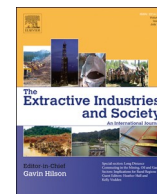




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Examining Mexico's energy policy under the 4T

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ABSTRACT

Since December 2018 there has been a new government and a new energy policy in Mexico. This government, under President Andrés Manuel López Obrador, has called for the fourth transformation of the country, or 4T, which includes implementing profound changes in energy policy focused on a strong oil sector headed by Mexico's state oil company PEMEX. Some of the key elements of the new policy are the construction of the Dos Bocas refinery with public investment, a rescue plan for the highly indebted PEMEX, non-private development of unconventional resources (i.e. shale gas and oil), and combatting the illegal extraction of hydrocarbons. These changes are being driven by government policies to support the uptake of hydrocarbons production to achieve 'energy sovereignty', making Mexico self-sufficient in energy in the medium term.

1. Introduction

After being a contender in three consecutive elections, in 2006, 2012 and 2018, Andrés Manuel López Obrador, hereinafter AMLO, was elected President of Mexico on 1 July 2018 and took office on 1 December 2018. As a candidate, he toured all of the municipalities of Mexico. He had previously been head of the government of Mexico City, from 2002 to 2005, and his political career had begun in the 1970s. President AMLO is thus an experienced politician who has had plenty of time to mature his policies, including energy policy.

AMLO was elected president under the banner of MORENA, the National Regeneration Movement which he created and formally registered as a political party in 2014. He has promised 'the fourth transformation' of the country, or 4T, which encompasses the government's vision. After three historical transformations, namely Independence from Spain (1810–21), the liberal and social movement known as the Reform (1854–76), and the Revolution (1910–17), 4T is envisioned as peaceful and orderly with austerity measures to eradicate corruption and impunity and reduce inequalities (De la Cruz Lugardo

and Reyes Torres, 2019). It also includes implementation of government energy "guidelines aimed to meet the needs of [a] society" (Blanco and Oxilia, 2016: 3) of 130 million people.

There are real energy policy implications to the 4T. According to the PEMEX Business Plan 2019–23, two of the main energy policy objectives are "to achieve energy sovereignty¹ and promote inclusive development. In both, PEMEX plays a decisive role by recovering its preponderance in the production of hydrocarbons" (PEMEX, 2019a: 72). The concepts of energy sovereignty and energy security, however, have not been thoroughly defined by the Federal Government of Mexico. The intentions of energy sovereignty and energy security could arguably be elicited from the Government Report 2018–19 (Presidencia de la República, 2019a: 230) as, respectively: achieving, in a sustainable way, energy self-sufficiency in the medium term while reducing fuels imports; and guaranteeing electric power and fuel supply at affordable prices.²

For the hydrocarbons sector, at least, energy sovereignty and energy security are the twin goals of the energy policy of the AMLO administration. Relevant steps towards achieving energy sovereignty and en-

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¹ According to Bilder (1994: 10), "the term sovereignty is very generally used to mean simply a state's right to do as it wishes, particularly within its own territory, free of external constraint or interference". The concept of energy sovereignty is in constant evolution and has been used to designate the ability of the state to shape and direct energy production and distribution (e.g. Laino, 2015). Energy sovereignty has been defined as "the right of people to have access to energy and to make their own decisions over sustainable energy sources and sustainable consumption patterns" (Dell'Anna and Menconi, 2016: 20), which emphasises sustainable development and the rights of energy users.

² This meaning is consistent with a conventional energy security concept which "refers mostly to assured access to oil, coal, and gas" (von Hippel et al., 2010: 74).

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energy security include building the Dos Bocas refinery in the state of Tabasco, implementing a rescue plan for Mexico's state-owned producer, PEMEX, and revitalising the fight against the illegal extraction of hydrocarbons. It is not possible to increase energy self-sufficiency and guarantee fuel at affordable prices if criminals steal and sell substantial amounts of the country's hydrocarbons. Thus, the fight against the illegal extraction of hydrocarbons, which was lost by the previous administrations, is also seen as a fight for the nation.

