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## Potential Impacts of Mexico's Energy Reform on the Texas Transportation System

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### Introduction

The recent energy reforms signed by Mexico's president, Enrique Peña Nieto, are expected to invite an increasing amount of foreign private investment for exploration and extraction of oil and gas.<sup>1</sup> Changing Mexico's energy industry was necessary to foster development for the economy and increase oil production. Due to the expected increase in investments for exploration and production of Mexico's shale reserves that are located south of the Rio Grande River (mainly in the Burgos Basin shown in Figure 1), the hydraulic fracturing boom along the Eagle Ford in Texas will likely expand south. The potential influx of investment from foreign companies in the Burgos Basin can have strong implications on Texas' transportation system.

During the oil/gas well development stage of the process, it is expected that the number of oversize/overweight loads moving on the Texas transportation system and crossing the Texas-Mexico border will increase in the short term. Some steel pipes might be imported through ports in Texas, such as Corpus Christi and Brownsville, or shipped to Mexico from Texas manufacturing facilities. This piping may be moved by rail or truck across the Texas-Mexico border to well sites in the Burgos Basin.

The sand needed for hydraulic fracturing (frac sand) originates from the Midwestern U.S. states, parts of Canada, and Brazil. As Mexico has no local sources for frac sand, most likely it will be imported into Mexico from the same origins through Texas' ports of Corpus Christi and Brownsville, which are the closest deep water ports to the Burgos Basin region in Mexico. Sand will be transported by rail or truck to Mexico, impacting Texas ports, highway and rail networks.

Given the shortage of Mexican refineries and pipelines in the area, it is likely that most of the extracted oil will be shipped to refineries in Texas and Louisiana. Oil will be hauled from drill sites by truck to gathering hubs and terminals for shipment by rail to the nearest refineries. The U.S. railroads serve the Gulf Coast and could eventually handle crude-by-rail from Mexico. This could become a concern in Texas as Mexico's energy sector increases. International rail crossing capacity might be an additional concern with increased demand.

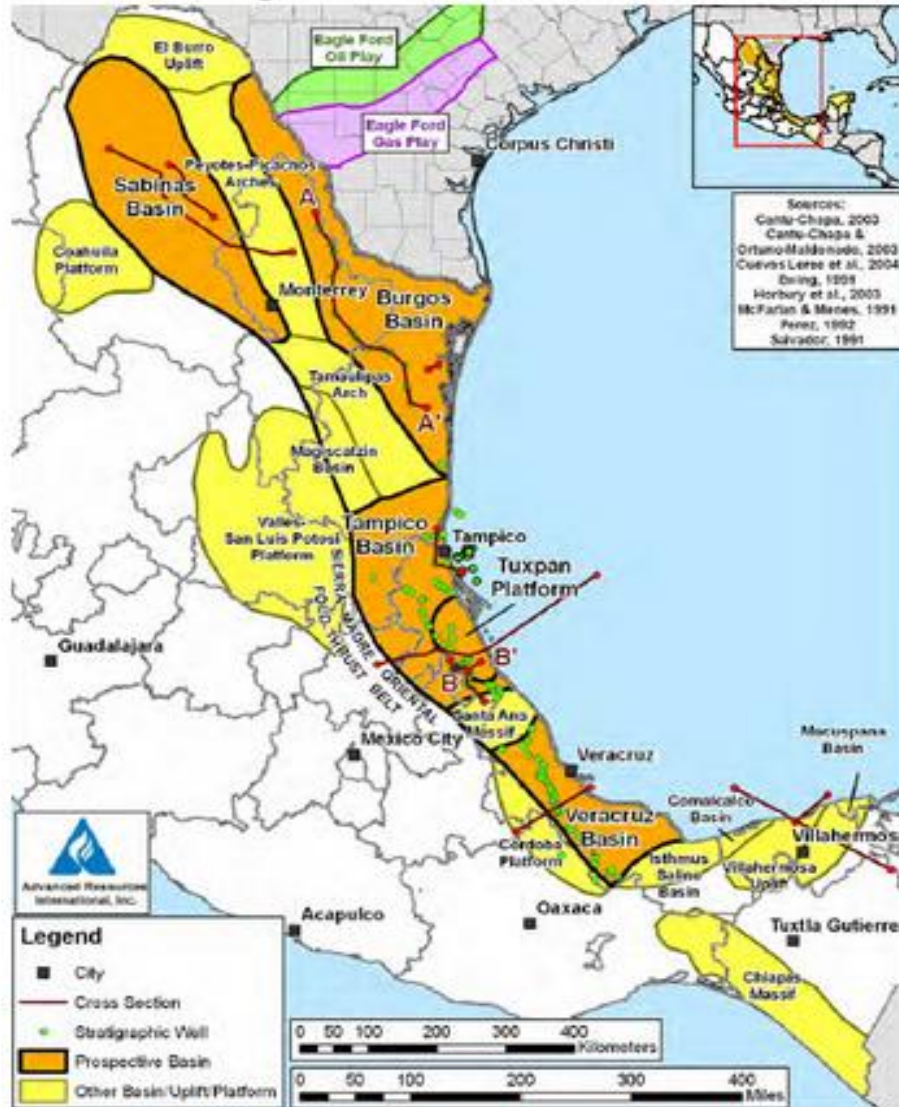
After a brief description of the hydraulic fracturing process, this paper analyzes the potential impacts of the Mexican energy reform in the Texas transportation system by first presenting the general goals of Mexico's energy reform and documenting previous research that was conducted on the influence that the energy sector had on Texas transportation systems. This paper then

