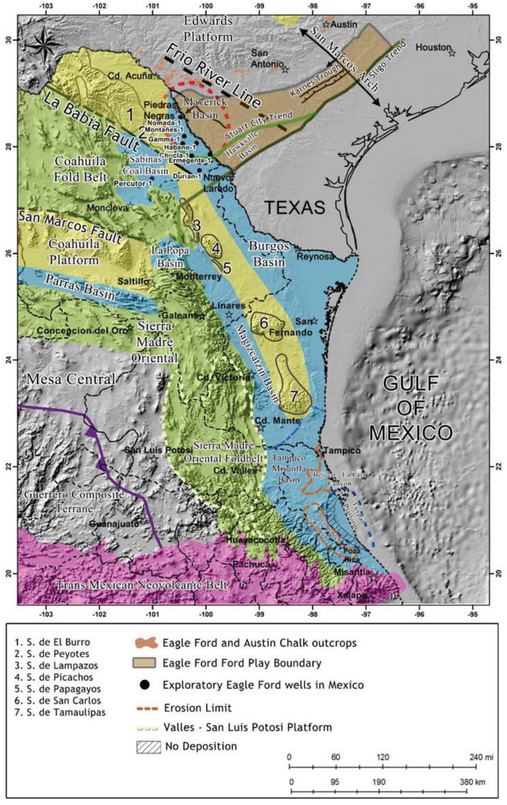
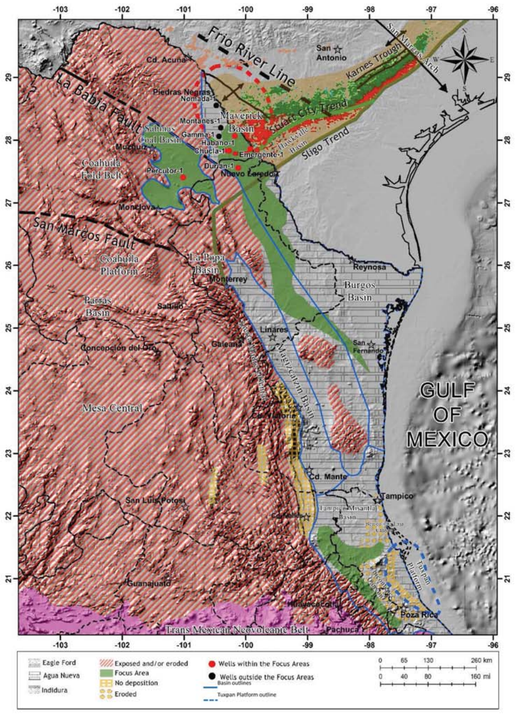
- The Eagle Ford Play in Texas has had an amazing development in the last seven years.
- A straightforward geological correlation between the Eagle Ford Group in Texas and their equivalent formations in Mexico has spurred the possibility of replicating this success in Mexico.



Principal structural features of the study area (after Salvador, 1991; EIA, 2014; CNH, 2015)

- A regional geological screening of the Texas Gulf coast and east and northeast Mexico, along with the analysis of the geotechnical factors for the success of the Eagle Ford in Texas, has allowed identity of our focus areas to assess the shale gas potential of the Eagle Ford Play in this part of Mexico (Meneses-Scherrer, 2015).
- Three of these areas are located in northeast Mexico and the fourth one is in east Mexico in the region known as La Huasteca.
- The concomitant question is how a shale industry might be developed in Mexico around these four focus areas by taking into account the geographic features and other important non-geological factors that made the success of this industry in the U.S.



Map showing a sketch of three "Mexican Eagle Ford/Agua Nueva Focus Areas" (green), and areas where the equivalents formations of the Eagle Ford were exposed and/or eroded not deposited (Meneses-Scherrer, 2015)

Geographic Context

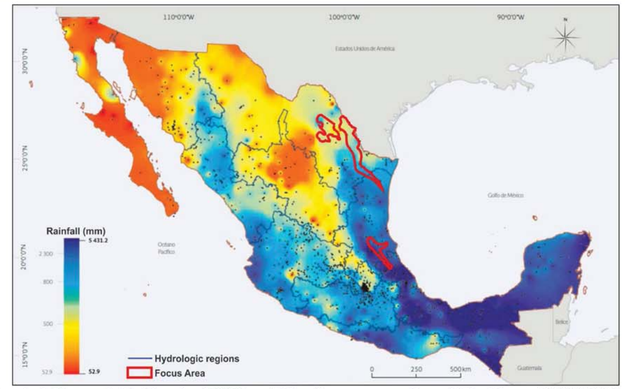
- Two contrasting geographical settings: La Huasteca region and the Northeastern Mexico region.