The government of former president Peña Nieto (2012–18) launched an energy reform in 2013 to strengthen energy sovereignty. Peña Nieto declared at the [World Economic Forum \(2014\)](#) that “Mexico had to modernise and update its legal framework, precisely to ensure energy sovereignty and have cheaper energy inputs”. The AMLO administration has a different view of energy sovereignty. According to this administration, the 2013 energy reform damaged the productive companies of the state (PEMEX and the Federal Electricity Commission) by increasing privatisation and as result Mexico became an importer of crude oil instead of an exporter ([Gobierno de México, 2019: 59](#)). Oil production fell in 2018 to the lowest level since 1980. Therefore, the AMLO administration is implementing a plan to rescue PEMEX and increase production of petroleum fuels and petrochemicals.

The energy reform also paved the way towards the development of unconventional resources. Following this reform, PEMEX was provided in 2014 with unconventional oil and gas resources and a call for a competitive tender process for private and public–private investment in unconventional and conventional terrestrial resources was issued in 2018. In contrast, immediately upon coming into office in December 2018, the AMLO administration cancelled the tender and has not encouraged private investment in the development of unconventional resources. Further, President AMLO has committed to ban fracking, which is consistent with the fact that “Mexico is not yet prepared for the wide implementation of this technology; there are many issues to be dealt with before reaching a proper starting point” ([Villalobos-Hiriart et al., 2020: 100](#)). However, this commitment has so far proved to be unenforceable, and PEMEX has gone ahead with exploration plans for shale gas and oil.

In 2019, the Secretariat of Energy (SENER) established the consultation forums ‘New Energy Policy for the Welfare of Mexico’ to define the country's energy policy for 2019–24. Besides hydrocarbons, these forums have discussed electricity, clean and renewable energy and technological innovation. The focus of this article is on hydrocarbons; further research is needed to shed light on the other areas of the new energy policy.

2. The Dos Bocas refinery

Mexico's oil output “fell to an almost 30 year low of 2.1 millions of barrels per day in 2018” ([BP, 2019: 1](#)) and it was forced to import light crude oil from the United States. A new energy policy to expand domestic refining capacity is required because Mexico is currently importing around USD19 billion of petroleum products (gasoline, diesel, liquified petroleum gas, jet fuel and fuel oil) per year ([García, 2019a](#)). As Forbes puts it, President AMLO wants “to reverse the highly expensive and nonsensical requirement to export domestic crude to the United States for refining and then import it back into Mexico again” ([Clemente, 2019](#)). Over the course of the Peña Nieto administration, from December 2012 to November 2018, imports of ‘crude oil and petroleum products’ from the United States doubled ([U.S. Energy Information Administration, 2019a](#)). According to Mexico's principal auditing body, the Chief Audit Office of Mexico (ASF), during “2013–2016, when the energy reform was launched, imports of petrol and diesel increased by 46% and 74.4% and production decreased by 27% and 31% (respectively)” ([Auditoría Superior de la Federación, 2016: 4](#)).

How desirable is the importing of gasoline? According to the ASF, in 2016 “the costs of production of Magna and Premium gasolines,³ as well as diesel, were lower by 61.1%, 56.2% and 61.5%, respectively, than import costs, due to the reduction in the price of the oil barrel and the increase in the exchange rate relative to the Dollar (USD)” (idem: 19). The opportunity to capitalise on these lower costs was lost, due to low domestic production of gasoline and diesel. There are also advantages to boosting the domestic refining capacity, including: the creation of 135,000 direct and indirect jobs by the Dos Bocas refinery ([Secretaría de Energía, 2019a](#)); stimulating the backward and forward linkages of the refining sector with the rest of the economy; and reducing the deficit in the supply of gasolines and diesel. The latter is an outcome of increasing demand for diesel and gasolines, which has to be met by imports ([Auditoría Superior de la Federación, 2016: 3](#)).

