

What Happened to Mexico's Burgos Shale?

Developments, Strategies, and Policy Options



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Executive Summary

Booming oil and natural gas production in the south Texas Eagle Ford Shale and enthusiastic predictions for similar shale production in Mexico's Burgos Basin were the initial motivations for this research. However, the 2018 political transition in Mexico and the suspension of the 2014 Energy Reforms changed the impetus of the study to explore the dynamics affecting energy production in the Texas-Mexico border region. More broadly, the Burgos Basin offers a fascinating space to understand changes in Mexico's oil and natural gas production strategies, associated public policies, and stakeholder perspectives on energy developments in the border region.

Through interviews conducted with key stakeholders, participation in oil and gas industry conferences, geospatial analyses, online journalism and social media tracking, and archival research, our study points to opportunities and challenges in the trans-border region and identifies differences between dominant social media and media narratives versus the situation on the ground. In terms of opportunities, respondents identified the Burgos' production potential, its proximity to Texas, access to infrastructure, and the post-Reform regulatory framework and contract models as important regional advantages. Of these, shale gas production potential and proximity to Texas were the primary strengths. Stakeholders also identified challenges that restrict production activities in the Burgos, especially current politics, lack of infrastructure and production inputs in the Basin, negotiating with communities and landowners, narco-violence and security concerns, a cumbersome regulatory framework, and dealing with Pemex and its legacy landscapes.

Beyond these challenges and opportunities, our research also identified two influential narratives driving discussions about developments in the Burgos Basin. First, there is a popular narrative that the Mexican government's ban on hydraulic fracturing is limiting Mexico's ability to produce oil and natural gas. However, despite large estimates of shale gas reserves in the Burgos, the extremely high costs to produce it compared to analogous production in Texas as well as the low price of imported natural gas from Texas suggest that shale and unconventional resources are not the panacea for Mexico that some industry analysts suggest. Second, and relatedly, the government's hydraulic fracturing ban might just be empty talk, since Pemex and oilfield services firms continue to practice this technique in some of Mexico's oil fields. Although politically expedient in the short-term, the ban may offer Mexico longer-term energy security with Burgos resources, especially given the glut of natural gas currently produced in Texas.

During interviews conducted in 2019, regional stakeholders proposed several policy and economic recommendations. These suggestions can motivate policymakers, industry participants, and the wider public in both Texas and Mexico to think realistically about near-term and future energy developments in the border region.

Policy Options and Stakeholder Recommendations

- ***Conventional gas is a superior target than shale gas in the Burgos.***



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The Mexican government's ban on hydraulic fracturing has garnered much attention. However, according to respondents, there are ample opportunities for conventional natural gas production in the Burgos as well as offshore production in the Burgos and elsewhere.

- ***Uncertainties in Mexico's energy policies are not new.***
Oilfield services companies have worked in Mexico and the Burgos for decades and faced similar policy and security uncertainties. Stakeholders advise private firms with interests in the Burgos to be patient with the current political and economic situation; chances are that favorable conditions are on the horizon.
- ***Firms want the Mexican government to reopen bidding rounds and amend the contract model.***
Some respondents recommend that the government reopen the contract model and taxing format from 2018 (i.e., the CEE model), start bidding rounds again, and create a fully independent and transparent hydrocarbon production regulatory body.
- ***In northern Mexico, security is not as big an issue for oil and gas firms as people believe.***
Most of the respondent's comments about security challenges were based on media narratives and not firsthand experience. Among respondents with firsthand experience working in the Burgos, security was not seen as a major challenge. As one respondent noted about cartels, "You can work along with these guys as long as you don't cross into their territory." As well, there is a tacit agreement that oil field employees will leave drug-controlled areas well before sundown.
- ***Mexico's offshore is open for business.***
Investments in offshore are much higher than onshore, and the types of companies working offshore also are different. Deep-water developments do not contend with many of the social, political and legacy issues faced by operators working onshore production areas. Offshore contracting has continued despite the change in administrations.
- ***It is not a problem to continue to import natural gas from Texas.***
Mexico has and will continue to rely on natural gas imports from Texas. The glut of Texas natural gas, record low natural gas prices, and several new import pipelines makes Texas gas much cheaper than liquefied natural gas from Asia or Latin America. At today's prices, there is little incentive for Pemex or private firms to over-invest in Burgos shale production.
- ***The Burgos shale is better thought of as part of Mexico's future energy security.***
If energy security is a concern, the Mexican government could wait to exploit Burgos reserves until the future, rely on Texas natural gas imports to meet national demand in the short-term, and double down on renewable energy infrastructure and investments.

Resumen Ejecutivo

El auge de la producción de petróleo y gas natural en el sur de Texas Eagle Ford Shale y las predicciones entusiastas para una producción similar de petróleo y gas de esquisto en la Cuenca de Burgos en México fueron las motivaciones iniciales para esta investigación. Sin embargo, la transición política de 2018 en México y la suspensión de las Reformas Energéticas de 2014 cambiaron la orientación del estudio para explorar la dinámica que afecta la producción de energía en la región fronteriza Texas-México. En términos más generales, la Cuenca de Burgos ofrece un espacio fascinante para comprender los cambios en las estrategias de producción de petróleo y gas natural de México, las políticas públicas asociadas y las perspectivas de las partes interesadas sobre los desarrollos energéticos en la región fronteriza.

A través de entrevistas realizadas con actores clave, participación en conferencias de la industria del petróleo y el gas, análisis geoespaciales, periodismo en línea, seguimiento de redes sociales, e investigación de archivo, nuestro estudio apunta a identificar oportunidades y desafíos en la región transfronteriza y establecer las diferencias existentes entre narrativas mediáticas y las de las redes sociales dominantes versus la situación de terreno. En términos de oportunidades, los encuestados identificaron el potencial de producción de Burgos, su proximidad a Texas, el acceso a la infraestructura, el marco regulatorio y los modelos de contrato posteriores a la Reforma como importantes ventajas regionales. De estos, el potencial de producción de gas de esquisto y la proximidad a Texas fueron las principales fortalezas. Las partes interesadas también identificaron desafíos que restringen las actividades de producción en Burgos, especialmente la política actual, la falta de infraestructura y de insumos de producción en la cuenca, las negociaciones con las comunidades y los propietarios de tierras, la narcoviolenca y las preocupaciones de seguridad, un marco regulatorio engorroso y el trato con Pemex y su huella en el paisaje.

Más allá de estos desafíos y oportunidades, nuestra investigación también identificó dos narrativas influyentes que impulsaron las discusiones sobre los desarrollos en la cuenca de Burgos. Primero, existe una narrativa popular de que la prohibición del gobierno mexicano de fracturación hidráulica está limitando la capacidad de México para producir petróleo y gas natural. Sin embargo, a pesar de las grandes estimaciones de las reservas de gas de esquisto en Burgos, los costos extremadamente altos para producirlo en comparación con la producción análoga en Texas, así como el bajo precio del gas natural importado de Texas sugieren que el esquisto y los recursos no convencionales no son la panacea que algunos analistas de la industria abogan. En segundo lugar, y de manera relacionada, la prohibición de fracturación hidráulica del gobierno podría ser una discusión vacía, ya que Pemex y las empresas de servicios petroleros continúan practicando esta técnica en algunos de los campos petroleros de México. Aunque políticamente conveniente a corto plazo, la prohibición podría ofrecer a México seguridad energética a más largo plazo con recursos de Burgos, especialmente dada la saturación de gas natural que actualmente se produce en Texas.

Durante las entrevistas realizadas en 2019, las partes interesadas regionales propusieron varias recomendaciones políticas y económicas. Estas sugerencias pueden motivar a los encargados de formular políticas públicas, a los participantes de la industria y al público en general en Texas y México a pensar de manera realista sobre los desarrollos energéticos en la región fronteriza tanto a corto plazo como a futuro.

Opciones de política y recomendaciones de las partes interesadas

- ***El gas convencional es un objetivo de mayor importancia que el gas shale en Burgos.***

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La prohibición del gobierno mexicano de fracturación hidráulica ha atraído mucha atención. Sin embargo, según los encuestados, existen amplias oportunidades para la producción convencional de gas natural en Burgos, así como la producción en alta mar en Burgos y en otros lugares.

- ***Las incertidumbres en las políticas energéticas de México no son nuevas.***

Las empresas de servicios petroleros han trabajado en México y Burgos durante décadas y se enfrentaron a incertidumbres similares en materia de políticas y seguridad. Las partes interesadas aconsejan a las empresas privadas con intereses en Burgos que sean pacientes con la situación política y económica actual; Lo más probable es que las condiciones favorables estén en el horizonte.

- ***Las empresas quieren que el gobierno mexicano vuelva a abrir las rondas de licitación y modifique el modelo de contrato.***

Algunos encuestados recomiendan que el gobierno vuelva a abrir el modelo de contrato y el formato recaudatorio de 2018 (es decir, el modelo CEE), y que comience nuevamente las rondas de licitación y cree un organismo regulador de producción de hidrocarburos totalmente independiente y transparente.

- ***En el norte de México, la seguridad no es un problema tan grande para las empresas de petróleo y gas como la gente cree.***

La mayoría de los comentarios de los encuestados sobre los desafíos de seguridad se basaron en narrativas de los medios y no en experiencias de primera mano. Entre los encuestados con experiencia de trabajo en Burgos, la seguridad no fue vista como un gran desafío. Como señaló uno de los encuestados acerca de los carteles, "Puedes trabajar junto con estos tipos siempre que no cruces a su territorio". Además, existe un acuerdo tácito de que los empleados de los campos petroleros abandonen las áreas controladas por los carteles de drogas mucho antes del anochecer.

- ***La costa afuera de México está abierta para los negocios.***

Las inversiones en el extranjero son mucho más altas que en el extranjero, y los tipos de empresas que trabajan en el extranjero también son diferentes. Los desarrollos en aguas profundas no enfrentan muchos de los problemas sociales, políticos y heredados que enfrentan los operadores que trabajan en áreas de producción en tierra. La contratación en el extranjero ha continuado a pesar del cambio en las administraciones.

- ***No es un problema continuar importando gas natural de Texas.***

México tiene y seguirá dependiendo de las importaciones de gas natural de Texas. El exceso de gas natural de Texas, el récord en cuanto al bajo precio del gas natural y varios ductos nuevos para la importación hacen que el gas de Texas sea mucho más barato que el gas natural licuado de Asia o América Latina. A los precios actuales, Pemex o las empresas privadas tienen pocos incentivos para realizar inversiones excesivas en la producción de esquisto de Burgos.

- ***El shale de Burgos es mejor considerado como parte de la seguridad energética futura de México.***

Si la seguridad energética es una preocupación, el gobierno mexicano podría esperar para explotar las reservas de Burgos hasta un futuro cercano, y continuar dependiendo de las importaciones de gas natural de Texas para satisfacer la demanda nacional a corto plazo, mientras que duplica la infraestructura y las inversiones en energía renovable.

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1. Introduction

The purpose of this report is to examine oil and natural gas developments along the Texas-Mexico border, with a focus on Mexico's Burgos Basin and its relation to the Texas Eagle Ford Shale: What are challenges and opportunities in the Burgos? How does the development of the Burgos compare to oil and gas developments in south Texas? What are expectations for near-term and long-term energy developments in the region? Once referred to as one of the best shale fields in the world in terms of geologic potential, the Burgos currently is ensnared in two fundamental changes to Mexico's energy industry.

First, the 2014 Energy Reforms aimed to reverse a decade-long decline in oil and natural gas production by opening the state-monopolized hydrocarbon sector — controlled by Petróleos Mexicanos (Pemex) since 1938 — to corporate competition, foreign capital investments, and new public-private partnerships. Mexico's Secretaría de Energía (SENER, Secretary of Energy) and Comisión Nacional de Hidrocarburos (CNH, National Hydrocarbon Commission) commenced bidding rounds (referred to as the "rondas") for exploration and production in designated concession blocks in 2015 (SENER 2016). Round One bidding took place with 33 offshore and 25 terrestrial blocks, totaling 2,911,550 hectares (7,194,590 acres), which were assigned to 26 private companies or consortiums. The second round with its four bidding processes (2.1, 2.2, 2.3, 2.4) covered 44 offshore and 51 terrestrial blocks, covering more than 6 million hectares (14.8 million acres) and were assigned to 28 private companies or consortiums. Round Three had three series of tenders; however, two of them were suspended. In the only series of bids, Round 3.1 saw 35 offshore blocks auctioned to 12 private firms.

Despite these concessions and the contracts signed with private firms since 2015, the second fundamental change to the Mexican energy sector is the suspension of the bidding rounds and implementation of a hydraulic fracturing ban in 2019. On December 1, 2018, the new presidential administration of Andrés Manuel López Obrador (AMLO) took office with a party majority in congress. The administration delayed scheduled bidding rounds while reviewing existing contracts and production efficiencies. The administration also imposed a moratorium on hydraulic fracturing. The government's aims appear to limit the goals of the 2014 Reforms.

This report illustrates how the present state and future of the Burgos reflect broader changes in Mexico's energy landscape. Using a geographical perspective, we focus on the historical and contemporary economic, social, and geologic overlaps in the Texas-Mexico border region. We draw on interviews with key stakeholders, participation in oil and gas industry conferences, geospatial analyses, online journalism and social media tracking, and archival materials to highlight new opportunities and challenges for Texas-Mexico energy integration; and provide recommendations for industry professionals and government officials with interests in the region.

2. Oil and Natural Gas Production along the Texas-Mexico Border

2.1 Historical Conventional Oil and Gas Drilling in the Region

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As a coterminous geologic region (**Figure 1**), the Eagle Ford Shale and the Burgos Basin share similar development histories. Hydrocarbon development in south Texas started in the 1910s with the first natural gas wells spudded near present day Laredo when ranchers were searching for water (Olien 2010). Prospectors and wildcatters tested geologies in Webb County near Mirando City, which experienced a major boom in the 1920s-30s (Black 1972; Lamar Rodriguez 2010). During that time, companies extended natural gas pipelines from Laredo to San Antonio and across south Texas, creating a local market for the associated gas brought to the surface with the oil. Leading into World War II, oil extraction intensified in southern Texas because of the abundant resource and the proximity to export facilities in Corpus Christi and Houston. Many of those early fields still produce large quantities of low-quality crude oil today.