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<sup>1</sup> Guzmán, Roberto. "Energy Reform in Mexico." Lecture, PIPA Consulting. Cartagena, Colombia. November 15, 2013

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discusses the potential impact that Mexico’s National Infrastructure Investment Program could have on Mexico’s shale region, identifying possible similarities in the energy sectors of Mexico and Texas. The final section of this paper presents conclusions and identifies areas for further research.



Source: World Shale Gas and Shale Oil Resource Assessment, U.S. Energy Information Administration

Figure 1. Mexican Oil Reserves.

## Background on Hydraulic Fracturing

Hydraulic fracturing is a process of extracting oil and gas to stimulate further production from existing oil and gas wells. Simply put, hydraulic fracturing is the pumping of a mixture of fluids and materials deep underground to create fractures in a shale bed that releases the oil and gas

deep underground. The two major commodities used in the fracturing process are water and frac sand. This speeds up the production process of the actual extraction of oil and gas.

## Mexico's Energy Reform

Mexico's energy reform, signed in December 2013, aimed to end the monopoly of the oil company Petróleos Mexicanos (PEMEX) and encourage foreign investment in Mexico's energy sector. The energy reform's key details or secondary laws were signed by President Peña Nieto on August 11, 2014, to implement the Constitutional energy reforms. With the passing of the secondary legislation that regulates the new energy sector, the government has introduced a number of measures to speed up the implementation of the reform. The secondary laws defined two stages or rounds:

- Resolution Round 0 – Awarding exploration and production areas to PEMEX in preparation for opening to private investment.
- Round 1 – Identifying the areas that will be opened to the private sector through partnerships and oil auctions.<sup>2</sup>

The reform to the Mexican constitution releases the government's control over PEMEX and attracts private investment in the energy industry. The government will now hand over the "regulatory authority over the oil and gas sectors to the Energy Regulatory Commission, the Secretary of Energy, and the National Hydrocarbon Commission, and create a new National Agency of Industrial Safety and Environmental Protections."<sup>3</sup> This action by the government will maintain PEMEX as a state-owned entity, but with more "administrative and budgetary autonomy, and allow the company to compete for bids with other firms on new projects."<sup>3</sup> These reforms are necessary for Mexico's energy industry to successfully develop, particularly along the Burgos Basin. Javier Treviño of the Energy Commission explains that Mexico has to develop its energy resources in order to keep the pace with Canada and the United States.<sup>4</sup> With an increase in drilling on the lands surrounding these shale reserves, demands for the materials and supplies for energy development, in particular use of hydraulic fracturing, will also increase.

Currently, PEMEX does not have the technical and operating expertise to develop resources that will capitalize on the Burgos Basin shale reserves.<sup>5</sup> U.S. companies already hold a strong

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<sup>2</sup>Herbert Smith Freehills Spain LLP, Latin American Bulletin, September 2014.

<sup>3</sup>"EIA: Mexico's energy reform will address many challenges." *Oil & Gas Journal*. May 27, 2014. Accessed June 1, 2014, <http://www.ogj.com/articles/2014/05/eia-mexico-s-energy-reform-will-address-many-challenges.html>.