In the United States there are 135 operable petroleum refineries ([U.S. Energy Information Administration, 2019b](#)), whereas in Mexico there are only six petroleum refineries that are operating close to maximum capacity, and these require urgent maintenance and modernisation. The most recent refineries (Salina Cruz in the state of Oaxaca and Cadereyta in the state of Nuevo León) were built in 1979. The planned Dos Bocas refinery will contribute to reversing the dependence on US refineries. The AMLO administration has initially allocated around USD8 billion to the construction of the new refinery and expects that it will be built within three years from June 2019. Initially, foreign companies were invited to participate in its construction following a bidding process. However, they declined to participate, raising questions about the feasibility of building the refinery within the established budget and timescale. Thus, the Federal Government of Mexico decided that PEMEX and SENER would “coordinate, administer and supervise” the project ([Secretaría de Energía, 2019b](#)). In addition to public investment, according to China's ambassador to Mexico, the Bank of China and Industrial and Commercial Bank of China (ICBC) “are providing \$600 million in financing for the construction” of this refinery ([Reuters, 2020](#)). In response, the head of SENER, Rocío Nahle, declared that the Dos Bocas financing project is not supported by any bank ([El Financiero, 2020](#)).

The new refinery is located in the municipality of Paraíso in the state of Tabasco, and it required clearing at least 40 hectares of mangroves. While it is common practice to build refineries at the Gulf of Mexico, the clearing of mangroves may have made the land more susceptible to flooding. The National Agency of Industrial Security and Environment Protection (ASEA) fined PEMEX approximately USD650,000 for illegal vegetation clearing. Nonetheless, the environmental impact assessment conducted by the Mexican Petroleum Institute (IMP) concluded that even though the “development of the project will cause moderate impacts on the environment, these will be controlled, mitigated or compensated through different environmental control systems, wildlife rescue and management programs, as well as reforestation programs” ([Instituto Mexicano del Petróleo, 2019a: 29](#)).

Another conclusion from the IMP assessment is that the Dos Bocas refinery would foster national, regional and local economic development and energy self-sufficiency (idem). According to an IMP technical report, the Dos Bocas refinery will consist of 17 processing plants and will refine 340,000 barrels per day of Maya heavy crude oil ([Instituto Mexicano del Petróleo, 2019b](#)). Mexico's Maya heavy crude oil blend is high sulfur grade, which can make its refining and commercialisation challenging. While it is still too early to evaluate the feasibility of the construction and production estimates for this refinery, it is clear that

³ PEMEX Magna (minimum content 87 octane) and PEMEX Premium (minimum content 91 octane) are two grades of gasoline in Mexico ([PEMEX, 2020](#)). Both comply with the Official Mexican Standard NOM-016-CRE-2016 ([Secretaría de Gobernación, 2016](#)). In areas other than the metropolitan areas of Guadalajara, Mexico City and Monterrey ethanol blending is allowed in gasoline (idem).

this is the most important flagship infrastructure project of the AMLO administration. Therefore, while government budgets in other areas are being cut through austerity measures, this refinery will benefit from public investment of around USD2 billion during 2020. The Dos Bocas refinery makes sense from a financial perspective if producing petroleum products domestically is cheaper than importing them. As mentioned previously above, two major factors that will determine whether the cost of production of diesel and gasoline in Mexico is lower, or substantially lower (over 50% in 2016), than import costs are the exchange rate (USD to MXN) and the price of the oil barrel. Some of the factors that influence the latter are supply, balance, spot prices, financial markets and demand (U.S. Energy Information Administration, 2020).

3. Thou shall not frack

The debate over how to reconcile increasing oil and gas demand with the potential gains and risks of unconventional resources is a long-standing one; however, the specific conditions of the Mexican case need to be considered before embarking on commercial-scale development of unconventional resources.

Increasing insecurity, PEMEX-organised crime links in the states with the largest proven shale gas reserves (particularly Veracruz, Tamaulipas and Puebla),⁴ and a novel regulatory framework for unconventional reserves established in 2017, are among the factors that increase the complexity of governing the development of unconventional resources in Mexico and the likelihood of environmental and social impacts (Hernández Ibarzábal, 2017b, 2018a). Some of the environmental risks of hydraulic fracturing (fracking) that need to be closely monitored are increasing water pollution nationwide and seismicity-related risks. Mexico City was “built-up on top of ancient lake deposits” and “experiences some of the largest seismic site effects worldwide” (Cruz-Atienza et al., 2016: 1). In 1985, Mexico City was devastated by an earthquake in which 15,000 died (idem) and in 2017 another earthquake located near the borders of the states of Puebla and Morelos “led to significant and extensive damage in central Mexico, especially in Mexico City”, including “38 collapsed and more than 3000 damaged buildings” (Elwood et al., 2018: 1).