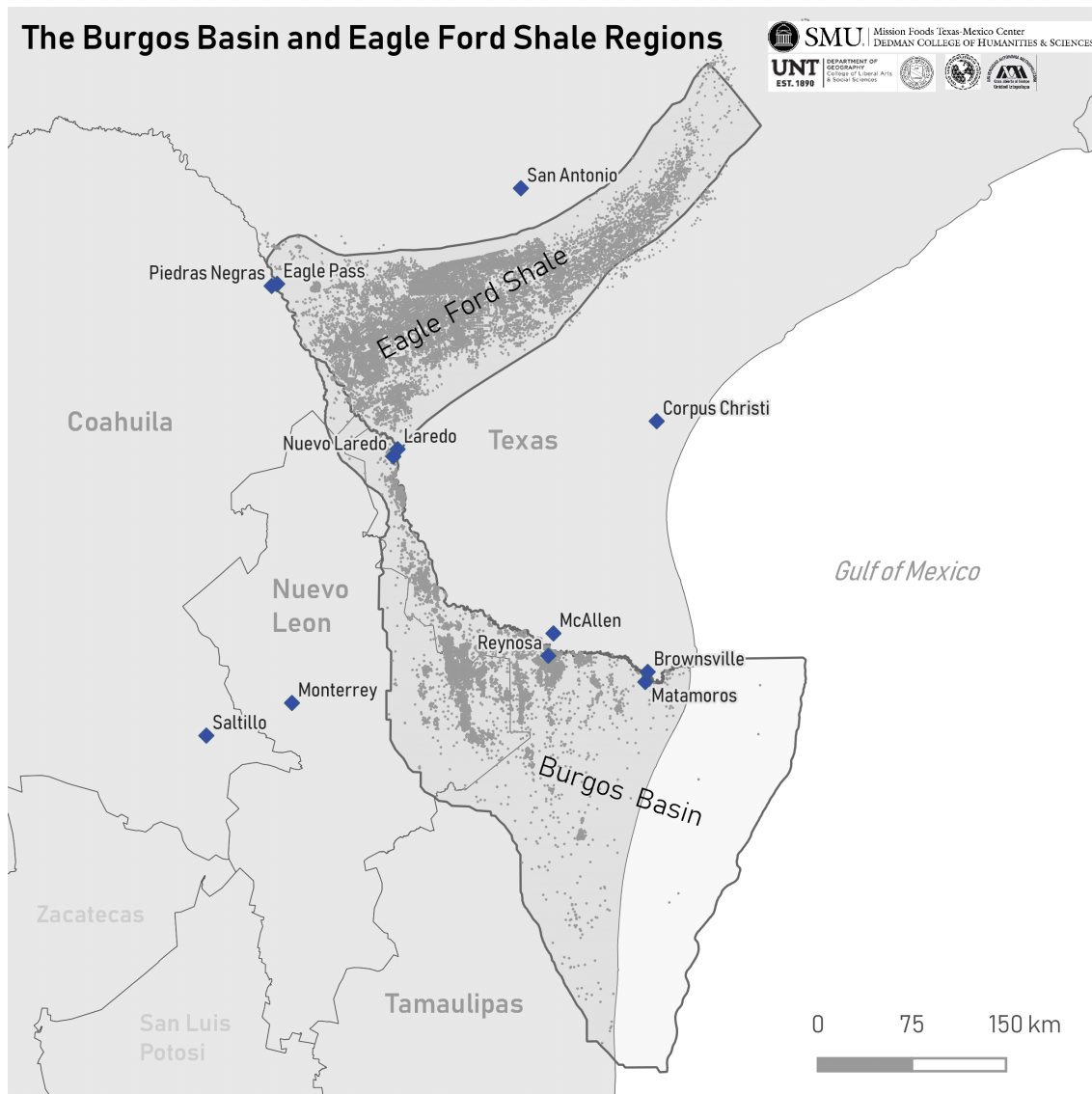


Figure 1: Texas-Mexico border and major cities, with oil and gas wells in Eagle Ford Shale and Burgos Basin, as well as offshore wells.

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In the Río Grande Valley, oil and gas extraction from the Frio, Vicksburg, and Wilcox geologic trends gained prominence in the 1920s. At the same time, private oil companies explored Mexico's Burgos Basin area. Pemex discovered commercial quantities of natural gas near Reynosa in 1945. Natural gas production from the Burgos Basin reached 620 million cubic feet per day (MMCFD) in 1970 followed by a gradual decline of 65% by 1993. Since its discovery, the Burgos Basin has been Mexico's largest source for unassociated natural gas.

Regionally, oil production accelerated in the 1970s as oil companies began experimenting with gel fracturing technologies (Swanson et al. 1976; Garza 2010; Garza and Long 2010). Throughout the 1980s and 90s, the Vicksburg geologic trend became a major producer of natural gas for south Texas and northern Mexico (Cauble Smith 2010). Large oil discoveries on the Austin Chalk in east Texas encouraged new developments in geologies situated above the Eagle Ford Shale in the border region in the 1970s, 80s, and 90s. In Mexico in the late 1990s, Pemex exploratory activities, field reentrance, and maintenance activities increased expectations for natural gas resources in the Burgos (Pemex SEC 1999). Investments in the Burgos increased and natural gas production grew in the 2000s, with peak natural gas production in 2009–2010, which coincided with Pemex's highest Burgos Basin investment expenditures (Figure 2; Pemex SEC 2011).

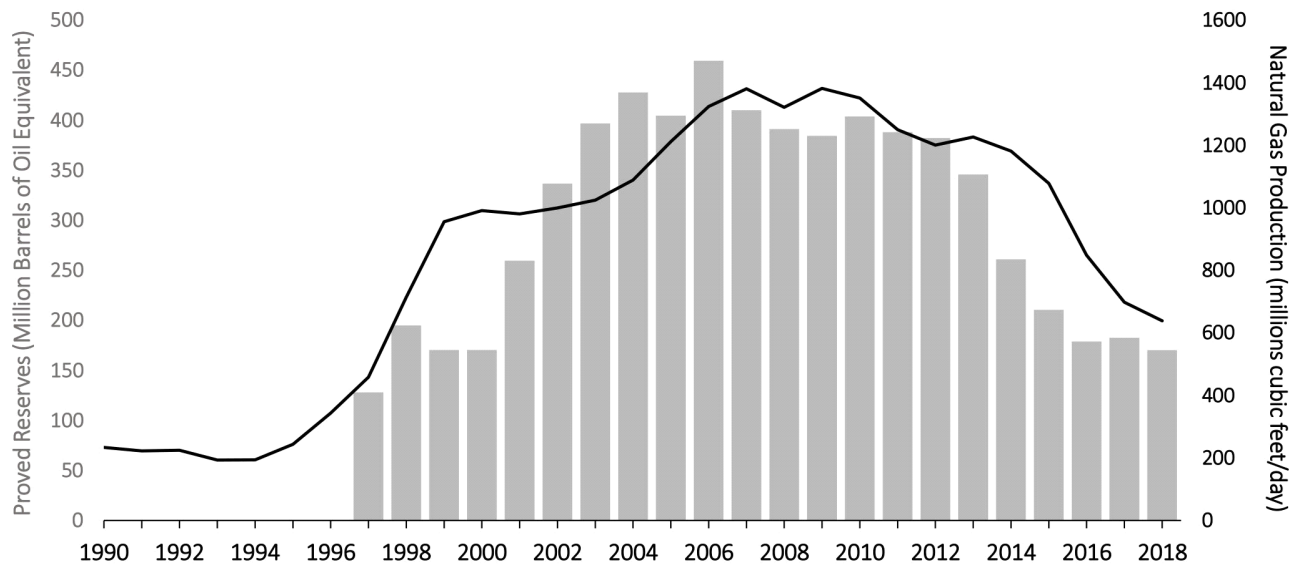


Figure 2: Burgos natural gas production (line) and proved reserves (bars) (sources: Pemex SEC documents; CNH)

In Texas, in the 1990s, oil companies deployed new well completion techniques, such as hydraulic fracturing on the north Texas Barnett Shale, and later horizontal drilling, to access unconventional deposits like shale. Using these techniques, in October 2008, Petrohawk Energy drilled the first two exploration wells into the Eagle Ford Shale in La Salle County (Francis 2008) sparking a massive boom that has since brought over 20,000 hydraulically fractured wells into

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south Texas. Those wells produce 1.368 million barrels of crude, 6.82 billion cubic feet of natural gas, and 179,000 barrels of condensate *per day* (EIA 2019, Railroad Commission 2019).

In 2011, Pemex Exploration and Production and U.S.-based Lewis Energy confirmed the discovery of shale gas in the Burgos. Pemex's shale explorations and the proximity to the Texas Eagle Ford were not the only things to trigger excitement about the Burgos' potential. The U.S. Energy Information Administration (EIA) ranked Mexico fourth highest globally in technically recoverable shale gas resources after Neuquén, Argentina; Sichuan, China; and Karoo, South Africa (EIA 2011, 2013), while noting that large technically recoverable shale gas and shale oil potential could be found among "oil- and gas-prone windows extending south from Texas into northern Mexico" (EIA 2013, 121).

2.2 Shale gas production and hydraulic-fracture stimulation

Shale is a sedimentary rock predominantly composed of consolidated clay-sized particles. Shale formations deposit as muds in low-energy marine environments. Phytoplankton, algae, and other organic matter, which often accumulate with the fine-grained sediments during deposition, can form organic rich units that generate hydrocarbons including natural gas, condensates, and oil. Shale rock can store natural gas in three ways: as free gas within rock pores, as adsorbed gas on organic material, and as free gas within the system of natural fractures. Due to the low permeability of sedimentary rocks, hydrocarbons trapped in shale migrate slowly over millions of years until the shale is perforated and production begins (Speight 2013; Hill and Nelson 2000; Curtis 2002).

Although commercial production has been achievable in shale wells that intercept natural fracture networks, in most cases, successful shale gas production requires hydraulic fracturing stimulation (Curtis 2002). The principal objective of fracturing is to create connectivity between hydrocarbon-filled pores and the wellbore (Chew 2014). To extract shale gas, a vertical wellbore is turned horizontally into the targeted layer, which enables operators to access a greater cross-section within the shale geology. As drilling is completed, multiple layers of metal casing and cement are placed around the wellbore. Next, a mixture of water, chemicals, and proppants (often, sand) are injected at high pressure at multiple points or stages along the horizontal wellbore. During the hydraulic fracturing stage, the pressure breaks apart the shale, the chemicals free up the hydrocarbons, and the sand props open the fractures that serve as pathways for the movement of shale gas to the well bore and the surface, where collection, separation, and transport of the gas, oil, and liquid flowback occurs.

Shale oil and gas production requires massive inputs of water. According to research by Scanlon, Reedy, and Nicot (2014), each Eagle Ford Shale well requires an average of 17.8–18.5 million liters (4.7–4.9 million gallons) of water. Shale gas extraction also requires relatively large capital investments and energy inputs (Chew 2014), has numerous economic and political effects on local communities (Fry, Brannstrom, and Murphy 2015), and affects environments and landscapes (Moran et al 2017; Aguilera et al 2010). A growing body of research documents hazardous emissions such as particulate matter, ozone, and volatile organic compounds that pose health risks to nearby populations (McKenzie et al. 2018; Whitworth et al. 2018; McKenzie

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et al. 2017; Brown et al. 2014; Helmig et al. 2014) as well as nuisances like noise pollution and increased truck traffic (Hays et al. 2017; Blair et al 2018; Rahm et al. 2015; Adgate et al 2014). Because of these fears, public concerns oriented towards hydraulic fracturing have emerged in both Texas and Mexico (Ontiveros, Munro, and Zurita 2018; Fry and Brannstrom 2017). In terms of shale hydrocarbon production, Texas is currently the world's largest producer.

2.3 *The Eagle Ford and Texas Shale Gas*

With over 21,000 drilled wells and 2,500 more permitted (RRC 2020), the Eagle Ford is one of the most active oil and natural gas extraction regions in the U.S. The Eagle Ford Shale produces approximately 14% and 5% of total U.S. production of crude and natural gas respectively. While oil and natural gas production peaked on the Eagle Ford in 2014 and 2015, firms continue to pump large investments into the region. The Eagle Ford's proximity to Corpus Christi's, Brownsville's, and Houston's oil and natural gas export facilities coupled with a very robust pipeline network corresponds to cheaper transportation costs and easy access to international markets.

Texas shale deposits are the origin for most of the natural gas resources exported to Mexico. Since 2016, six new border-crossing pipelines opened, including the Texas-Tuxpan, Nueva Era, Los Ramones, Kinder Morgan Mier-Monterrey, and Valley Crossing pipelines carry Texas shale gas into Mexico. That stated, many of these cross-border or near-border pipelines operate at less than full capacity because many are unfinished due to local social unrest (Baker 2019) and incomplete distribution networks in Mexico. Despite these challenges, U.S. natural gas exports to Mexico have grown six-fold since 2010. In 2018, Mexico's U.S. gas imports totaled 2.1 trillion cubic feet, with over 90% arriving through pipelines (EIA 2019).

Although the Eagle Ford Shale has been an economic driver in south Texas from 2008 to present, certain aspects of that development remain problematic. City and county officials complain that high levels of truck traffic associated with drilling hydraulically fractured wells destroy state and county roads jeopardizing the safety of local residents (Rahm et al. 2015; Ellis et al. 2016; Murphy et al. 2018). Further, south Texas local governments struggle to meet housing demand. During the height of the Eagle Ford boom in 2013–2014, workers complained that there was “nowhere to house the family” (Murphy et al. 2018, 34). Some communities assuaged the high demand by encouraging the development of hotels and temporary housing/man camps. However, when Eagle Ford Shale production slumped and firms optimized drilling to use fewer workers, many communities were burdened with too much housing. As well, the high demand for oil and gas workers pushed local wages to exceptional levels, which encouraged a flight of government officials into the oil industry. As a result, many local governments were understaffed and lacked enough public servants at a time when there was increased demand on local community services (Murphy et al. 2018).

Studies also found that only approximately 2% of the capital extracted from Eagle Ford Shale production stays local. The bulk flows to oil and gas company offices in metropolitan locations, to finance institutions across Texas, and to absentee mineral owners (Murphy, Brannstrom, and Fry 2017). All the while, local residents are burdened with the societal effects

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of that production as well as the environmental consequences, such as increased air pollution (Ellis et al. 2016; Roest and Schade 2017), water disposal wells in close proximity to low income families (Johnston, Werder, and Sebastian 2016), high profile explosions (Chapa 2019b, 2019c; Garcia 2019) and an uptick in minor earthquakes (Frohlich and Brunt 2013).