State	Capital	Population 2013	Urban (%)	Rural (%)	Area (km^2)	Population Density (people/km^2)	# of municipalities	% of poverty (2014)	Average annual rainfall (mm/year)	# of aquifers
Nuevo León	Monterrey	4,941,059	96%	4%	64,220	77	51	20%	589	23
Tamaulipas	Ciudad Victoria	3,461,336	90%	10%	80,175	43	43	38%	760	14
Coahuila	Saltillo	2,890,108	90%	10%	151,563	19	38	30%	386	28
Total		11,292,503			295,958		132			65

State	Capital	Population 2013	Urban (%)	Rural (%)	Area (km^2)	Population Density (people/km^2)	# of municipalities	% of poverty (2014)	Average annual rainfall (mm/year)	# of aquifers
Veracruz	Xalapa	7,923,198	65%	35%	71,820	110	212	58%	1,617	18
Puebla	Puebla	6,067,607	78%	22%	34,290	177	217	65%	1,040	6
Hidalgo	Pachuca	2,806,334	60%	40%	20,846	135	84	54%	829	21
San Luis Potosí	San Luis Potosí	2,702,145	68%	32%	60,983	44	58	49%	1,040	19
Total		19,499,284			187,939		571			64

Geographic context of the Northeastern and La Huasteca region (data from CONEVAL, 2015; CONAGUA, 2015).

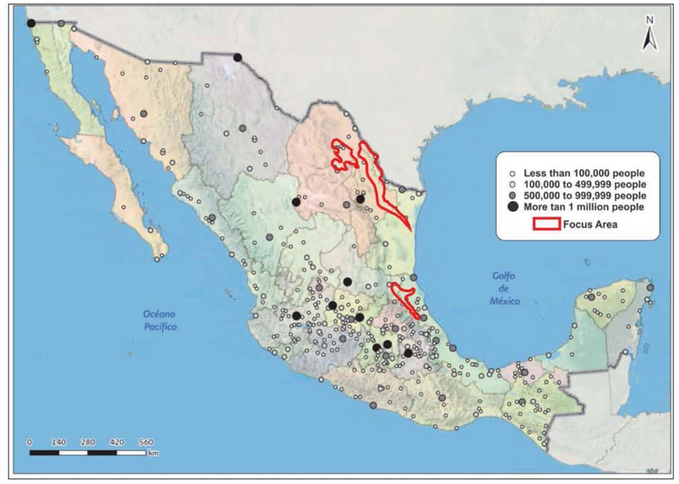
Water Resources



Annual rainfall precipitation in 2013 and the focus areas (modified from CONAGUA, 2015)

Hydrologic regions in Mexico and the focus areas (modified from CONAGUA, 2015).

Population Facts and Socio-Economic Conditions



Map showing the largest population centers and the focus areas in Mexico (modified from CONAGUA, 2015)

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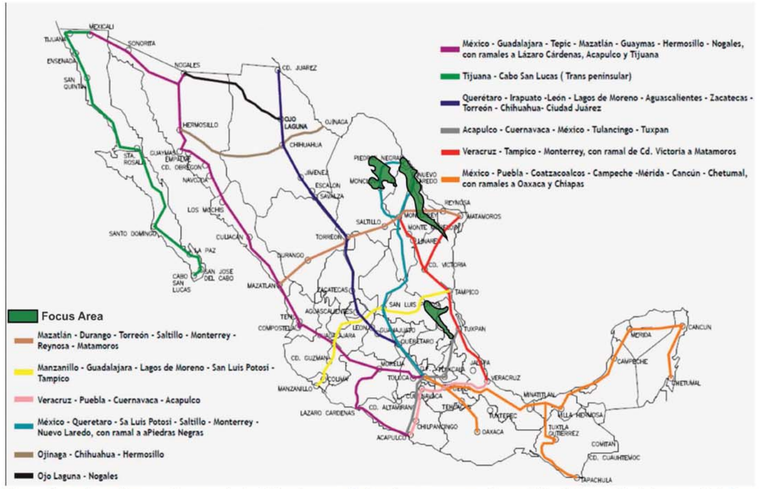
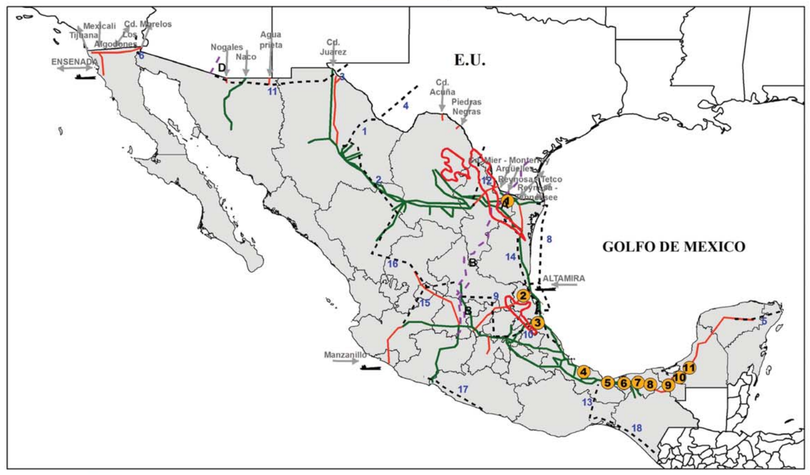
Infrastructure