Another risk that will need to be thoroughly assessed and carefully monitored is the possible impact of hydraulic fracturing on the volcanic activity of Popocatepétl, the most dangerous volcano in Mexico, located about 45 kilometres southwest of the city of Puebla and 70 km southeast of Mexico City, which has seen increased eruptive activity since 1994 (Delgado Granados et al., 2018). The activity of the Popocatepétl volcano, including exhalations, tremors, explosions and volcano-tectonic earthquakes, is monitored by Mexico's National Centre for Prevention of Disasters and other institutions, but further research is needed on possible links between volcanic activity and hydraulic fracturing, especially if unconventional resources are to be developed in Puebla.

Between 2007 and 2018, the national production of natural gas decreased from 47 to 37 billion cubic metres and consumption increased from 49 to 77 billion cubic metres (BP, 2019: 1). Moreover, natural gas “now accounts for 60 per cent of electricity generation” (idem). The increasing demand for natural gas has been met by imports, mainly from the United States, which poses challenges of its own (Hernández Ibarzábal, 2017a). On the other hand, Mexico is among the top 10 countries in terms of technically recoverable shale gas and shale oil resources (U.S. Energy Information Administration, 2013: 10). If it were not for the associated environmental and social impacts of the development of unconventional resources, and the adverse above-ground and below-ground conditions, aiming to increase gas production from this source would seem reasonable.

Following the 2013 energy reform, Mexico was poised for the commercial-scale development of unconventional resources. In August 2014, Round Zero granted PEMEX exploration concessions of fields covering 8408 km² and containing an estimated 5225 millions of barrels crude oil equivalent (Fundar, 2017: 67). In March 2018, the bidding rules for Round 3.3 ‘Exploration and extraction of inland areas of unconventional resources’ were published by SENER. Round 3.3 would have granted unconventional oil fields to private investors; it was “integrated by nine contractual areas under the license type contract, with an average area of 300 km², located north in the state of Tamaulipas” (Comisión Nacional de Hidrocarburos, 2018a: 16). On 11 December 2018, the National Hydrocarbons Commission (CNH) cancelled Round 3.3 following a request of SENER to exclude the nine contractual areas that were part of this process (Comisión Nacional de Hidrocarburos, 2018b). Although the AMLO administration cancelled Rounds 3.2 and 3.3, and no bidding rounds have been issued, farmouts (PEMEX–private sector ventures) and private exploration in deep waters of the Gulf of Mexico cannot be discarded.

Since the cancellation of Round 3.3, the Mexican government has given mixed signals on the development of unconventional resources. Whereas President AMLO's 75th commitment after taking office consists of not using “methods of extracting raw materials that affect nature and deplete water sources, such as fracking” (Reforma, 2019a), on 29 January 2019 Rocío Nahle declared that fracking would be used but with less environmental impact (Mares, 2019). In response, President AMLO reiterated on 4 February 2019 his commitment that there would be no fracking.

Notwithstanding the president's commitment to ban fracking, as part of strategy 2.2 of the PEMEX Business Plan 2019–23 there is ongoing assessment of the potential of shale oil and gas (PEMEX, 2019a: 89). According to the Expenditure Budget of the Federation 2020 (Secretaría de Hacienda y Crédito Público, 2019: 9) around USD260 million will be invested in shale oil and gas projects, namely in evaluating the shale plays containing around 60,000 millions of barrels crude oil equivalent. On 11 February 2019 the CNH approved a resolution for unconventional areas that includes hydraulic fracturing (García, 2019b). This resolution agreed to the modification of four exploration plans presented by PEMEX as part of Round Zero for the Pitepec, Amatlán, Soledad and Mihuapán fields, located on the border between the states of Puebla and Veracruz (Comisión Nacional de Hidrocarburos, 2019a).