2.4 *The Burgos Basin and Private Firm Activities*

While exploration continues on the Texas side of the border, today all 3,500 producing natural gas wells in Mexico's Burgos region are in non-shale formations. These wells account for 15% of Mexico's total natural gas production. Despite the first bidding rounds for potential shale fields opening in 2017, there are no private firms producing from Burgos Shale today. Nevertheless, according to the EIA (2017), one of Mexico's goals is to eventually supplement (or replace) gas imports with domestic shale production from the Burgos Basin, which holds Mexico's largest undeveloped shale resources.

The Burgos Basin is a paleotectonic unit of the larger Gulf of Mexico Coastal Plain and Tamaulipas Continental Shelf. Formed over the course of several million years of tectonic compression and uplift (from Upper Jurassic, approximately 150 million years ago, to the present), the layered sequences of rock fragments (i.e., clastic sediments) deposited on an extensive marine platform. To date, most hydrocarbons encountered in the Basin are in the 1000 to 5000 m (3280 to 16,404 feet) Frio-Vicksburg and deeper Wilcox geologic trends, which extend through the Rio Grande Valley region of Texas into northern Mexico (Swanson et al. 1976; Cruz 1993; Cocker et al 2002).

In the mid-1990s, Pemex Exploration and Production performed a feasibility study that estimated the Burgos Basin's non-shale (or conventional) natural gas reserves at 9.7 trillion cubic feet (TCF; **Figure 2**) and initiated a 15-year development project in 1997 that aimed to increase Burgos production and attenuate imports (Pemex SEC 1998). In the region, Pemex awarded three turnkey contracts: to Dowell-Schlumberger México (U.S. \$108 million), Industrial Perforadora de Campeche, S.A. de C.V. (U.S. \$96.4 million), and Halliburton International, Inc. (U.S. \$71 million) (Pemex SEC 2008, Oyervides Benítez 2003). Under these contracts, Pemex only paid the contractor's fee if a predetermined production milestone was achieved; until then, contractors assumed all risks.

In 2003, Pemex introduced Multiple Service Contracts (MSCs) to stimulate Burgos natural gas production. The MSC program also gave foreign investors some influence over evaluation, development, and operations in the Burgos Basin (Young and Meacham 2003). MSCs grouped exploration, development, and production services in an assigned area to one company or consortium. Unlike risk-sharing contracts, MSC contractors received in-cash compensation and the hydrocarbons remained property of Pemex (Pemex SEC 2003). During bidding rounds in 2003, 2004, and 2006, Repsol-YPF (Spain/Argentina), Teikoku Oil (Japan), Tecpetrol (Argentina), Industrial Perforadora de Campeche (Mexico), Grupo Diavaz (Mexico), Lewis Energy (U.S.), and Petrobras (Brazil) signed MSCs either as individual companies or consortiums. In 2005, MSCs became known as Contratos de Obra Públicas Financiadas (COPF,

Financed Public Works Contracts). According to Pemex SEC reports, from 2004 to 2018, COPF work areas produced an annual average of 22.6% of Burgos natural gas.

Estimated proven reserves of the Burgos were highest in 2006. Reserve estimates decreased annually thereafter, with the exception of 2010, and eventually reached 170.2 MMBOE in 2018 (**Figure 2**). To some, the lack of infrastructure, inadequate technology, and limited finances forestalled further conventional development projects in the Basin (Muñoz et al. 2012) — production characteristics that we explore below.

2.5 Mexico's Hydrocarbon Policies and current Contract Models

Hydrocarbons are central to Mexico's economy and national patrimony, especially after their nationalization in 1938. Mexico has been a major supplier of oil to the U.S., the world's largest consumer, comprising 5% to 17% of total U.S. imports between 1993-2016 (EIA 2017). The bulk of Mexico's reserves are located along the Gulf of Mexico. Declining production since the early 2000s stimulated a push to identify new sources of hydrocarbons. The 2014 Energy Reforms were enacted to stimulate economic competition among energy firms, which would lead to growth in oil and gas production (Samples and Vittor 2013; EIA 2013; Ibarra-Yunez 2014) but also make oil and gas production structurally dependent on foreign firms and capital — a situation long resisted by Mexican nationalists (Checa-Artasu 2014).

In addition to the presence of material oil and gas resources, laws, regulations, institutions, and social practices are central to oil and gas development (Bridge 2008; Perreault 2013). Three important hydrocarbon-related laws in Mexico are the 1925 Petroleum Law, the 1938 expropriation decree, and the 2014 Energy Reforms. The post-Revolution, 1925 Petroleum Law reversed an 1883 law and gave the state exclusive control of subsoil resources. The Petroleum Law also stipulated that oil production took priority over all other land uses. Nevertheless, foreign firms retained control of Mexico's hydrocarbon sector by renegotiating access rights to state-owned territories. But labor disputes and contract disagreements led to the 1938 expropriation of all foreign properties and assets and the creation of Pemex. After expropriation, Pemex had exclusive control over exploration, extraction, production, transport, and retail of hydrocarbons. But the initiation of neoliberal reforms in the 1980s began a process of opening the oil and gas sector to private firms.

The 2014 Energy Reforms instigated new contract models, including new 1) service contracts, 2) profit-sharing contracts, 3) production sharing contracts, and 4) licenses. Licenses represent the most visible form of the new contract models. These allow firms awarded licenses under the bidding rounds the opportunity to own the hydrocarbons produced at the wellhead while paying fees and a royalty to the government. Further, the contractor gives a bond to the national government to secure commitment to the contract (England, García Bello, and Castilla 2014). While the subsurface is still owned by the national government, once the hydrocarbons are produced at the wellhead, they become property of the company that produced them (Alpizar-Castro and Rodríguez-Monroy 2016). These licenses were allocated through drilling blocks that were doled out in bidding rounds. Many of the Round 1 and 2 fields were awarded on the Burgos oriented towards conventional production.

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Under the production sharing contract model, contractors working closely with Pemex share a portion of the hydrocarbons produced in-kind after cost recovery (Anderson and Park 2015; Alpizar–Castro and Rodríguez–Monroy 2016). In this contract model, the contractor assumes all the costs and risks associated with production and receive a share of the production (Rangel García 2018; Carlos Serra and Eduardo Escobedo 2019). This contract model was applied to the unconventional shale blocks, such as the Burgos Basin; however, the bidding rounds for these plays were cancelled before coming to fruition. Profit sharing contracts operate in the same manner as production sharing contracts except that payment is made in currency as opposed to in-kind (England, García Bello, and Castilla 2014).

The final contract model built into the constitutional reforms are the service contracts, which are like most service contracts found globally as well as those executed prior to the energy reforms of 2008-2013. In total, from 2014 to 2018, 110 contracts and licenses were signed by the Peña Nieto administration (Morales 2019). The CIEPs and COPFs negotiated following the 2008 legislative reforms were going through the transition period into production sharing agreements or licenses until the new administration suspended this transition (De Brito de Gyarfás and Portillo Díaz 2019).

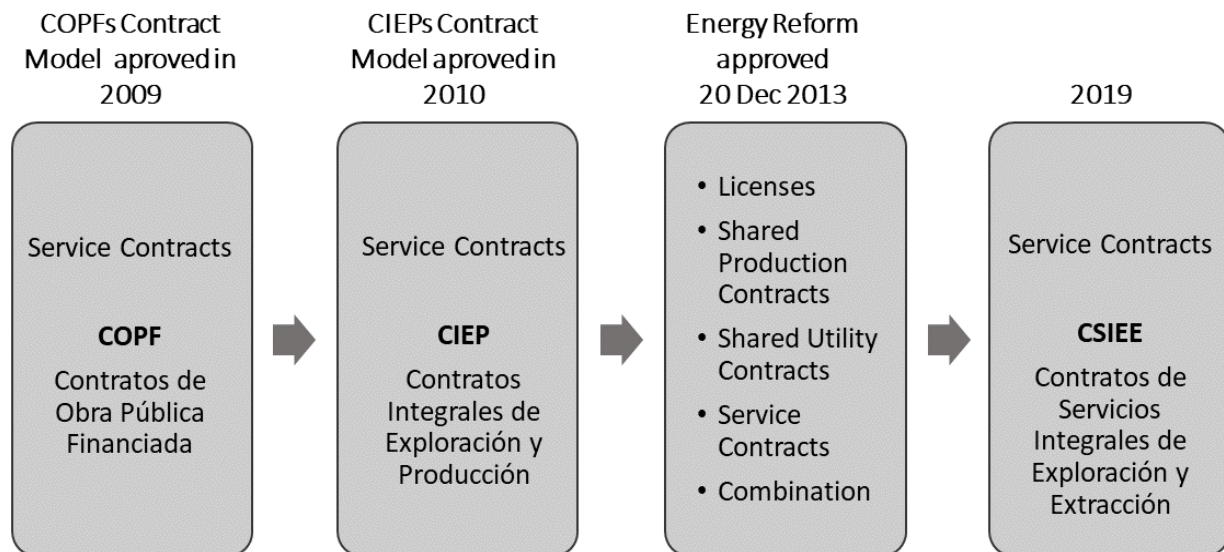


Figure 3: Types and evolution of the contract model in Mexico.

To that end, CNH formed the Contratos de Servicios Integrales de Exploración y Extracción (CSIEE, Integrated Service of Exploration and Extraction Contracts) in 2018 to help Pemex develop two natural gas fields in Veracruz state; however, the first CSIEE signed was actually a contract renegotiation between Pemex and Lewis Energy to continue to develop the Olmos Sands in the Burgos Basin (de Montmollin 2018; Pemex 2018). The AMLO administration revived the CSIEE and updated the terms to help Pemex develop fields that had been awarded in Round Zero of the bidding rounds in 2014 (Morales 2019) including non-associated gas fields in the Burgos Basin (Vera and Cherem 2019). In CSIEE provisions, the contractor bears all the

capital as well as operating expenses while Pemex remains the oil field operator. The service provider receives a fee payment that varies based on the level of production from the field. The 2019 version is likely to be similar to the 2018 version with more provisions for taxes and fees for the Mexican government. The 2019 version is currently going through regulatory review and will be rolled out in summer 2020 (De Brito de Gyrfas and Portillo Diaz 2019; Vera and Cherem 2019). It is expected that the Mexican government will try to migrate old CIEPs and COPFs to the 2020 CSIEEs.

3. Objectives and Methods

3.1 Objectives

Booming production in the south Texas Eagle Ford shale and enthusiastic predictions for Mexico's Burgos shale potential were the initial motivations for this study, but the 2019 political transition in Mexico and the postponement of the 2014 Energy Reforms provide an opportunity to examine how perceptions of the Burgos have morphed over the course of the past decade. The Burgos Basin offers a fascinating space to better understand Mexico's dynamic energy policies, economies, and landscapes. For this reason, our analysis is not constrained to quantitative economic statistics, physical geology studies, or oil industry data. Rather we also sought to include production inputs (such as, water, sand, electricity), state and national policies, and qualitative interview data. To tap into current events and expert knowledge, we targeted individual stakeholders with direct involvement in oil and natural gas activities in the region. In this way, the goal of this report is to present a comprehensive picture of Texas-Mexico energy developments from the perspective of oil and gas professionals, policy experts, and government officials.

Three objectives guide this study:

1. Identify and compile the primary opportunities and challenges stakeholders face in the Burgos region.
2. Examine stakeholder perspectives on oil and natural gas production activities in northern Mexico.
3. Analyze the oil and natural gas geographies of the trans-boundary, Texas-Mexico region.

3.2 Methods

For this study, we use primarily semi-structured interviews as our data source. From May to November 2019, we conducted 24 confidential audio-recorded interviews of 22 stakeholders who had knowledge of the Burgos Basin, including lawyers, journalists, academics, consultants, and others (**Table 1**). Our questionnaires examined how the stakeholder 1) perceived of the resource potential of the Burgos Basin, 2) understood production strategies, 3) viewed recent political developments, 4) hypothesized what shale production would look like, and 5) examined the primary opportunities and challenges in northeastern Mexico for

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production. The interviews lasted between 20 minutes and two hours, with an average of 45 minutes. Student research assistants at our universities transcribed the audio-recorded interviews. We examined the interviews for commonalities and differences using industry-standard analytical software.

We also attended several key stakeholder conferences focused on discussions about extraction in the Texas-Mexico border region. At these conferences, the research team met informally with conference participants and took detailed notes of the conference proceedings. In several cases, we audio recorded sessions pertinent to our research objectives. The conferences included two Eagle Ford Shale Consortium meetings, the North American Development Bank Border Energy Forum, the U.S.-Mexico Natural Gas Forum, among others. We also accessed stakeholder comments from panelists at the Mexico Oil & Gas Summit 2018 Onshore Outlook session (accessed at: <https://go.unc.edu/Rd75S>) and from media interviews (e.g., Salas 2019).

In addition, we acquired and analyzed geospatial data sourced from the CNH and the Texas Railroad Commission (RRC) — the primary petroleum regulatory bodies in Mexico and Texas, respectively. We used these data to create a snapshot of oil and gas development in the border region by producing cartographic products. These maps provide a spatial and visual element to understanding the potential challenges and opportunities to future oil and gas development in the Burgos Basin. In this regard, we have collected the most recent data from diverse government agencies and industry partners to provide a comparative spatial layout of geographic features such as a) oil and gas infrastructure, including wells, pipelines, and other mid-and-downstream sites, b) transportation infrastructure, c) water resources, d) property regimes, and e) universities and educational resources.

Lastly, we maintained a running list of archival documents, news accounts from the United States and Mexico, academic articles, Tweets of prominent Mexican energy commentators, YouTube videos of Mexican Government activities, and state reports published throughout the investigative period. These documents served as key sources for finding potential interviewees as well as staying abreast of the rapidly changing Mexican energy landscape throughout 2019.

Table 1: Interview participants

Present Interviewee Sector	Number of Interviewees
Project Manager	6
Academic	4
Consultant	3
Mexican Government	3
Geologist	1
Journalist	1
Lawyer	1
Non-Profit	1
Outreach Manager	1
US Government	1
TOTAL	22

4. Geographic Features related to Oil and Gas in the Burgos Basin

Maps provide spatial context, show spatial patterns, and reveal spatial connections. To envision spatial data related to oil and gas developments in the Burgos Basin, the following maps present information on contractual areas, natural gas fields, pipelines, property regimes, institutions of higher education, active wells, roadways and surface water.