Map showing the main roads in Mexico and the focus areas (modified from Gobierno del Estado de Chihuahua, 2007)



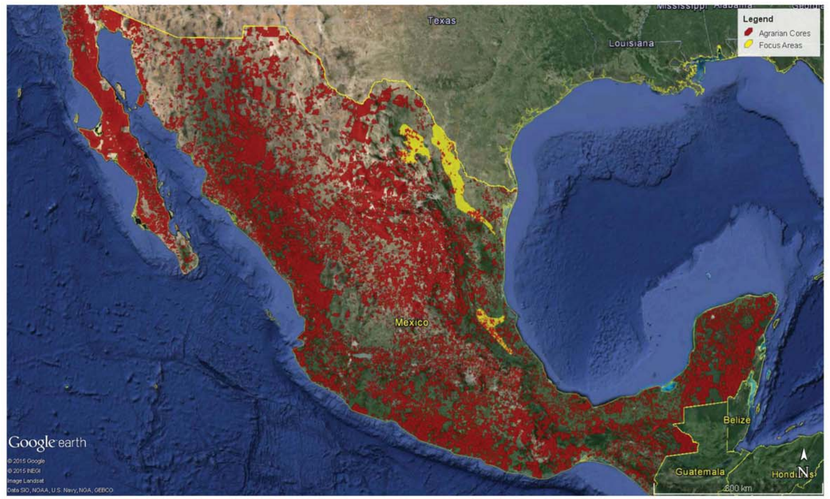
Mexican natural gas current infrastructure and current and future projects to increase the capacity (SENER, 2013; PEMEX, 2014; Salazar Diez de Sollano, 2015)

Natural Gas Processing Plants			
U.S.	551	Mexico	11
Texas	181	Veracruz	5
Oklahoma	75	Tabasco	3
Louisiana	50	Tamaulipas	2
Colorado	43	Chiapas	1
Wyoming	36		
New Mexico	27		
California	23		
Other States	116		

Refineries			
U.S.	140	Mexico	6
Texas	27	Guanajuato	1
Louisiana	19	Hidalgo	1
California	18	Nuevo León	1
Wyoming	6	Oaxaca	1
Alaska	5	Tamaulipas	1
Oklahoma	5	Veracruz	1
Utah	5		
Washington	5		
Other States	50		

EIA, 2016

Mineral and Land Ownership



Map showing the area occupied by Agrarian Cores in Mexico and the focus areas (made with data from Registro Nacional Agrario, 2015a).

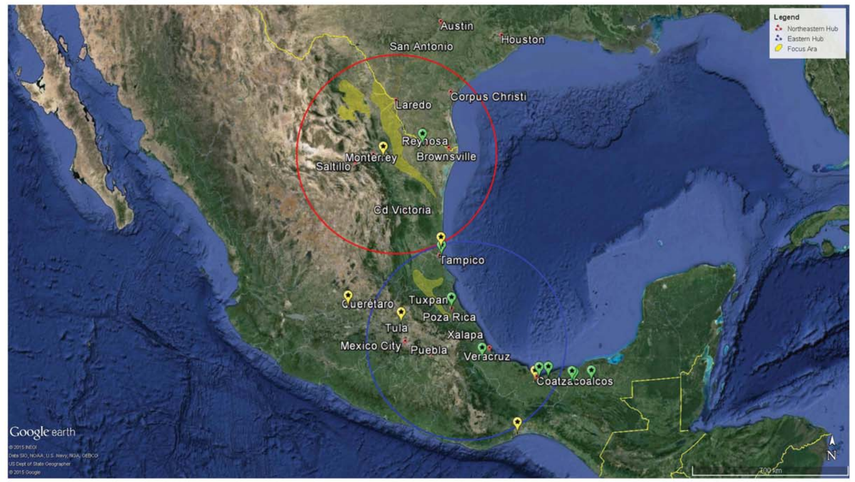
State	Total Area (km²)	Area km²	Area %	Agrarian Cores	Main land use: Common Land Use	Main land use: Parcel Lands
Veracruz	71,820	28,681	40%	3,725	Forestry (34.9%)	Agriculture (51.8%)
Puebla	34,290	15,419	45%	1,196	Livestock (44.3%)	Agriculture (91.6%)
Hidalgo	20,846	9,452	45%	1,171	Livestock (33.6%)	Agriculture (96.7%)
San Luis Potosi	60,983	40,686	67%	1,444	Livestock (69.5%)	Agriculture (75.7%)
Total				7,536		