On 25 June 2019, the CNH also approved the plan by PEMEX Exploration and Production of assignment AE-0387-2M-Humapa. This terrestrial assignment, also located on the Puebla–Veracruz border, was granted exploration rights in November 2018 and seeks to incorporate unconventional gas and oil reserves. This plan has a baseline study that includes the drilling of a well (Laxix) in 2020 with an estimated initial investment of approximately USD20 million (Comisión Nacional de Hidrocarburos, 2019b). The Laxix well is to be drilled more than 3000m vertically and 6000 m horizontally with the aim of exploiting unconventional reserves with a prospective output of 43 million barrels of oil equivalent. There is also an incremental scenario that includes the drilling of a second well (Pixcuy) in 2021 with a USD38 million budget, which is expected to produce about 35 million barrels of oil equivalent. Furthermore, there are three other nearby wells (Argilo, Chali and Tachawin) that will be evaluated as part of the approved plan.

The development of unconventional resources is carried out under the specialised guidelines of the National Water Commission (Secretaría de Gobernación, 2017a) and the ASEA (Secretaría de Gobernación 2017b) and regulations dating back to 1994. Although there is a specialised and risk-based framework (albeit one which could be much improved), the regulatory challenges “outweigh the regulatory capacity to tackle environmental impacts associated with shale gas development” (Hernández Ibarzábal, 2018b: 491). Under these conditions, President AMLO's commitment to ban fracking is consistent with the precautionary principle contained in the 1992 Rio Declaration: “in

⁴ For a detailed discussion on these interactions see Pérez (2017).

order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation” (United Nations General Assembly, 1992: 4).⁵

Following the 2018 general election, MORENA has a simple majority in both houses of Congress, but not the qualified majority necessary to carry out constitutional reforms together with the approval of the absolute majority of the states’ legislatures. Thus, MORENA would need the support of other parties to issue laws that prohibit hydraulic fracturing in Mexico. There have been state and federal parliamentary initiatives but these have not materialised. In August 2018 state congressmen of San Luis Potosí asked the Federal Government of Mexico to prohibit the use of fracking to develop unconventional reserves (El Universal, 2018). This petition was discussed in the Senate, where an agreement was reached on 16 October 2018 to summon deputies and senators to create a special commission on fracking (Senado de la República, 2018a). On 9 October 2018, congressmen Gracia Guzmán and Pérez Rivera (2018: 12) presented a proposal to issue the Federal Law that Prohibits Hydraulic Fracture, and in December 2018 Senator Delgadillo García presented an initiative to ban the use of fracking to extract liquid and gaseous hydrocarbons (Senado de la República, 2018b).

The inconsistencies between the president’s commitment to ban fracking, the exploration plans approved by the CNH, and the USD220 million that will be invested by PEMEX in shale oil and gas projects in 2020 indicate that the development of unconventional resources is likely to continue during 4T, funded by public investment. In that case, the 4T policy change vis-à-vis the Peña Nieto government would not consist of a ban on fracking but rather on handing its development to PEMEX, the sole licensee of 25 of the 26 assignments for the exploration and extraction of unconventional hydrocarbons.

4. The rescue of PEMEX

During the six-year term of former president Peña Nieto, PEMEX’s debt almost doubled, rising from USD59.6 billion on 31 December 2012 to USD103.8 billion on 31 July 2018 (PEMEX, 2018: 7), making it the world’s most indebted oil company. The rate of debt growth slowed down from 2016 to 2018 (climbing from USD94.6 to USD103.8 billion) compared to the jump experienced from 2012 to 2015 (from USD59.6 to USD85.7 billion). Nevertheless, a debt of USD103.8 billion limits the investment capacity of PEMEX.