<sup>4</sup>Miroff, Nick. "The fracking divide: Mexico's oil frontier beckons U.S. drillers in wake of new law." *The Washington Post*. April 19, 2014. Accessed May 29, 2014, [http://www.washingtonpost.com/world/the\\_americas/the-fracking-divide-mexicos-oil-frontier-beckons-us-drillers-in-wake-of-new-law/2014/04/19/1951ba0c-e8ff-452d-84bd-d488f730991c\\_story.html](http://www.washingtonpost.com/world/the_americas/the-fracking-divide-mexicos-oil-frontier-beckons-us-drillers-in-wake-of-new-law/2014/04/19/1951ba0c-e8ff-452d-84bd-d488f730991c_story.html).

<sup>5</sup>"Mexican Energy Reform Opportunity Knocks." *Deloitte*. Accessed September 8, 2014. <http://www.deloitte.com/assets/Dcom->

expertise in developing shale plays and should be able to partner with Mexican companies who already understand “local regulatory and operating realities and have the first mover advantage.”<sup>5</sup>

Another aspect of the secondary laws is the allocation of what resources will be available to PEMEX and what resources will be available for foreign private companies. The Mexican Energy Ministry believes that there will be between 20 and 25 percent of onshore and offshore reserves that will be reserved for PEMEX use. The Mexican government is worried about PEMEX’s lack of expertise with shale fields and deep water drilling. Because of this, it is expected that private sector companies will be given more opportunities with shale fields and deep water drilling.

## **Experience of Texas Energy and Transportation**

Texas’ transportation system supports three major activities along the energy supply chain: well development, production/extraction, and resource distribution.

### *Well Development*

Construction traffic is generated during the five-step well development process: site preparation, rigging up, drilling, hydraulic fracturing, and rigging down. Initial site preparation requires heavy bulldozers for grading and dump trucks for hauling rock to build a road that serves the pad site. Subsequently, the rotary rig must be moved to the pad site and assembled on site. Typically, a rig that can drill a 10,000 foot well will require 35 to 45 semi-trucks to move and 50 to 75 people to assemble the rig.<sup>6</sup>

For the well development, piping supplies are typically transported via railways to distribution hubs, where they are then transported using flatbed trucks. These two modes of transportation have increased significantly due to hydraulic fracturing.

### *Production/Extraction*

On the production side of the oil industry, the demand for water and sand has skyrocketed due to hydraulic fracturing. Water is primarily transported through the roadways, but steps are being taken to start this transportation by using pipeline. The frac sand needed for hydraulic fracturing is being sourced from Midwestern U.S. states, parts of Canada, and Brazil. In Texas, sand has been imported through the Port of Corpus Christi and is primarily transported to major distribution points by railway and then delivered to final locations using trucks. Impacts to the following transportation modes are discussed below.

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UnitedStates/Local%20Assets/Documents/Consulting%20MOs/CSMLs/us\_consulting\_MexicoEnergyReformPaper2014FINAL\_0342014.pdf.

<sup>6</sup> Prozzi, Jolanda, Sergey Grebenshikov, Ambarish Banerjee, Jorge Prozzi. Impacts of Energy Developments of the Texas Transportation System Infrastructure. Conducted by *Center for Transportation Research at The University of Texas at Austin*. Texas Department of Transportation, Austin, TX, 2011. Pp. 135.

## ***Roadways***

Previous studies have been conducted on the impacts of Texas roadways due to the Barnett Shale and Permian Basin. In the Barnett Shale area, according to a study by Prozzi, Grebenschikov, Banerjee, and Prozzi (2011) and sponsored by Texas Department of Transportation's (TxDOT), "average daily traffic (ADT) in some areas, such as Benbrook and Lake Worth has increased by 16 and 23 percent, respectively, since 2000."<sup>7</sup>

Studies show that the majority of Texas roads that are experiencing the most change due to oil production are state and county roads. In this study, that had an analysis period of 20 years, it was concluded that the production traffic due to the crude oil sector "reduces the service life of pavement structures by almost 9 percent" in the Permian Basin. The estimate is, however, conservative, and in reality the impacts could be more severe, because the additional damage and the reduction in service life were estimated separately for the construction and production truck traffic. In other words, the combined impacts of the two different operations on the infrastructure were not calculated.<sup>8</sup> The Texas A&M Transportation Institute (TTI) conducted a study that reached a conclusion regarding the increased stress on Texas roads. The TTI report says, "unfortunately, the roads in and around the boom areas are quickly deteriorating – they were simply not designed for this kind of use."<sup>9</sup>

## ***Railroads***

A thorough quantitative analysis on the energy industries influence on Texas railways is absent. The energy sector is increasingly more dependent on Texas railways because of the demand for sand used in hydraulic fracturing.