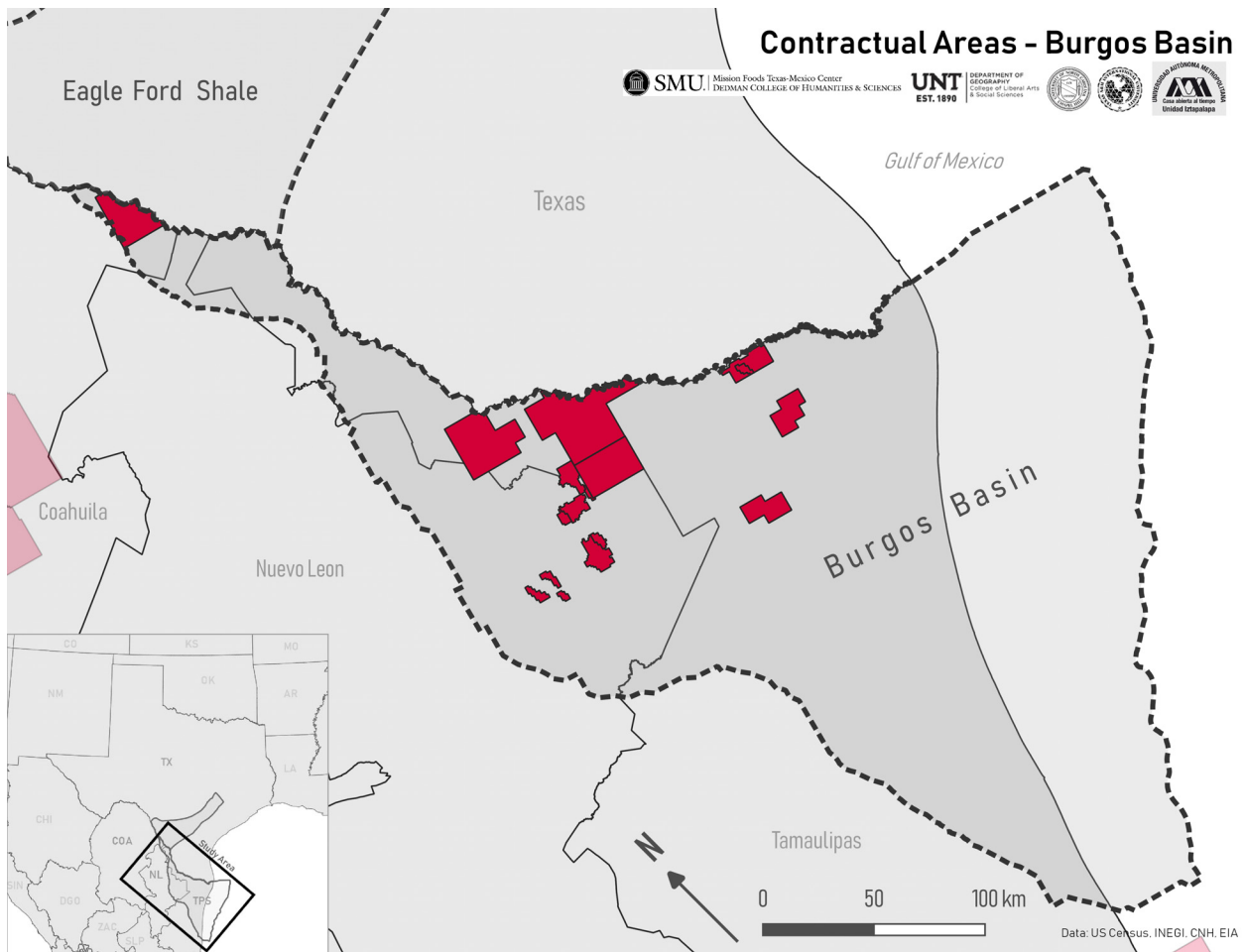


Figure 4: Contractual Areas in the Burgos Basin. This map illustrates where private firms have active drilling contracts with CNH.

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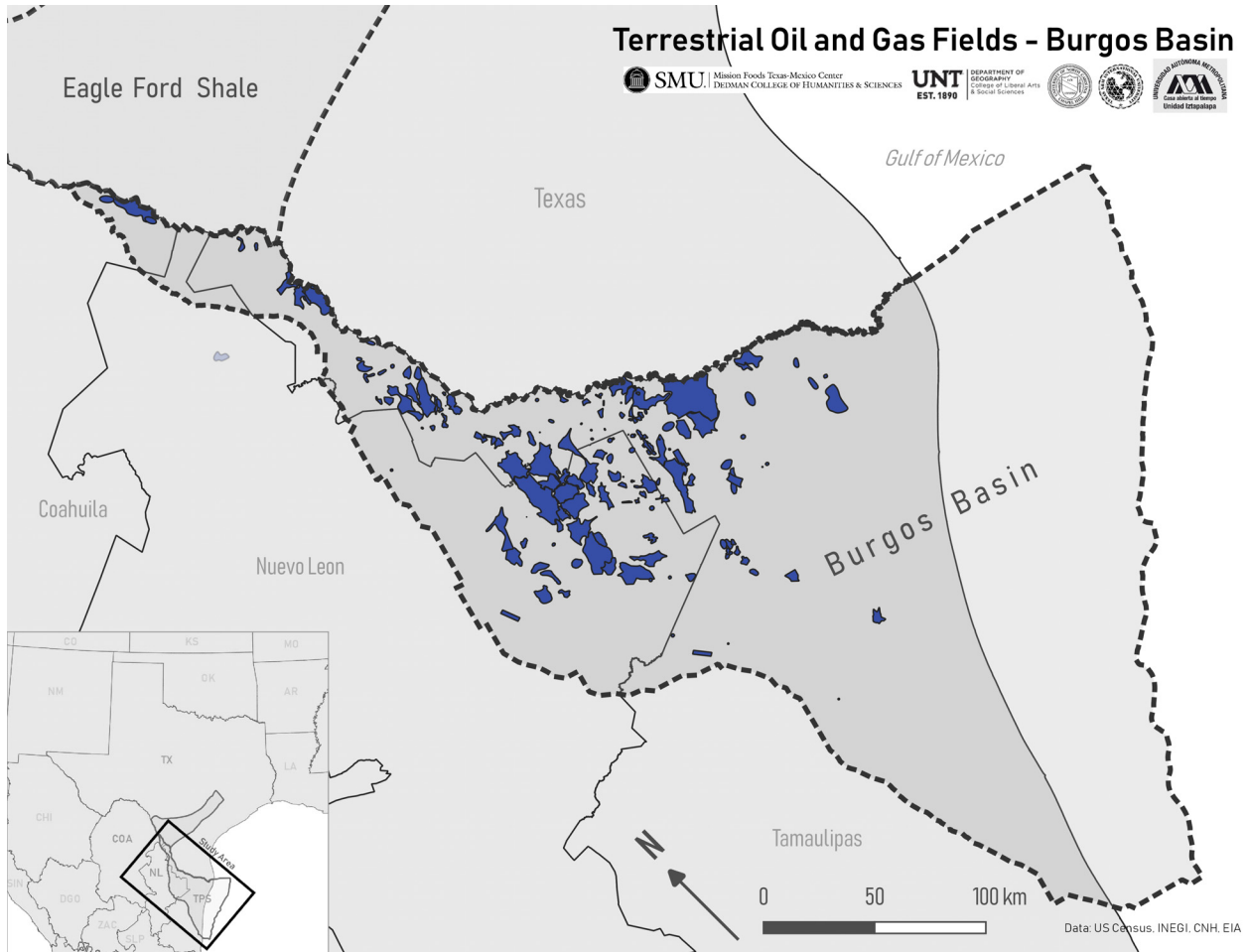


Figure 5: Terrestrial Oil and Gas Fields in the Burgos Basin. This map shows the location of primary terrestrial oil and gas fields as identified by CNH in the Burgos Basin. Note that the vast majority are within 100 kilometers (62 miles) of the US-Mexico border.

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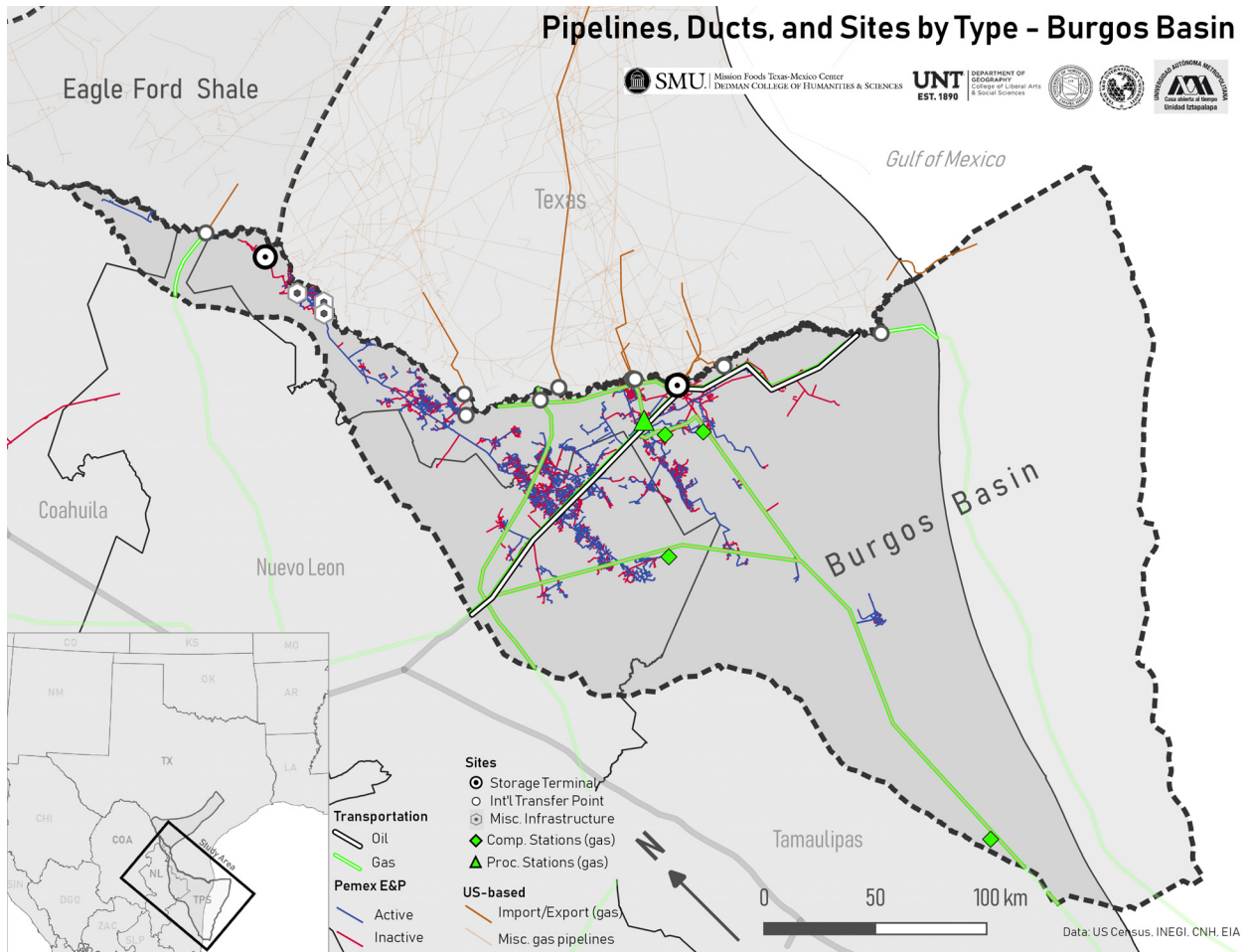


Figure 6: Pipelines in the Burgos Basin. Some respondents noted the advantage of a well-developed pipeline network in the Burgos Basin.

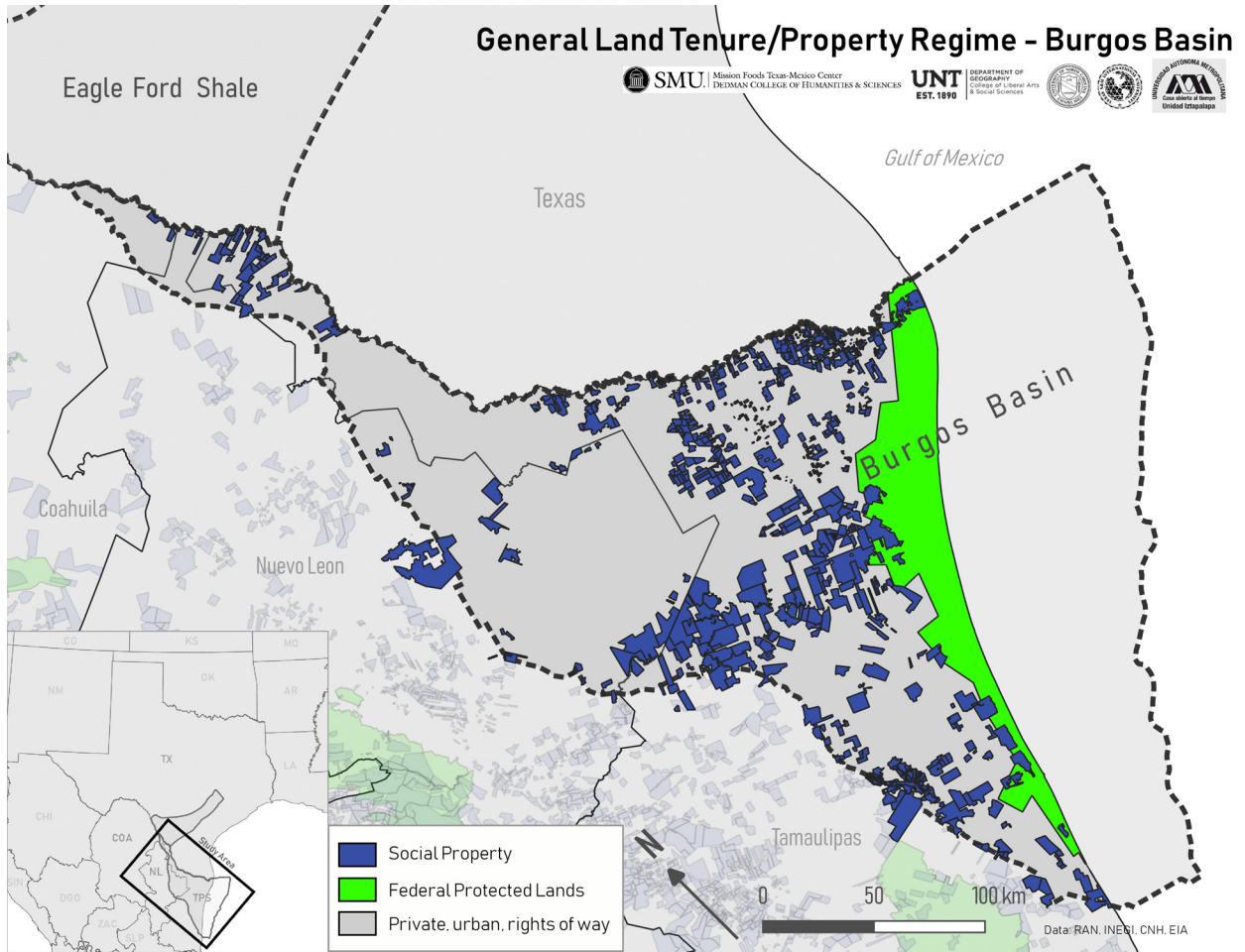


Figure 7: Property regimes in the Burgos Basin. There are a variety of property types found in Mexico on the Burgos Basin, not the least of which are “social properties,” such as ejidos.