State	Total Area (km²)	Area km²	Area %	Agrarian Cores	Main land use: Common Land Use	Main land use: Parcel Lands
Nuevo Leon	64,220	18,651	29%	608	Livestock (62.3%)	Agriculture (56.8%)
Tamaulipas	80,175	25,819	32%	1,395	Livestock (62.4%)	Agriculture (53.6%)
Coahuila	151,563	62,258	41%	891	Livestock (78.2%)	Livestock (62.7%)
Total				2,894		

Characteristics of the Agrarian Cores in the states occupied by the Focus Areas (data from Registro Agrario Nacional, 2015b)

Considerations For Development Of A Successful Shale Industry In Mexico

- Therefore, interested parties will need to shape a technological and management strategy adapted to each specific geographical condition to overcome these challenges and build a reliable reputation in the communities.
- A possible strategy that might take advantage of existing infrastructure could comprise a Northern Hub embracing the Burgos , Maverick and Sabinas Coal Basins, and an eastern Hub including the Tampico- Misantla Basin.



References

+Comisión Nacional del Agua, 2015, Atlas del Agua en México 2014, http://www.conagua.gob.mx/CONAGUA07/Publicaciones/Publicaciones/SGP-17-14.pdf

Comisión Nacional de Hidrocarburos, 2015, Seguimiento a la exploración y extracción de aceite y gas en lutitas, http://www.cnh.gob.mx/_docs/Aceite_gas_lutitas/seguimiento_a_la_exploracion_y_extraccion_de_aceite_y_gas_en_lutitas.pdf+

+CONEVAL Consejo Nacional de Evaluación de la Política de Desarrollo Social, 2015, Anexo estadístico de pobreza en México, http://www.coneval.gob.mx/Medicion/MP/Paginas/AE_pobreza_2014.aspx

Gobierno del Estado de Chihuahua, 2007, Mapa Carretero, http://portaladm.chihuahua.gob.mx/atach2/scop/uploads/PRINCIPALES/MAPA/MAPA%20CARRETERO%20REVERSO%202007%20%28ALTA%29.pdf

Meneses-Scherrer, E. J., Lessons learned in the Eagle Ford play and applicability to Mexico [Master of Arts]: University of Texas at Austin, 182 p.

+Petróleos Mexicanos, 2014, Anuario Estadístico 2013, http://www.pemex.com/ri/Publicaciones/Anuario%20Estadistico%20Archivos/anuario-estadistico-2013_131014.pdf

Registro Agrario Nacional, 2015b, Panorama Agrario de México / Núcleos Agrario, http://www.ran.gob.mx/ran/index.php/informacion-estadistica/nucleos-agrarios

Registro Nacional Agrario, 2015a, Núcleos Agrarios, http://catalogo.datos.gob.mx/dataset/nucleos-agrarios

Salazar Diez de Sollano, F. X., 2015, Nuevo marco regulatorio y plan de expansión de la red de gasoductos en México, XIX Reunión Anual de Reguladores de la Energía de Ariae Comisión Nacional de los Mercados y la Competencia CNMC: Madrid, Spain.

Salvador, A., 1991, The Gulf of Mexico Basin, The Geology of North America, The Geological Society of America, p. 568.

Secretaría de Energía, 2013, Plan Nacional de Desarrollo 2013-2018 - Programa Sectorial de Energía.

+U.S. Energy Information Administration, 2014a, Updates to the EIA Eagle Ford Play Maps, http://www.eia.gov/maps/pdf/eagleford122914.pdf

+U.S. Energy Information Administration, 2016, North American Cooperation On Energy Information (NACEI), http://www.eia.gov/special/trilat/

+Website accessed February 20, 2017