The increased demand for sand has resulted in sand vendors constructing storage facilities near drill sites with direct access from railways. The destinations of frac sand shipments depend on the freight railroads in place that span from the Midwest to the shale reserves.<sup>10</sup> In 2012, Texas Pacifico Transportation Ltd. (TXPF) tripled their carloads on the South Orient rail line and carloads were projected to triple again in 2013.<sup>11</sup> Union Pacific Corp. is also developing a "Sand 2 Shale" program that is expediting sand delivery to the Permian Basin and Eagle Ford Shales.<sup>12</sup> These two railroads are finding themselves increasing investments to cater to the growing frac

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<sup>7</sup> *ibid* pp. 11.

<sup>8</sup> Prozzi, Jolanda, Sergey Grebenschikov, Ambarish Banerjee, Jorge Prozzi. Impacts of Energy Developments of the Texas Transportation System Infrastructure. Pp. 136.

<sup>9</sup> "TTI Study Estimates Roadway Damage of the Texas Energy Boom." *Texas A&M Transportation Institute*. September 17, 2012. Accessed June 4, 2014, <http://tti.tamu.edu/2012/09/17/tti-study-estimates-roadway-damage-of-the-texas-energy-boom/>.

<sup>10</sup> Sobczak, Blake. "Hydraulic Fracturing: Rail arteries make or break frac sand growth in Midwest." *E&E Publishing, LLC*. June 17, 2013. Accessed June 4, 2013, <http://www.eenews.net/stories/1059982951>.

<sup>11</sup> Stagl, Jeff. "Crude oil surge in Permian Basin drives Texas-style business boom for short-line railroad." *Progressive Railroading*. July, 2013. Accessed June 4, 2013, [http://www.progressiverailroading.com/short\\_lines\\_regionals/article/Crude-oil-surge-in-Permian-Basin-drives-Texasstyle-business-boom-for-shortline-railroad--36739](http://www.progressiverailroading.com/short_lines_regionals/article/Crude-oil-surge-in-Permian-Basin-drives-Texasstyle-business-boom-for-shortline-railroad--36739).

<sup>12</sup> Sobczak, Blake. "Hydraulic Fracturing: Rail Arteries make or break frac sand growth in Midwest."



sand industry. Non-rail companies are also responding to this large demand for frac sand via rail transport by developing infrastructure to improve transportation logistics. Badget Mining Corp. planned to spend “several million dollars to build eight tracks at its San Angelo frac sand operation.”<sup>13</sup> Texas Specialty Sands L.L.C. is also joining in on infrastructural investments by “building six to eight more tracks at its Barnhart frac sand operation.”<sup>13</sup>

The demand for rail car leases is also increasing. “Cars that haul sand for fracking are leasing for about \$650 a month, up nearly 50 percent from the end of last year, according to leasing-industry analysts.”<sup>14</sup> Railcar leasers do not have a sufficient supply of cars to lease for hauling frac sand. There are plans to manufacture and distribute new tank cars into 2016.<sup>14</sup> This will likely increase the traffic in Texas’ rail network. Since these rail companies are expanding infrastructure to meet increasing demands of frac sand in the Permian Basin and Eagle Ford, potentially they will also develop infrastructure to meet the potential demand on the Mexican side of the Eagle Ford. This would be an important aspect to keep track of because it would have a strong effect on the rail network in Texas.

### ***Ports***

As mentioned earlier, frac sand is being imported through the Ports of Corpus Christi and Brownsville. This increased demand will require additional handling facilities and land connectivity to the rail and highway networks in Texas.

### ***Resource Distribution***

On the distribution side, the supply of crude oil is being brought to refineries along the Gulf Coast through railways and pipelines, and sometimes by truck.