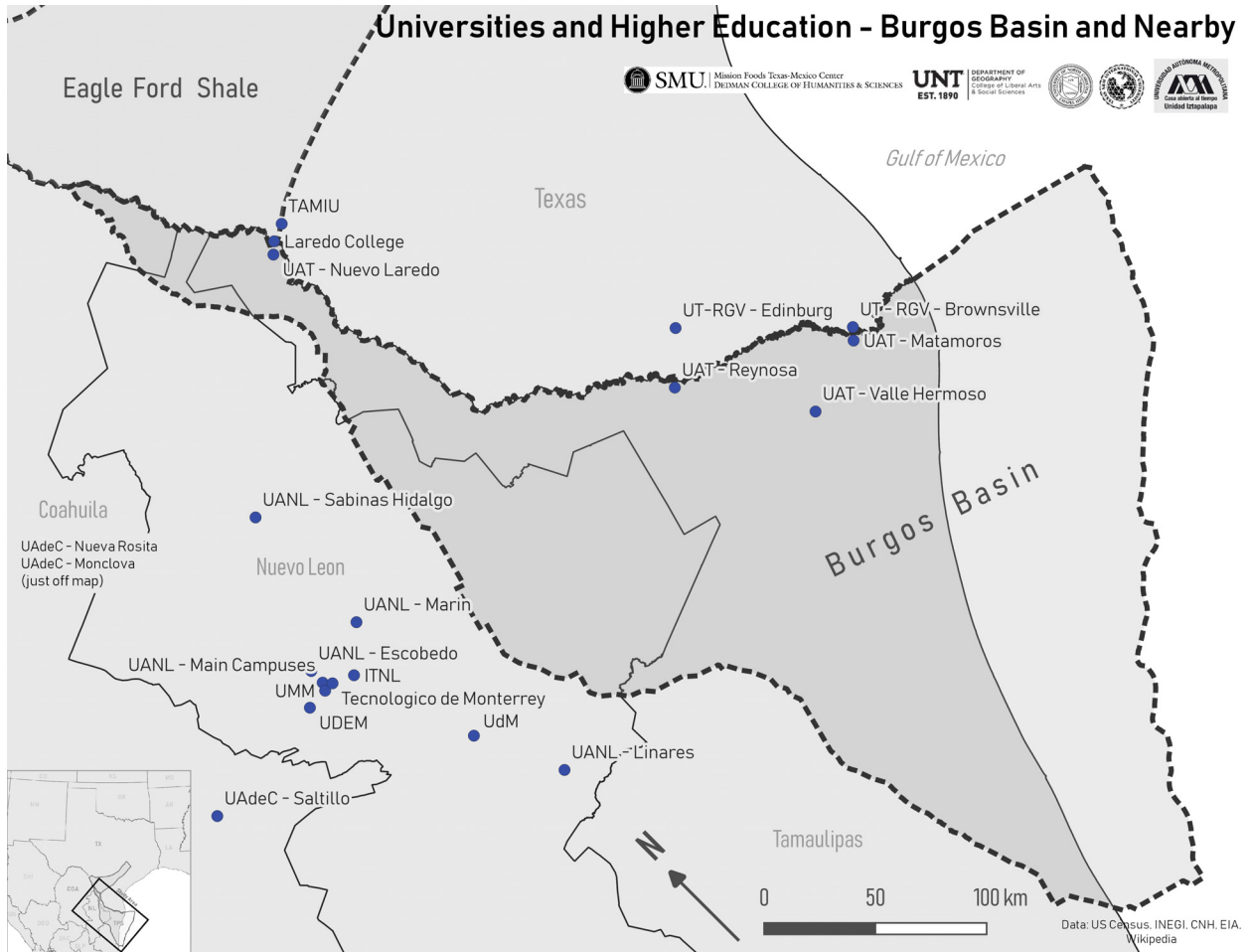


Figure 8: Universities and higher education institutions in the Burgos Basin region. Several respondents discussed human capital in the Burgos area, including institutions of higher education.

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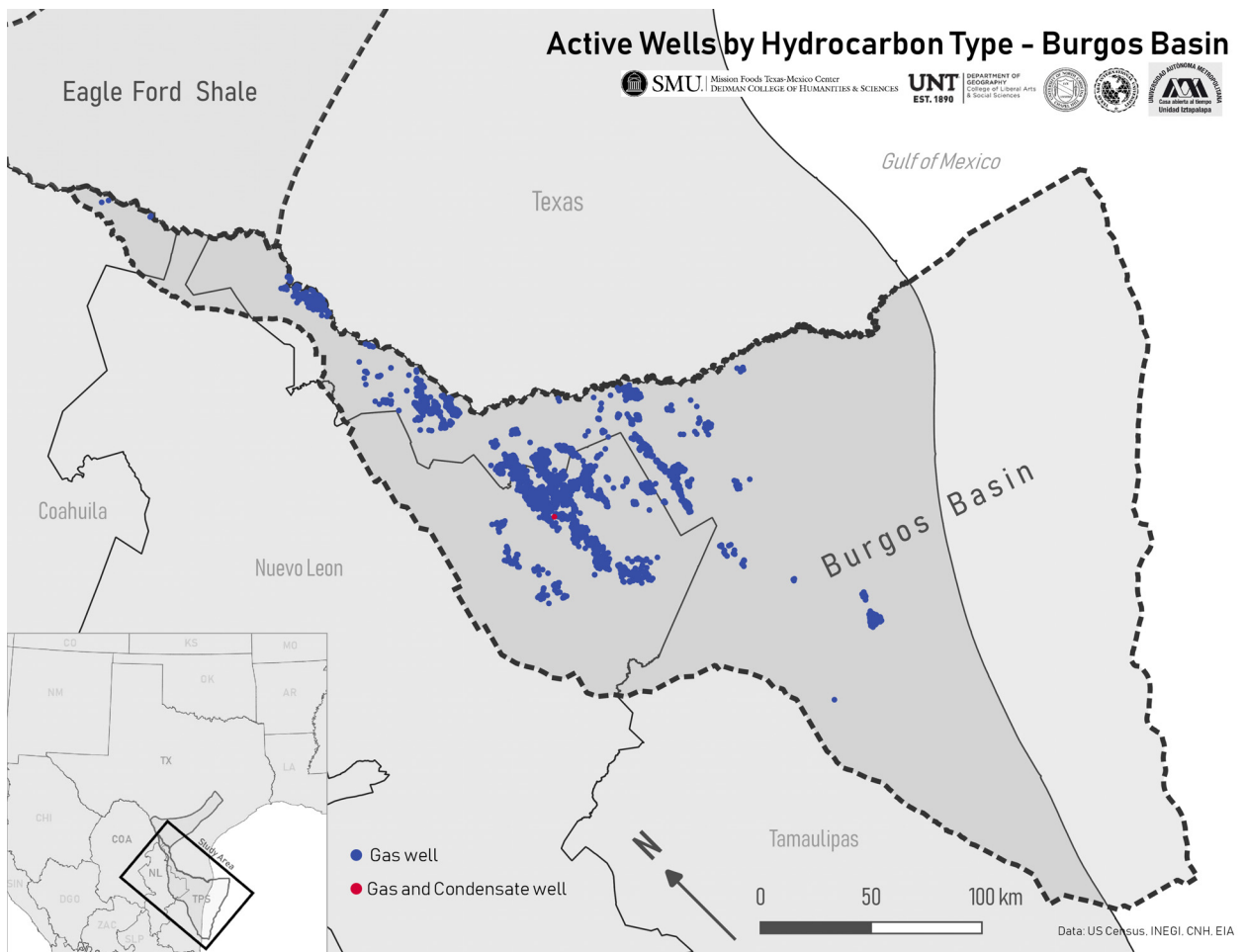


Figure 9: Active wells in the Burgos Basin. The overwhelming majority of these wells were drilled into conventional deposits and did not use hydraulic fracturing.

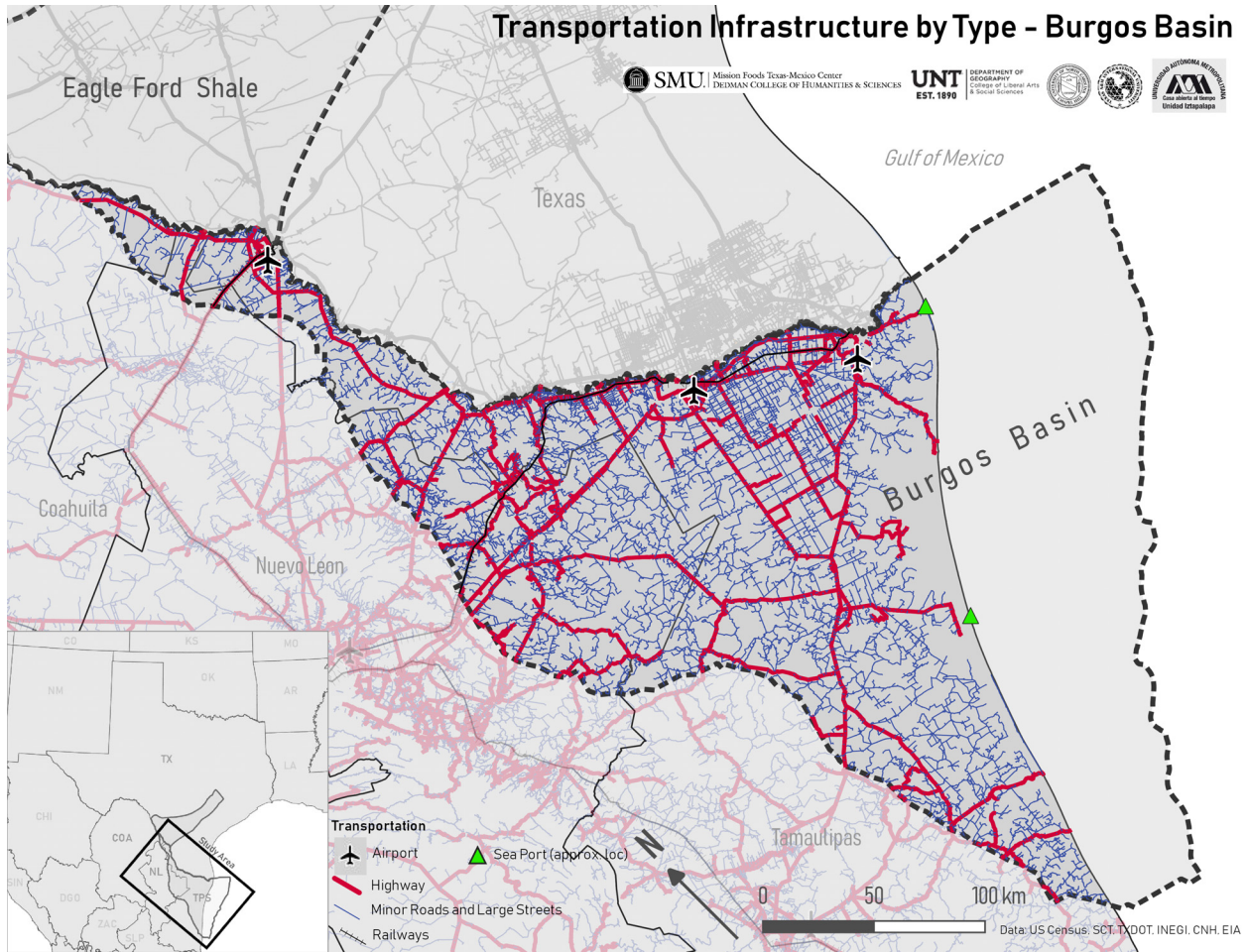


Figure 10: Transportation infrastructure in the Burgos Basin. Respondents noted the variety of transport options in the Burgos area, especially the well-established road network.

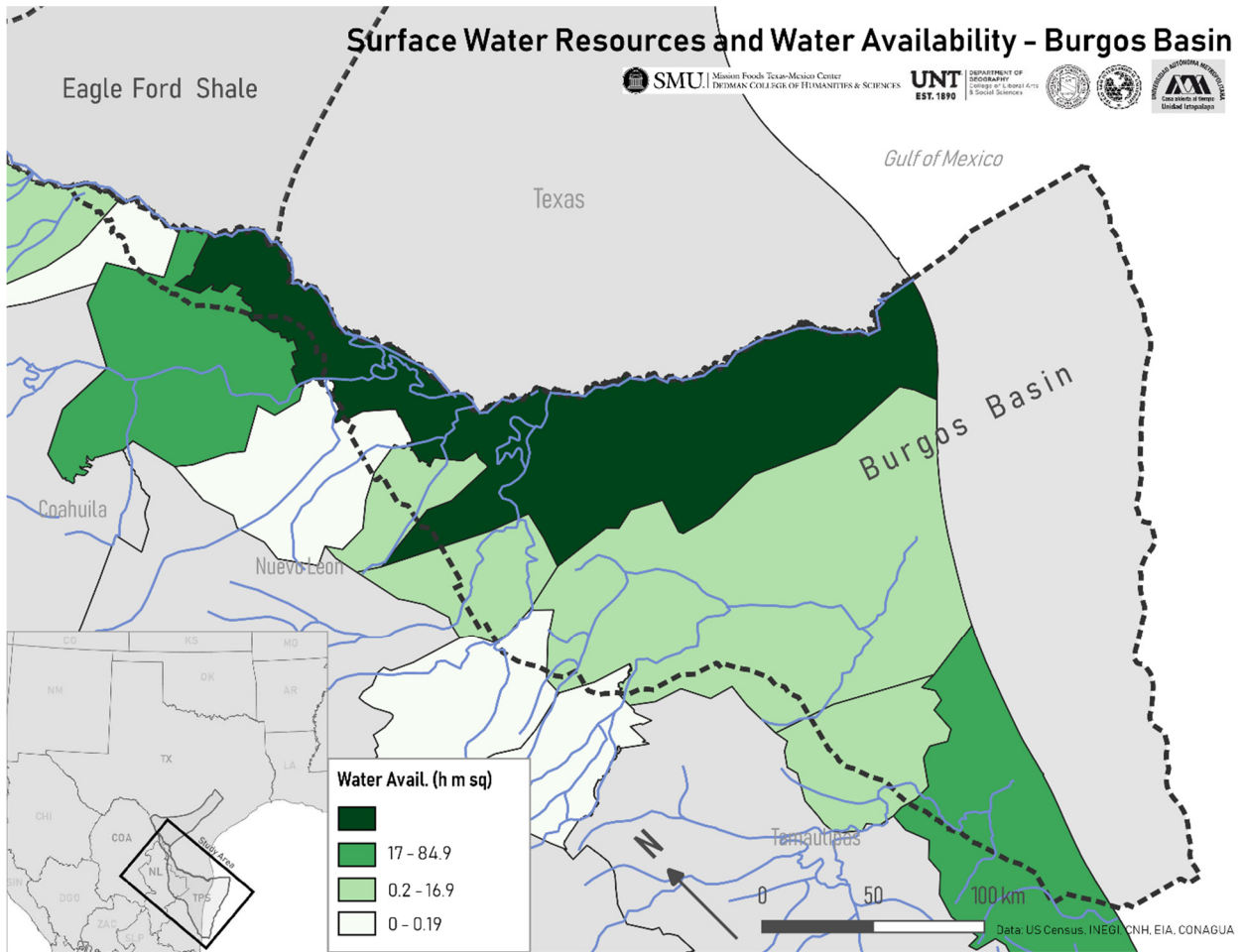


Figure 11: Rivers and water availability in the Burgos Basin. Access to water is a concern in the Burgos Basin. Data on water availability is from the Comisión Nacional del Agua (CONAGUA).

5. Shale Production Strategies along the Texas-Mexico Border

Because of differences in Texas and Mexico's legal and political geographies, there are distinct shale production strategies. To produce oil and natural gas from shale, operators must follow a series of steps to gain access to a site, and eventually drill, extract, and produce hydrocarbons. In straightforward terms, this might include obtaining geologic information, signing a contract with a landowner, obtaining a permit, hiring contractors, clearing the site, and drilling. During production, operators interact with local communities, and they engage with property owners, laws, and regulations. There are local environmental and economic issues as well. Comparing production strategies in the Eagle Ford and Burgos Basin offers one way to identify some of the social, legal, and environmental considerations confronted by energy firms operating in the region and policymaker efforts to monitor hydrocarbon production.

Clear distinctions exist in Texas and in Mexico in what operators must follow to produce oil and gas from shale. For example, in Mexico, there is no private mineral ownership, so operators must qualify to bid for government contractual areas, they must go through the bidding process, and then win the bid award before they can even begin the next phases of production. Whereas in the Eagle Ford, there is rarely bidding for contract areas on private lands. Instead operators mostly negotiate with private mineral owners and secure mineral leases by signing private contracts referred to as leases. Another difference is property ownership. In Mexico, operators must interact with surface owners, who might belong to an ejido (i.e., social property holding; **Figure 7**), which creates additional negotiations like nothing an operator would encounter in Texas. In Texas, surface property owners, if the surface is separate from the mineral owner, have little say in how drilling proceeds and surface use agreement contracts are rare, unless the mineral owner also owns the surface property.

Given the difference in the number of steps required to reach production, it comes as no surprise that the oil and gas industry strongly favors the Eagle Ford (i.e., Texas) production model in **Figure 12**, which we detail in Section 7.

What Happened to Mexico's Burgos Shale?

Burgos Basin

1. Incorporate as a Mexican company
2. Collect surface and subsurface data for contractual area
3. Evaluation of interest
4. Sign up for tender to identify contract model (*inscribirte en la licitacion*), review contract
5. Qualify to bid
6. Bidding process and awarding
7. Formalize contract agreement
8. Subcontract and conduct impact assessments (environmental and social)
9. Surface use agreements, community engagement, and social development
10. Water permits and other environmental criteria
11. Exploration and evaluation phase
12. Submit development plans
13. Site Prep
14. Drilling Phase
15. Fracturing Phase
16. Production Phase

Eagle Ford Shale

1. File organization report
2. Secure mineral leases from mineral owners
3. Complete contract agreements with other companies
4. Site delineations and tract information
5. Exploration or seismic testing
6. Apply for RRC Permit (apply for local permits if applicable)
7. Surface use agreement (if applicable)
8. Site Prep
9. Drilling Phase
10. Fracturing Phase
11. Production Phase

Figure 12: Comparison of production protocols for shale oil and gas at the Texas-Mexico border. Steps do not align until the “Site Prep” stage, as indicated by grey box.

6. Opportunities and Challenges in Mexico's Burgos Basin

A variety of opportunities and challenges exist for natural gas and shale development in Mexico's Burgos Basin. Over the course of 18+ hours of interviews, 19 stakeholders in this study identified four opportunities, including the Basin's production potential, its proximity to Texas, access to infrastructure, and the post-Reform regulatory framework and contract models. However, 26 stakeholders identified more challenges than opportunities. Challenges mentioned include current politics, access to infrastructure and production inputs, dealing with communities and landowners, security, the regulatory framework, and Pemex. Through our questions, we tried to assess respondents' views on the two primary changes to the Mexican energy law identified in the Introduction: the passage of the 2013–2014 constitutional reforms and the recent changes implemented under the Lopez Obrador administration in 2018-2019.

Here, we present diverse opportunities and challenges as identified by key stakeholders. We report their comments on these subjects with edits only made for readability. We identify comments from confidential interviewees with the interview date, while comments from public fora — such as conferences, media interviews, or government documents — are indicated by the person's name and the date, or source and date, of the comment.

6.1 Opportunities

Respondents identified several opportunities for natural gas and shale development in the Burgos Basin. In 24 instances, the Basin's geology and production potential were mentioned as opportunities. In 19 instances, respondents identified the advantages of the Basin's proximity to Texas. Access to infrastructure — including roads, transportation networks, pipelines, ports, and refineries — and to production inputs like water were mentioned as opportunities. Lastly, in eight instances, respondents commented on Mexico's bidding process, its contract models, or the country's regulations as opportunities for private companies.

6.1.1 Production Potential Opportunity. *As the following quotes indicate, stakeholders reinforced dominant narratives about the potential for conventional and unconventional natural gas production in the Burgos Basin. There are two main ideas here: first, there is geologic potential because of hype about the Burgos. As discussed above, the 2011 and 2013 EIA global shale reports along with media accounts sensationalizing those studies seem to be the sources for this hype. Second, there is a 'comparison narrative' of Burgos potential constructed around its proximity to and continuity with the Eagle Ford Shale.*

6.1.1a. Production Potential Constructed from Hype

“La Cuenca de Burgos está considerado una de las más grandes reservas que se tienen en nuestro país eso impactaría pues enormemente en empleos, impactaría en infraestructuras, no tengo los datos exactos, pero, el número de empleos se los puedo mandar, pero, sería un boom no solamente para la región de la Cuenca de Burgos o para los estados que componemos la Cuenca de Burgos sino para el país.” -- Respondent (17-Jul)

“The most important of all is that Tamaulipas has the Burgos Basin that concentrates the biggest oil and gas resource in Mexico. And outside of that, Tamaulipas not only has the most important natural gas reservoir, but it is the richest in condensate.” -- Respondent (9-Jul)

“I think the Burgos is still pretty virgin. You still can find a lot of golden nuggets there.... It's still not totally explored.” -- Respondent (28-May)

6.1.1b. Production Potential Constructed from Continuity with the Eagle Ford Shale

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“By the way, the resource in Mexico is just as big as in Texas. There is as much oil and gas in place, recoverable oil and gas in place in Mexico than there is in Texas. But [Mexico] produces a fraction of it you know.” -- Respondent (29-May)

“I mean there's no doubt that resources are there.” -- Respondent (20-May)

“They say that geology doesn't know about borders.... They know the formation continues into Mexico.” -- Respondent (28-May)

6.1.2 Proximity to Texas Opportunity. *Geographical proximity to the Texas energy industry and economy as well as access to its infrastructure and technology were recognized as important advantages for the Burgos Basin. This advantage goes beyond hydrocarbons; it implies and recognizes an integrated economic region.*

“And having Texas close by [makes fast whooshing sounds]: huge, huge advantage.” -- Respondent (11-Jul)

“Given that you [Texans] have been using this technology for many years, that's the biggest asset that we have in Tamaulipas. Being south of the border to one — that if Texas was a country would be one — of the most influential economies around the world.” -- Respondent (9-Jul)

“And you know, with its proximity to Texas, [the Burgos] seems like a low hanging fruit. You could totally do it. All the service companies, all the chemicals all the frack sand, it's all right here. And all the knowledge and all the know how is right here, and it's not that far deep you could go and take care of business and be back you know, on the American side within a day if you needed to.” -- Respondent (20-May)

“If there were parts that you wouldn't be able to find in Mexico that are imported from the U.S...you can just import as needed. So, again, operating in Mexico was relatively easy.” -- Respondent (2-Aug)

“And speaking of other logistics, infrastructure: we have railroads that cross the border as well. We have 70 border crossings with the state of Texas. These border crossings provide a billion daily commerce entries between Mexico and the United States.” -- Respondent (9-Jul)

6.1.3 Access to Infrastructure and Production Inputs Opportunity. *With over 50 years of natural gas production, the Burgos Basin has developed infrastructure, including roads, pipelines, ports, and refineries. Some respondents also mentioned water availability in the region.*

“You've got the geology, but also you've got the infrastructure. So, for companies I do not think it is going to be that difficult to take production out of the region and send it to markets.” -- Respondent (15-Jul)

“Well I would say you may have more infrastructure in the Burgos here than in the Eagle Ford.” -- Respondent (15-Jul)

“We're building a port that's basically 200 kilometers away from the Burgos Basin for all the importing and exporting of materials and machines that we need for the oil and gas industry. This is a state-owned port. It's located in the city of Matamoros.” -- Respondent (9-Jul)

“Another one is that, that area is close to small refineries...There are two refineries, the Madero and Cadereyta...proximity lowers the price of transportation and it might be profitable for them.” -- Respondent (11-Jul)

“We have universities. We have local entrepreneurs that understand the oil and gas industry.” -- Respondent (9-Jul)

“La cuestión del agua yo no creo que debiera de ser un problema por una cosa que tiene CONAGUA [Comisión Nacional del Agua]. CONAGUA puso justamente un orden de prelación. El primerito es la parte del consumo humano después esta creo que la parte de riego, esta una serie de cosas y es hasta la octava prioridad que se le da el agua a la industria, hasta la octava y solo si y solo si se cubrieron las siete anteriores, antes no puede tener agua la industria...Yo no pensaría que hubiera un problema del agua, porque otra vez, primero esta cubierta la población, riego, agricultura, una serie de cosas, antes de llegar a la parte de industria, no debería de haber problema ahí.” -- Respondent (8-Jul)

6.1.4 Regulatory Framework and Contracting Opportunity. *A few stakeholders were excited about Mexico's bidding process, its contract models, or the regulatory structure and how these regulations provide opportunities for private companies.*

“Streamlining the drilling permit obtainment process is among the most noticeable advancements.” -- Javier Zambrano (Salas 2019)

“But it's not a confusing process. I will not say that it is an easy process. It's a very long process with a lot of steps, but the rules are pretty clear. You have to comply with twenty steps, but the twenty steps are pretty well drafted and well written.” -- Respondent (28-May)

“The fact that the awarding mechanism changed to put a cap on royalties was a true tipping point for the industry. It was a game changer for the licensing rounds. The cap allows companies like us to actually invest in the development of the assets. The 25 percent royalty for the natural gas block in Burgos is comparable to the royalties offered in similar fields in Texas, which makes the assets in Mexico competitive on the national and international markets.” -- Javier Zambrano (Salas 2019)

6.2 Challenges

Stakeholders identified more challenges than opportunities for developing the natural gas and shale resources in the Burgos. Stakeholders mentioned politics, including the new administration, lack of trust in the federal government, bureaucracy, or the current hydraulic fracturing ban. Production needs — including pipelines, roads, labor, and water — were mentioned frequently, as well. Dealing with landowners or communities were mentioned as challenges. Security, broadly understood as working among drug cartel activities and violence, was noted as a challenge. Respondents commented that Mexico's bidding process, contract model, or regulatory structure were challenges. Lastly, respondents noted that Pemex company culture or Pemex past environmental degradation were ongoing challenges.

6.2.1 Political Challenges. *The change in administration in 2019 and the current political situation were identified as a challenge to developing the Burgos Basin. Stakeholders thought that political bureaucracy and current policy uncertainties, including the hydraulic fracturing ban, had created a loss of trust. To many, this was the key obstacle for companies with interests in the Burgos Basin. As an example, a few stakeholders noted that despite the public announcement of a hydraulic fracturing ban, this technique was in fact still widely practiced throughout Mexico.*

6.2.1a. Bureaucracy and Corruption

“Yo considero que el Estado mexicano estuvo muy al margen cuando ellos tenían el ‘know-how’ de como manejar un poco las cosas. No pusieron reglas claras, no había dinero en la oficina de consultas ni de ocupación superficial. Había un problema de permisos también porque muchos de los problemas de origen no fueron de las empresas, fueron del estado mexicano.” -- Respondent (30-Jul)

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"Here's the real problem is that, in a jurisdiction like Mexico, when you have a bunch of different government approvals, you're creating invitations for corruption. It is what you absolutely are doing. And that's a big turn-off to American companies." -- Respondent (29-May)

"[The government has] slowed down to 18 months to get those approvals. And the problem is that that just kills the flow of your drilling program. Because again it's scale and efficiency. If you have one rig and you can make that rig, give it a consistent drilling schedule for five months or six months or something like that, your total well cost is going to come so far down that you ultimately are making that much more production economic." -- Respondent (29-May)

6.2.1b. Trust.