### ***Railroads***

Rail transportation is also becoming more important with the transport of crude oil from distribution terminals to refineries. At the national level, in 2013, the rail share of crude oil transport was 11 percent. This percentage was a large increase from a “negligible percentage a few years ago.”<sup>15</sup> Due to the distance from wells to refineries and existing pipeline network in Texas, crude-by-rail transportation is not expected to increase in Texas.

### ***Crude-by-Rail Safety Concerns***

Crude-by-rail has consequent safety concerns. The U.S. Department of Transportation (DOT) announced new regulations for trains carrying crude oil. The United States and Canada are passing regulations to increase puncture-resistant tank cars. “Canada set a three-year deadline to replace or retrofit 65,000 tank cars that carry flammable materials. U.S. rail regulators are

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<sup>13</sup> Stagl, Jeff. “Crude oil surge in Permian Basin drives Texas-style business boom for short-line railroad.”

<sup>14</sup> Tita, Bob. “Railcar Shortage in U.S. Pushes up Lease Rates” *The Wall Street Journal*. May 29, 2014. Accessed June 16, 2014, <http://online.wsj.com/articles/railcar-shortage-in-u-s-pushes-up-lease-rates-1401393331>.

<sup>15</sup> *Association of American Railroads*.

expected to adopt tougher standards this year.”<sup>16</sup> U.S. DOT issued an advisory that strongly urged “those shipping or offering Bakken crude oil to use tank car designs with the highest level of integrity available.”<sup>17</sup> Bakken crude, from North Dakota, is more flammable than typical crude oil. Crude oil from the Eagle Ford and Permian Basin produce light, sweet crude along with gases such as propane and butane.<sup>18</sup> Ramanan Krishnamoorti, a professor of chemical and petroleum engineering at the University of Houston said this light, sweet crude, “generally has lighter hydrocarbons than heavy crude. This means it’s more flammable and vaporizes more easily.”<sup>18</sup> Crude oil from the Eagle Ford and Permian Basin are said to be just as flammable.

U.S. DOT also passed an Emergency Order (Docket Number DOT-OST-2014-0067) that required trains with more than 1 million gallons of crude oil to provide State Emergency Response Commissions with the exact movements of the train in the particular states. These notifications must include:

- Estimated volume of crude oil.
- Frequency of traffic.
- The exact route of travel.

With an expected increase of crude-by-rail transport coming from south of the border, safety measures will be of concern in Texas.

## **Mexico’s Infrastructure Investment Plan**

In 2012, Mexico’s President Enrique Peña Nieto announced a six-year plan to invest \$316 billion on developing infrastructure spanning from roadways, railways, telecom infrastructures, and maritime ports.<sup>19</sup> The goal for the National Infrastructure Program (NIP) is to develop the logistics of the movement of products, services, and people. This includes the development of roadways and railway networks. The plan of projects includes, but is not limited to, creation of 60 new roads (15 toll roads, 29 freeways, and 16 rural roads), seven ports, three passenger railroads, and seven airports. This is the plan that is projected by the Mexican national government, but as private investment begins to flow into Mexico, the projects are expected to become more diverse.

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<sup>16</sup> Tita, Bob. “Railcar Shortage in U.S. Pushes up Lease Rates.”

<sup>17</sup> “U.S. DOT Takes New Emergency Actions as Part of Comprehensive Strategy to Keep Crude Oil Shipments Safe.” *United States Department of Transportation*. May 7, 2014. Accessed June 16, 2014. <http://www.dot.gov/briefing-room/us-dot-takes-new-emergency-actions-part-comprehensive-strategy-keep-crude-oil>.

<sup>18</sup> Hiller, Jennifer. “Federal regulators check Eagle Ford oil flammability.” *Fuel Fix*. January 23, 2014. Accessed October 23, 2014. <http://fuelfix.com/blog/2014/01/23/640993/>.

<sup>19</sup> Webber, Jude. “Mexico plans \$316bn for infrastructure.” *Financial Times*. July 16, 2013. Accessed June 5, 2014, <http://www.ft.com/cms/s/0/df02d3d4-ed9e-11e2-8d7c-00144feabdc0.html#axzz33rrWfU31>.

Rail transportation is also an important aspect of the NIP. Mexico is very focused on developing freight transportation through rail networks so it can keep pace with the neighboring United States. In 2012, “rail carried about 45 percent of freight in the United States and 60 percent in Canada, but only 26 percent in Mexico.”<sup>20</sup> The CEO of Ferrocarril Mexicano (Ferromex) said, “When the private sector took over [the railroads], the new rail carriers started improving the network and heavily marketing their services. Plenty of opportunity remains to be tapped.”<sup>20</sup> Part of the infrastructure investment plan was a new invitation for the private sector to invest in partnerships with the federal government to foster development. With this invitation, we could expect more growth in infrastructure.