"Obviously the political instability of Mexico might be a little bit of a concern." -- Respondent (2-Aug)

"The reality is that the energy reform is relatively young, right? And the thing is that the developments have not taken place because of the uncertainty." -- Respondent (24-May)

"That new government Lopez Obrador and his people came in very brash and said, 'No more changes on the tax regimes.' Now it looks like they're wanting to change and allow some of these changes that everybody was waiting for. So, but then, still the people that we are here and we can see what's happening from close up. We say, 'Okay, we're hopeful that things, some positive changes will come.'" -- Respondent (12-Sep)

6.2.1c. New Administration and Hydraulic Fracturing Ban

"If it's difficult for the companies that are already established, I don't see how these companies without the networks with the current administration are going to make it." -- Respondent (24-May)

"So, you don't do farm-outs. You don't do frac-ing. You don't do deep water. You only focus on your existing fields, and you're going to be overproducing them. That's like a recipe for a nightmare in the long-term. In the short term, they're going to increase production. That's for sure. But in the long term, I don't know where they're going to get the oil." -- Respondent (14-Aug)

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"I believe that everything is turning back to the big almighty PEMEX, the way that they are going to control every - every operation in Mexico. That's exactly what happens with PDVSA [Petróleos de Venezuela, S.A.]. Like, you don't work for anyone else unless its PDVSA in Venezuela." -- Respondent (2-Aug)

"And the other thing these changes: it's been the pressure...on the Commissioners themselves. I don't know if you've heard what is happening. The CNH, the National Hydrocarbons Commission. The CNH and the Comisión Reguladora de Energía, the CRE. They have received so much pressure from the government to resign that many of them have resigned." -- Respondent (14-Aug)

"La regulación. Porque este gobierno actual es más reticente a que participen primero las empresas privadas y segundo las empresas extranjeras. Entonces es más difícil el poder lograr que una autoridad federal te de algún permiso. El marco regulatorio está más complicado. Es más lento. Hay como, ahora si yo lo diría en lo funcional, por ignorancia también como el no querer, como se juega mucho con el tema de la soberanía nacional y es un gobierno que su prioridad tiene que ver con la soberanía nacional mal entendida." -- Respondent (17-Jul)

"However, the main barrier is the current administration that they don't think that frac-ing is a good idea." -- Respondent (11-Jul)

"Because of the political, the new political environment and because of the fact that Mexican government does not like to do frac-ing, does not want to support frac-ing, Mexican government is going to maintain the contracts but is not going to extend them." -- Respondent (24-May)

6.2.2 Access to Infrastructure and Production Inputs Challenge. *Respondents identified the production needs for natural gas production as an obstacle to developing the Burgos Basin.*

"Nos hace falta muchas carreteras, nos hacen falta trenes, porque al día de hoy por ejemplo llevar las arenas que se requieren para las fracturas, para mantenerlas abiertas la sílica pues las tenemos que importar y por desgracia el tren entra por una parte, pero, ya de ahí llevarlo hasta donde es el sitio nos hace falta alguna estación multimodal e intermedia para podernos desplazar." Respondent (8-Jul)

"That's one of the major problems the lack of infrastructure, talking about roads." -- Respondent (28-May)

“On the Mexican side, it takes you two months to get a full frac-ing crew together to do a multi-frac job, and by the time they get it, the price tag is such that they charge a high price tag for it.” -- Respondent (12-Sep)

“The bigger problem is like the crews don't really know how to run big stage frac jobs. You can assemble a bunch of pump trucks and do a multi-stage hydraulic frac but if you don't have the crews who know how to do it that is kind of bad.” -- Respondent (29-May)

“So, getting the water from where? People say large cities like Monterrey or Torreón or cities that are pretty close by might run out of water. I don't know if that's true. However, putting water there might be costly to say the least.” -- Respondent (11-Jul)

6.2.3. Communities and Landowners Challenge. *Unlike in the U.S., oil and gas companies are required to work with local communities, through the development of social impact assessments and with social development projects. Private companies also must interact closely with landowners.*

“And then always doing a little bit of negotiation with the communities that are surrounding, because they all want jobs. They see a big company, big names, big loads that are going to be part of a project there, and obviously they want to be part of that somehow. So, there is always a negotiation, an interaction with them. Lots of times, the operator have what they call the community relations person, and we would relate to the community through that community relations person. That was the face for us.” -- Respondent (2-Aug)

“I think that a part of the problem is that in the U.S. the industry doesn't necessarily need a social license to operate. They have already been granted the license to operate; it doesn't matter what the public thinks. In Mexico, it could be different, it seems like they do need a social license to operate.” -- Respondent (16-Jul)

“Onshore is complicated. You have got land access issues, land ownership. Often you've got areas where there were no prior agreements. You got to implement a royalty regime on that. You've got complicated syndicators situations, formal, informal. You've got communities, many of whom will feel disadvantaged by the oil industry in the past and are looking for their share of the rent.” -- Glyn Jones (2018)

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"In Mexico in theory, especially if you are just a private going against the oil and gas company the surface owner can absolutely just say "f--k off " if they're just not interested." -- Respondent (29-May)

6.2.4 Security Challenge. *Security was mentioned as a challenge 45 times (n=45). However, it was apparent that most of the comments about security challenges were based on media narratives and not firsthand experience. Among respondents with firsthand experience working in the Burgos, security was not seen as a major challenge. As one respondent with long experience working in the Burgos noted about cartels, "you can work along with these guys as long as you don't cross into their territory."* (Respondent 12-Sep)

6.2.4a. Security and Violence.

"Híjole, pues yo creo que el reto serio, híjole, pues primero la seguridad." -- Respondent (17-Jul)

"Tenemos que reconocer que tenemos un grave problema de inseguridad, eso también nos afecta la estructura de costos." -- Respondent (8-Jul)

"La presencia del narcotráfico, de los huachicoleos, del huachicoleo que había mucho huachicol este, autoridades corruptas, representantes de comunidades que negociaban por ellos, estos secuestros en la zona, enfrentamientos armados." -- Respondent (30-Jul)

"A lot of the Burgos basin is still complicated, security wise. That is what I will say, complicated...I mean they [prospective operators] are going to have to contend with drug cartels. They are going to have to contend with abandoned land issues." -- Respondent (20-May)

6.2.4b. Dealing with Cartels.

"At certain locations, we were...exposed to difficult conditions when the people would start to show up at the locations asking for diesel or asking for some sort of support. And you couldn't deny any access, or you couldn't basically do anything. You immediately realize that they were outlaws, and you just follow the game, and nothing really happened." -- Respondent (2-Aug)

"But I mean, so you can work along with these guys as long as you don't cross into their territory, you don't get mixed up into their business, which is booze, alcohol, drugs, and women." -- Respondent (12-Sep)

“Look it's an issue. You have to contend with it. You have to be respectful of it. Somedays that bad guys are going to show up and say, ‘Hey you guys aren't working today.’ And you're going to say, ‘Great, sounds good.’ And you're going to go home.” -- Respondent (29-May)

6.2.5 Regulatory Framework and Contracting Challenge. *Some respondents identified Mexico's bidding process, contract model, or regulatory structure as challenging and not conducive to developing the Burgos Basin.*

“It's quite the challenge to deal with all of the paperwork and all of the permits.” -- Javier Zambrano (2018)

“For me the consultation process was a no-winner for nobody: not the companies, not the government and last the communities. This is a big issue in Mexico, because the indigenous populations historic, historical, it was the most vulnerable population, also poor with less access to the basic services.” -- Respondent (30-Jul)

“Mexico's not friendly. The regulation's not friendly. Just to incorporate a company, it's a headache. It's really a headache. To get the tax I.D. number, it's a headache. And it's getting more complicated to get the permits, to win a bid. To win one of these contracts they will have to invest, I don't know, only in attorneys, \$50,000.” -- Respondent (28-May)

“Where it gets challenging starting out is the regulatory piece. When you have a lack of clarity on response time, on approval time for things.” -- Respondent (29-May)

“The second [challenge] is like the contracts.... The new administration is thinking about production contracts. Which is more like a... service contract. It is pure services so if you sign an agreement that you want to produce on an oil play then they might be saying ‘Okay, I'm going to pay you as if you were like a service provider.... I'm not going to share the production with you.’ So, those contracts are not very popular. So, as far as I know, the new contracts are not going to share the risk. The risk is going to go all the way to Pemex and the private contractors will get a fee for their services. So, I think in my opinion that that's the biggest, biggest, biggest challenge.” -- Respondent (11-Jul)

“The fact that these operators in the U.S. can get in there and experiment and have the economics to do that, it seems to be fairly unique. Even though we sort of

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thought developing shale was going to end up in this cookie cutter approach, it really never has. It really varies lease to lease, well to well. And if you don't have that sort of setting for operators to get in there and experiment and optimize, it's pretty hard to see it happening in the same way that it's happened on the other side of the border." -- Respondent (18-Jul)

"If suddenly you woke up tomorrow and you had the Texas regulatory regime for all of Mexico, the first thing people would go drill probably wouldn't be shale formations anyway. There's so much conventional infill opportunities working over stuff- that would be where you would go put your money. And you could do that for ten, twenty years probably, before you needed to really go look for shale opportunities to get comparable returns." -- Respondent (29-May)

6.2.6 Pemex as Challenge. *A few respondents noted that Pemex's company culture or Pemex's past environmental degradation also were challenges. According to some respondents, Pemex's reputation as a company not interested in the environment and having poor past community relations made it difficult to enter into new production regions, such as the Burgos.*

"The hardest challenge is trust. I mean it's very difficult to sign a contract knowing that your counterpart, in this case it's Pemex, might not be able to honor all the terms of the contract. For example, Pemex is well known among the industry for having, let's say, an organizational problem. Sometimes they pay late." -- Respondent (11-Jul)

"And when the people, when they want to complain with Pemex about something, they have to cross bureaucratic nightmare just to find the people who...know both of the areas. Pemex is also kind of full of bureaucracies. It's crazy. it's completely inefficient. The description is 'To move the legs of the elephant.' It's an animal. It's complicated to move." -- Respondent (28-May)

"So, PEMEX complained that 'oh, you're treating us, you're asking us to ... with the private companies.' You're telling us that you are no longer going to be 'la niña bonita del pueblo,' and you're not going to get everything. You have to compete. But when it comes to choosing partners, you choose my partner? So, that's not treating me like an adult. 'Either you emancipate me, or you don't emancipate me. You treat me like a private company, or you don't.' But that was set up in the way it was set up, so they can't complain about it." -- Respondent (14-Aug)

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“Also, there's a lot of sad stories of Pemex or oil and gas industry, mostly Pemex, polluting the areas, having spills, not being really...There are some places that Pemex has affected a lot.” -- Respondent (28-May)

7. Near-term Developments in the Burgos Basin

A few stakeholders discussed current oil and gas activities in the Burgos and reflected on what they thought would be near-term developments in the basin. With bidding rounds postponed, one respondent discussed their expectations for Pemex and service contracting. Several respondents brought up offshore developments and compared these to onshore issues in the Burgos. Because of the distance to offshore facilities and Pemex's lack of deep-water technologies, offshore has not been subjected to the same levels of politicization and therefore, has continued despite the change in political administrations.

7.1 Pemex Activities.

Two takeaways here. First, Pemex is still interested in the Burgos but lacks funding. Second, money likely will come from service contracts.

“On one side there's the administration saying that there is not going to be any frac-ing in the country... On the other side is the Pemex management team. They think that the Burgos has lots of potential and they could be producing gas that the country needs and making a profit there...Pemex wants to produce, but regulators might not be willing to do that.” -- Respondent (11-Jul)

“I think the future is [that government will] put lots of public money into the company hoping that it will be profitable again sometime. However, they aren't going to let private money come in for sharing of the risks and sharing profits. The only private money that is coming in is for the service contracts where you get a set rate for every barrel of oil that you produce and that's it.” -- Respondent (11-Jul)

7.2. Offshore versus Onshore.

There are different requirements necessary to develop onshore and offshore fields. For one, offshore investments are much higher than onshore, and as a result, the types of companies working offshore and onshore also differ. Whereas Mexico's deep water, offshore blocks attracted oil majors, the onshore blocks attracted smaller independent oil firms. Because of the changing contract policy regime with the new administration, smaller companies lost faith in the near future prospects to develop onshore fields in the Burgos. Second, although deep-water developments are more expensive, they do not contend with many of the social, political, and legacy issues faced by onshore production.

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"In offshore, it's a little bit different because the investment there is much higher than onshore. So, in offshore it's almost the same process but you have to be sure that you actually have research, before you actually develop. So, the only way to be sure of that is when you drill as many wells as possible, just to be sure that you have a reservoir. We call it [a] reservoir, you have a reservoir and maybe to be sure how big is it before you actually invest for the well. And of course, the time to develop the wells offshore is a little bit longer, because there is not enough equipment. So, you have to order those and it takes some time to get the platform over there." -- Respondent (21-May)

"So, the majors haven't done anything onshore. I mean offshore is kind of a different story. There's Talos Energy. There's ExxonMobil and other companies doing the offshore projects on the energy rounds." -- Respondent (20-May)

"The guys that have the concessions offshore: I mean, PEMEX on the deep water and they can't do much when they just do not have the resources. So, these companies are pretty confident that they'll be going on, no problem. But the companies that gained contracts on land fields, onshore, they saw that there was an...interruption. And that's what caused a lot of the onshore work by the new independent companies was interrupted, or uh, started to run very slow suddenly." -- Respondent (12-Sep)

"There's something to that [offshore being out of sight out of mind] yeah. And you know offshore development's a lot easier in that respect. That you don't have the land risk. It's...you get the contract and boom you have the rights pretty much to be out there. You know they're still going to get hung up on these kind of approvals but you know if you're an Exxon or a Shell or something like that. If you're Mexico, you've got to look at them kind of the way you look at big banks or something too like. You've got to be a little careful before you mess with them. If you're just a small independent operator from the U.S. that goes down there, you're pretty vulnerable, especially if you don't have a local presence or aren't used to navigating these kind of things. You're just going to get eaten up alive in trying to get permits out in time. They'll sense it, and they'll feel it, and they'll kind of enjoy it. You're not going to get a permit out anywhere near your time frame so. The bigger companies that are already doing the big offshore stuff are a little better equipped to handle that kind of environment anyways. I hope it's not cynical. -- Respondent (29-May)

"And in many ways, offshore is simpler, much simpler." -- Glyn Jones (2018)

8. Stakeholder Advice and Policy Recommendations

During interviews with stakeholders, we asked if they had advice for someone who wanted to start a project in the Burgos Basin. Three themes came up. First, stakeholders

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advised companies with contracts to be patient. Second, stakeholders advised prospective firms to be good neighbors and introduce themselves slowly to local communities. Third, it is best to be well prepared and work with someone who has experience in the region. We also asked stakeholders to suggest policies to improve the oil and gas business climate in the Burgos.