In December 2013, Mexico enacted a new federal public-private partnership law to attract more private investors. Key changes include:<sup>21</sup>

- Transparent bidding process for contracts.
- Minimum mandatory terms.
- Clearer rights for investors.
- Dispute resolution via arbitration.

The new law now follows common business practices in other countries and aims to protect investors. This will attract more private investors and could potentially help Mexico become a top infrastructure market in the coming years.

## **Mexican Refineries and Pipeline Network**

Currently, there are only six refineries in Mexico, and the energy reform does not contemplate attracting private investors to increase refining capacity. PEMEX’s refineries have a history of poor productivity, and this low productivity is turning international investors away from wanting to develop refineries in Mexico. Miguel Hidalgo Refinery is one-fifth less productive than refineries along the U.S. Gulf Coast. It is overemployed compared to top US refineries with 3,200 full-time employees. In comparison, the U.S. refinery Valero Energy Corp. has 480–800 workers at five plants of similar size.<sup>22</sup>

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<sup>20</sup> Douglass, Merrill. “In Mexico, Rail is On a Roll.” *Inbound Logistics*. January, 2012. Accessed May 29, 2014, <http://www.inboundlogistics.com/cms/article/in-mexico-rail-is-on-a-roll/>.

<sup>21</sup> Fernández, Vicente. Khokhar, Someera. Goldstein, Sean. Segura Alonsa, José Ignacio. “Open for investment: How Mexico is paving the way for infrastructure investors.” White & Case <http://www.whitecase.com/files/Publication/6c5d86fe-e7cc-451f-b40d-a2209f290cd2/Presentation/PublicationAttachment/571ee350-c448-41ab-9948-aaef30df4cfd/Mexico-Infrastructure-Open-for-Investment-March-2014.pdf>.

<sup>22</sup> Alire Garcia, David. “Analysis: A new hope or false dawn for Mexico’s oil refiners?” *Reuters*. January 3, 2014. Accessed June 16, 2014, <http://www.reuters.com/article/2014/01/03/us-mexico-oil-analysis-idUSBREA0205O20140103>



Energy analysts agree that U.S. refiners would probably not invest in Mexico's refinery industry with this current shortage of refineries.<sup>23</sup> It appears logical to assume that it would be cheaper for U.S. refiners to import the crude oil to Texas and Louisiana rather than invest in new refineries.

There have been limited talks of developing pipelines in Mexico. Sempra Energy was awarded a contract in 2012 with PEMEX to develop a pipeline.<sup>24</sup> The existing projects are limited to being constructed along the Pacific coast of Mexico. The existing pipelines in Mexico are mainly in the south near the Miguel Hidalgo refinery. To meet the future development in the north along the Burgos Basin, more pipelines would need to be constructed. The exact locations of these pipelines are not known. The bidding process for more contracts will likely happen when the bidding window is opened.

## **Potential Impacts to the Texas' Transportation System**

### *Well Development*

It is expected that in the short term, depending on the availability of rotary rigs and other well development equipment in Mexico, which is believed to be limited, the rigs and equipment will probably be moved from Texas to the Burgos Basin. This would impact Texas' roadway and border crossing infrastructure with an increased number of oversize/overweight loads moving through the Texas transportation system and crossing the Texas-Mexico border. Over the long term, the machinery involved in well development could potentially be manufactured in Mexico since there is already a strong manufacturing industry present in the country.

### *Production/Extraction*

During the production stage, the main impact in Texas would be related to the transportation of frac sand. As mentioned earlier, sand will most likely be shipped to Corpus Christi and Brownsville, which are the closest deep water ports to the Burgos Basin. As volume of frac sand grows, these ports would potentially require additional handling capacity, as well as connecting infrastructure to the highway and rail networks.

Other impacts from the frac sand needed in Mexico during the production/extraction phase would be to the road and rail networks in Texas that handle sand from the ports to the border and at the land border crossing itself. Additional capacity to handle southbound sand rail cars would be needed.

As far as impacts from water, which is the other major commodity needed during this phase of the process, the damage to Texas roads would most likely depend on whether or not Mexican drillers will decide to import water or rely on Mexico's own water resources. A likely scenario in

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<sup>23</sup> Sider, Alison, "Mexico Still Needs Help Solving its Trillion Dollar Challenge." *The Wall Street Journal*. March 4, 2014. Accessed June 16, 2014, <http://blogs.wsj.com/corporate-intelligence/2014/03/04/mexico-still-needs-help-solving-its-trillion-dollar-challenge/>.

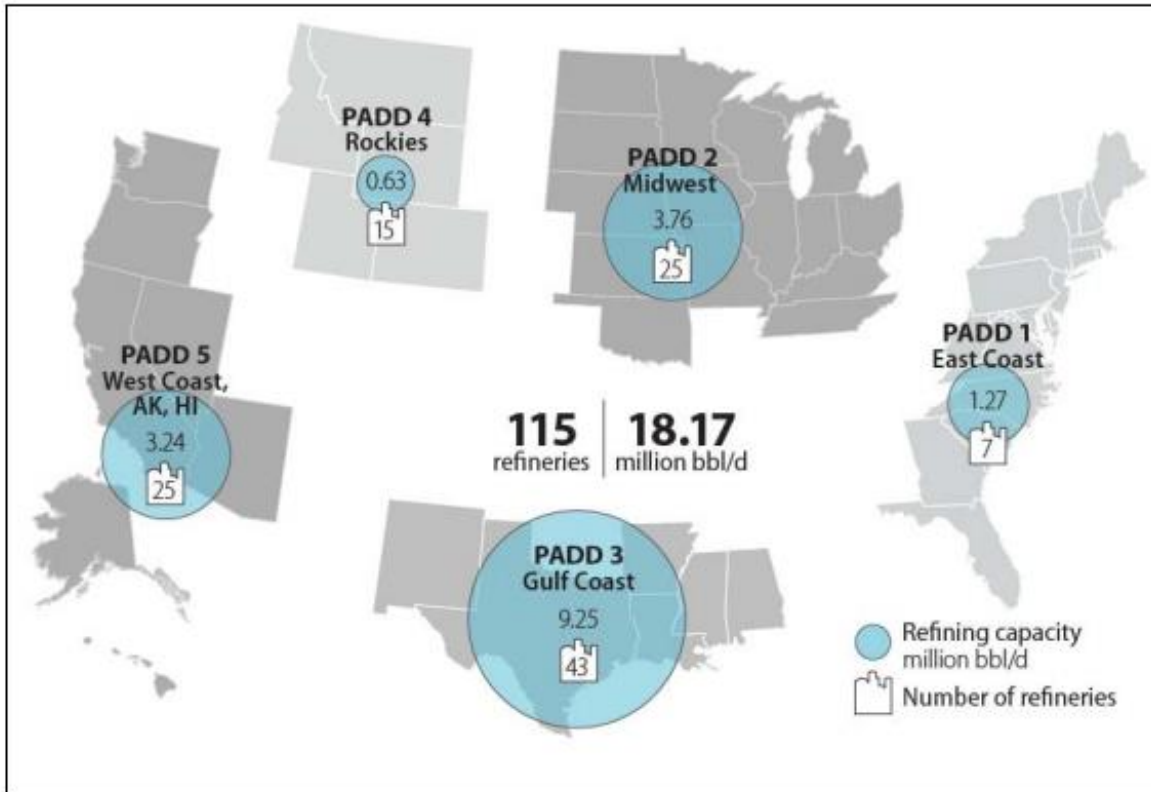
<sup>24</sup> Cox, Edward. "US utility Sempra looks at Mexico's growth in pipeline natural gas opportunities." *ICIS*. May 7, 2014. Accessed July 1, 2014. <http://www.icis.com/press-releases/lng-article-us-utility-sempra/>.

Mexico is that water will be extracted from Mexican resources. Currently, the majority of water used for the fracturing process is extracted from fresh groundwater resources, and these are typically extracted by using a well. If Mexico's energy industry follows the same trends as that of Texas, then Mexico can be expected to begin extracting from its own fresh groundwater supplies. Also, the energy industry is making innovations to use less water.