8.1 Advice to Private Firms with Interest(s) in the Burgos

8.1.1 Firms Biding Time for Optimality. *With the current uncertainties among international companies and their involvement in developing the onshore Burgos Basin, stakeholders suggested that companies with contracts in the basin consider waiting things out.*

“We've taken kind of a ‘wait and see approach’ to just kind of see how everything shakes out. We aren't pulling out of Mexico you know we're still very happy with what we have we think it's a great country to invest in.” -- Respondent (29-May)

“In fact, waiting things out is part of a broader strategy...You know to have a presence, have people, have a footprint, have some infrastructure; if something ever changes in the future, you've got a big leg up.” -- Respondent (29-May)

“[The firms] can't sit long, and with their blocks, and not doing anything for a year, a year and a half, and just wait. They need income, short-term.” -- Respondent (12-Sep)

“[Companies with experience in Mexico] can see what's happening from close up.... Some positive changes will come...but [the] companies that are out there, foreign companies that don't have insight, they're all frightened. They say, ‘Look at what's happening in Mexico, that's not very attractive.’ And they're all turned down and all turned away, and that is a bit of a shame. Now, we need additional capital and new companies to come in.” -- Respondent (12-Sep)

8.1.2 Returning to the Burgos. *If new companies again return to work in the Burgos, stakeholders suggested that firms learn how to become good neighbors.*

“When you come to a new country, you need to get educated...as to how the local community works” -- Steve Hanson (2018)

“I have a friend in one of these companies and he said literally, ‘If they actually review our social impact status, we can lose the case. We didn't do anything that we pledged to the community.’ As I said, companies need to learn how to be better neighbors.” -- Respondent (15-Jul):

"[It is important to] know how to treat and deal with the locals. I have a very easygoing character, and I can usually become friends with them very rapidly, and get them on my side, and then suddenly the roadblocks disappear, and you're free to do your technical work as you intended. But it's that type of thing, the social stuff...that's what you have to deal with, and that takes a bit of experience." -- Respondent (12-Sep)

"[Best to assume an] easygoing character, to become friends with and get people on your side, and what you will notice is that suddenly the roadblocks disappear" -- Respondent (12-Sep)

8.1.3 Developing Sustainable Outcomes. *From a development perspective, it is important to survey sites and collect data early on, which includes completing environmental baseline studies, assess above ground risks, and identify landowners.*

"We assessed not just what was below ground, which is so critical in the oil and gas industry, but what are the above ground risks, social, environmental, archeological, security. All those risks were assessed very, very early on in the bid rounds." -- Steve Hanson (2018)

"If you're just a small independent operator from the U.S. that goes down there, like you're pretty vulnerable. Especially if you don't have a local presence or aren't used to navigating these kind of things." -- Respondent (29-May)

"[It can be useful to put together] a consortium to acquire data together" -- Respondent (15-May)

"[Form an alliance with an experienced service company to access] new knowledge in techniques, in logistics, in how to handle an exploration and production projects." -- Respondent (8-Jul)

8.2 Stakeholder Policy Recommendations

Stakeholders offered a diverse list of potential policy recommendations that ranged from the abstract to the prescriptive with many pushing economic strategies. Others suggested that Pemex and the Mexican government should focus more on natural gas, because currently their attention is mostly on oil extraction and production. One respondent suggested that the government's royalties are excessive. Others wanted to see the bidding round reopened and suggested that the contract models could be updated. Finally, it was suggested that oil and gas firms should be given more autonomy.

8.2.1 Economic Strategies. *While respondents offered many different financial policy incentives to encourage production, some wanted the Mexican government to subsidize production on a per mcf basis.*

“En México no se sí llegara a ser el caso, porque otra vez un mil, poner un subsidio, vamos a ponerlo de 5 dólares el millón de BTU, 5 por las importaciones, estaríamos hablando de cerca de doce mil millones de dólares al año de impuestos, de subsidios.” -- Respondent (30-Jul)

8.2.2 Focus More on Natural Gas and less on Oil. *Respondents recognize that oil holds a special place in the Mexican national consciousness, but they also recognize that the country needs to produce more natural gas if policymakers want to head-off increased imports from the United States and elsewhere.*

“So, this is the importance of the Burgos Basin, which is the biggest natural gas reservoir that Mexico has and that is not being used in holistic natural gas environment because we are talking about oil, because the federal government is investing in a huge refinery down in Dos Bocas, Mexico.” -- Respondent (9-Jul)

“So, it would all depend on the following. If the government of Mexico does a physical reform, and they're able to reduce the dependency, I think the logic behind whatever's going to happen is going to change, right? And that was the goal of the previous administration: to keep reducing the amount of money the government was relying on. Because ultimately then you are always in this trap of cycles of you know, cycle prices, and it just makes no sense, and you're depending on the production.” Respondent (14-Aug)

8.2.3 Reign in the Royalties paid to the Government. *At least one respondent noted that some companies offered exorbitant royalties that were unsustainable in the long term.*

“So, there is so much enthusiasm of all these companies that they want a piece of the pie, and there they come! They offer 70, 75% royalties...Let's take the example of your barrel of oil. Of your \$45 that you received for your oil, you're only left with 30 or 25% after paying royalties. So, 25% of 45 dollars is like 11 dollars. Holy f**k, I mean, \$11 is barely enough to cover your OPEX [operating expenditures].” -- Respondent (12-Sep)

8.2.4 Reopen Bidding Round and Amend Contract Model. *Several respondents identified that one of the quickest methods to boost production on the Burgos would be to reintroduce the energy reform bidding rounds and open up new locations for drilling.*

“And we will be very content if...the Energy Minister will announce more rounds of the bidding process to the CNH.” -- Respondent (9-Jul)

“It’s a must to continue the bidding, especially in shale oil areas and also you have offshore.” -- Respondent (21-May)

“Pemex cannot do it all... that was a fact recognized by the previous administration [the Enrique Peña Nieto administration] and many people today believe that.” -- Respondent (15-Jul)

“[The Mexican government] should let the oil company work as a private company, because again, the government is not the best administrator.” -- Respondent (28-May)

“Yeah, what [the oil and gas industry] calls the migration of the oil CIEP contracts...those were meant to migrate to what they call the CEE, Contrato de Exploración y Extracción..., which were managed by the CNH and which had a much better structure on the exploration side.... That’s what people are waiting to come back.” -- Respondent (12-Sep)

8.2.5 Increase Transparency. *Finally, respondents identified that perhaps the best policy would be to have a fully transparent Mexican regulatory body that is completely independent from the presidential administration to oversee the production of oil and gas in the country.*

“And it’s really important that Mexico, to compete with the global energy market, is to have incentives and to have attractive, transparent regulatory frameworks that will allow companies to say, ‘Listen, I can make more money in Mexico than I can in another country somewhere else.’” -- Steve Hanson (2018)

“[CNH] are the ones supervising the fields of production. They are supervising the production plans. They are supervising that you are complying with all of the requirements in the contract. If you destroy them, the only ones that are going to be winning out of it are the producers.” -- Respondent (14-Aug)

9. What Lies Ahead for the Burgos?

Current investments into Burgos shale resources have, with a few exceptions, stalled since the election of the López Obrador administration. Moreover, cheap natural gas imports from Texas also disincentivize Pemex and private firms from over-investing in the Burgos. Still relevant today, a five-year-old quote from Stillman (2014) notes, "It is increasingly difficult to see the advantage of developing Mexico's shale resources while the U.S. is experiencing a glut next door.... Spot prices at Henry Hub, the U.S. natural gas pricing benchmark...[are] about four times less than Mexico has paid for liquefied natural gas from Asia and Latin America." Stillman (2014) also quotes a former Mexican trade official noting, "At today's price, there is very little incentive to develop Mexican shale gas. You would rather pipe it in from Texas." Thus, cheap U.S. imports can answer much of the country's gas needs quicker and cheaper than developing its own shale resources in the Burgos Basin.

Interview respondents see a high degree of uncertainty in the Burgos' future. A lot depends on the price of natural gas, extent of trans-border pipeline completions, and public support for Mexico's current energy policies. Developing shale resources is complicated and requires the right mix of geology, infrastructure, prices, public acceptance, and regulatory environment. Although much of the excitement for the Burgos' potential has to do with its proximity to the Texas and continuity with the Eagle Ford Shale, the likelihood for a similar type of shale boom in the Burgos currently seems rather low.

Stakeholders and experts estimate about 10-20 more years of high productivity from the Eagle Ford Shale. Some suggest that Mexico would be wise to continue to import less expensive natural gas from Texas during that period, while also exploiting conventional natural gas in the Burgos Basin, both onshore and offshore. For the Burgos Shale, it is better to look to its future potential, say in 20 to 30 years, as an energy security stopgap. Currently, however, existing conventional gas-producing geological strata in the Burgos Basin could be further explored and exploited to enhance Mexico's energy security for now and into the future. The extant technical skills and infrastructural capacity appear adequate for these conventional deposits. The challenge will be synchronizing newer business and contract models with these "lower-hanging fruit" hydrocarbons. If done efficiently, this third path, though divergent from the Burgos as the Eagle Ford heir, could reactivate Burgos production activities and stimulate local economic activities.

Yet, it is important to recognize that Texas's competitive advantage extends well beyond the next few decades and perhaps beyond the lifetime of the Eagle Ford. The massive Permian Basin is already providing natural gas to north-central Mexico through pipelines in Presidio-Ojinaga as well as El Paso-Juárez. It stands to reason given the many interconnecting pipelines between the Eagle Ford and the Permian that one day Permian gas could fill south Texas trans-border pipelines. Further, in the Río Grande Valley, companies have started re-targeting the Vicksburg formation, where new pipeline infrastructure makes natural gas production profitable (Chapa 2019a). The long-term viability of the Vicksburg formation is unknown at this point, but it is likely that it too will contribute to trans-border trade, at least in the near term.

10. Summary Assessment

Here, we offer our assessments of three issues that came up during our research. First, there is a popular narrative that the Mexican government's ban on hydraulic fracturing is limiting Mexico's ability to produce oil and natural gas. However, despite large estimates of shale gas reserves in the Burgos, the extremely high costs to produce it — as compared to shale gas production in Texas — and the low price of imported natural gas from Texas, suggest that shale and unconventional resources are not the panacea that some industry analysts and media pundits suggest. Rather than remaining fixated on unconventional production, businesses, local and state-level governments, and economic development groups should look to conventional natural gas resources in the Burgos Basin. Respondents with geology backgrounds and industry experience note that there are quite a few regions in the Burgos where conventional production could be profitable. Moreover, the private sector could engage with the federal government to seek areas of compromise, such as reopening the bidding rounds, but for non-shale resources. This is especially true for private firms that maintain interests or were awarded contracts in the region. The oilfield services industry has a long working history in Mexico, while weathering the uncertainty and inconsistency of the Mexican energy sector. As identified by several respondents during interviews, many companies are mirroring the oilfield services industry by retaining as much mineral land as possible with the hope of exploiting those resources in the future under a different policy regime.

Second, by postponing the bidding rounds, the new administration created a lot of uncertainty for private firms. The hydraulic fracturing ban has garnered the most attention. Although a growing body of research suggests that unconventional oil and natural gas production can produce negative health and environmental externalities, the ban appears to be empty talk. According to several respondents in our study, as well as others (e.g., Duhalt et al 2019), the practice of hydraulic fracturing continues in Mexico despite the discourse around the ban. Moreover, most analysts expect that unconventional resources will be the predominant source for hydrocarbons for decades to come, far exceeding the *sexenio* of the current administration. Given the current administration's nationalist discursive approach and historical nostalgia, it would not be surprising to see a rebranding or gradual incorporation of unconventional production. Combined with long-term energy security, conventional resources could provide the administration a political pressure valve to shift their policies to reflect the realities of both supply and demand and current business and technological approaches. In many ways, what private firms "want" and what the Mexican government "wants" are the same: access to productive fields, efficient production, and outcomes that benefit their constituents. Further, by developing local conventional natural gas fields, there would be less demand for large and highly visible transnational pipelines, many of which have encountered community backlash during construction.

Third, policy options and other recommendations offer possible solutions for both the Mexican government and the private sector. From a governmental perspective, our

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respondents identify that maintaining or re-establishing the integrity of 2014 Energy Reforms is a priority for sector-wide growth. The *de jure* blueprint of contract models, production zones, and bidding and award rounds of the reforms, which are based on precedents in other parts of the world, were generally supported by interview respondents. Removing the uncertainty from their *de facto* implementation could provide a more sustainable long-term future for Mexico's energy sector. Uncertainty could be mitigated through the updated CSIEE contract models, the removal of moratoria, or resumption of the bidding rounds, which may potentially lead to increased production. The private sector and regional governments could potentially look to extant conventional hydrocarbon resources to expand capacity for the short term while developing a "long game" strategy that includes unconventional, deep offshore, and renewable energy production models. As the Mexican government charts a future for production, transparency will be a key issue. Oil and gas firm employees articulated that the uncertainty in the Mexican energy market could be partially remedied through the roll-out of an agenda for the duration of the reevaluation of the bidding rounds or by setting a firm deadline for the transition from legacy contract models to the new CSIEE model.

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