Currently there are concerns with Mexico being able to meet the demands with its limited water supply. With innovation and numerous solutions like frac water recycling, building pipelines from the Gulf of Mexico or extracting water from wetter coastal regions, Mexico could possibly be capable of running a self-sufficient water industry to meet the demands of hydraulic fracturing. A self-sufficient Mexican water supply means that Texas' transportation system will likely be unaffected by the water trucks needed for Mexico's energy industry.

### *Resource Distribution*

The safety of crude-by-rail remains a great concern throughout the United States and may be a source of concern in Texas because rail traffic could likely increase due to Mexico's energy industry. Since the majority of the refineries in the United States are located along the Gulf Coast, crude oil from North Dakota and Wyoming is being transported by rail through Texas to the Gulf Coast. Though these refineries are primarily designed to refine a more heavy crude (known to originate from North Dakota and Wyoming), currently investors are retrofitting the refineries to adjust for meeting the higher supply of light, sweet crude from the current U.S. shale boom. Given that Mexico's oil will come from the same basin as the Texas shale, and that the U.S. Gulf Coast refineries would have the capacity and are close to where the Mexican shale oil will be extracted, it appears that the refineries along the Gulf Coast will be used to refine oil coming from south of the border. The map in Figure 2 shows where the refineries are located in the United States.



Sources: Congressional Research Service; Energy Information Administration.

Figure 2. Map of Refineries in United States.

With the combination of an increase of crude oil production in Mexico and the lack of refineries in Mexico, it appears likely that this demand for railways running through Texas will increase when more oil is being brought from south of the border. The main concern is the rail transportation of crude oil originating from outside of Texas that uses railways through Texas to arrive at refineries along the Gulf Coast. Though it is expected that pipeline networks will be constructed along the Burgos Basin, this may not be sufficient in the short term, and there would still be the necessity of crude-by-rail transport to the refineries from Mexico to the U.S. Gulf Coast.

Due to the increased demand of crude-by-rail transport and frac sand, it is likely that this demand will be extended to the Mexican side of the border. The rail system in the United States is already facing challenges with the increase in demand of rail car leases and the new regulations on the safety of crude oil transportation. The U.S. railroads that connect to the Mexican rail system in Texas are Union Pacific (UP), Kansas City Southern (KCS), and Burlington Northern Santa Fe (BNSF). The Texas Pacifico (TXPF) connects to Mexico at Presidio, but currently the international bridge is not in operation. The three U.S. railroads that serve the Gulf Coast, and would eventually handle crude-by-rail from Mexico, are UP, BNSF, and KCS. The TXPF could possibly handle some crude once the international connection is operational, but capacity off that rail line could be an issue.

## *Vulnerabilities*

This research has led to the conclusion that Texas' railways will be the most affected transport mode by Mexico's energy reform:

- The shortage of refineries and absence of pipelines in the Burgos Basin will lead to an increase in use of railways for the transportation of crude oil from Mexico to refineries on the U.S. Gulf Coast.
- Rail border crossings will also be affected, as currently there are capacity constraints at the few existing rail crossings in the region. The new Brownsville-Matamoros rail crossing could solve this issue in the short term.
- The frac sand that is coming from the Midwest by rail to areas like the Eagle Ford and Permian Basin, as well as to Texas' ports, are likely to be extended toward the Mexican side of these shale reserves. Rail volumes through Texas could potentially increase.

Other areas of potential concern are the Ports of Corpus Christi and Brownsville that would need to be prepared to handle frac sand for delivery to Mexico. Additional handling capacity at the ports may be required.

With a greater amount of cargo crossing through the borders (inbound and outbound traffic), it will be necessary to address potential capacity and security/immigration/contraband issues. These issues could be resolved with additional physical capacity that will require expanding current ports of entry or building new ones. The other alternative is to use current infrastructure more efficiently by adding staff and/or technology. The latter requires less funding and could be implemented faster, as the development of international port of entry infrastructure is a lengthy process. Further research would be needed to quantify the potential increase in the flow of goods through the land and ocean ports.

## **Areas for Further Research**

There are several specific aspects that could be studied in order to better inform effective policy considerations:

- Overweight and oversized rig movement from Texas into Mexico.
- Safety measures for rail cars in the United States and Mexico.
- Handling capacity at Corpus Christi and Brownsville.
- The anticipated increase in rail traffic.
- Increase in border crossing volumes, identifying location, and commodity types.
- Mexico's future water extraction processes.
- Mexico's manufacturing capacity relative to the well equipment needed.