The rescue plan for PEMEX is a task of the highest complexity and one of the major challenges for the Federal Government of Mexico. On 15 February 2019, following President AMLO’s presentation of the rescue plan, PEMEX announced a series of measures, including “\$15 [MXN] billion in additional tax breaks (each year until 2024), \$25 [MXN] billion capitalisation, \$32 [MXN] billion in savings from combating fuel theft and \$35 [MXN] billion from the payout of pension liability promissory notes” (Barrera Díaz and Villamil, 2019). In May 2019, PEMEX announced a “\$8 [USD] billion syndicated loan along with new tax breaks for the company” (idem). This loan financing agreement was signed with JPMorgan Chase & Co., HSBC Holdings PLC and Mizuho Financial Group Inc. Notwithstanding the measures adopted by the federal government, on 6 June 2019 (Fitch Ratings, 2019a) downgraded PEMEX’s “Long-Term Foreign and Local Currency Issuer Default Ratings (IDRs) to ‘BB+’ from ‘BBB-’”. The downgrade of the debt to ‘junk’ status increases the costs of debt financing and is a setback for the plan to rescue PEMEX.

The strategies to strengthen PEMEX’s financial position in its

Business Plan 2019–23 are: “1) maintain zero-net indebtedness in real terms over the course of the administration; 2) implement monitoring and control schemes for the company’s revenues and expenditures, and to consolidate the coordination among the subsidiaries and corporate, in order to achieve the annual financial balance targets; 3) maintain financial discipline in the operating and investment budgets with austerity and efficiency; and 4) design and implement execution schemes to attract private investment” (PEMEX, 2019a: 80). The plan also includes initiatives to increase the proved reserves and production of hydrocarbons. However, Fitch Ratings (2019b) noted that the mismatch between the planned (crude oil) production levels and the historical average proven reserves additions “could lead to a material decline in reserve life to less than three years by 2024 from about 7.2 years currently, if production goals are achieved”.

Professor Emeritus Lorenzo Meyer (2019), a specialist in the history of PEMEX, believes that President AMLO’s decision to rescue PEMEX will determine the “success or failure of this government”. PEMEX was long used as the government’s cash cow and only time will tell whether President AMLO’s plan can overcome its financial challenges. Beyond this, the rescue of PEMEX requires better governance and administration, greater transparency over its activities, including “strengthen[ing] oversight and reporting on activity under PEMEX entitlement” (International Monetary Fund, 2018: 131) and cracking down on fuel theft.

5. Huachicoleo: the theft of a nation

The illegal extraction of hydrocarbons is described in Mexico by the verb *huachicoleo*, a term that was originally used for adulterated alcoholic beverages. From 2006 to 2018, during the Calderón (2006–12) and Peña Nieto administrations, there was an exponential increase in fuel theft. The number of clandestine siphoning incidents increased from 220 in 2006 (Solís, 2019) and 691 in 2010 (Hernández, 2017: 14), to 14,894 in 2018 (PEMEX, 2019a: 44). There was also an increase in organised-crime-related violence; the number of intentional homicide victims per 100,000 inhabitants rose from 9.6 in 2006 to 25.2 in 2017 (INEGI, 2019). The quantitative change in fuel theft had its origin in a qualitative change. According to Guillermo Valdés, director of the Center for Research and National Security (CISEN) from 2007 to 2011, after the implementation of the National Security Strategy of President Calderón, the theft of hydrocarbons transitioned from a basically local activity, well-organised but not violent, to merge with drug-trafficking organisations (Montalvo, 2017). Calderón’s failed and counter-productive strategy left *huachicoleo* in the hands of drug-trafficking organisations that infiltrated PEMEX (Pérez, 2017).

The exponential increase in the theft of hydrocarbons from 2006 to 2018 took place with the collusion of PEMEX and government officers. In 2019, the Attorney General’s Office (FGR) indicted for theft of hydrocarbons General Trauwitz, who was appointed head of PEMEX Strategic Safeguard Sub-Directorate in 2014. This sub-directorate was created after the 2013 energy reform and is responsible for the safeguarding of PEMEX’s facilities, coordinating the actions for its surveillance and guaranteeing the integrity and operations of the company. Further, on 18 July 2019 the FGR arrested General Herrera Pegueros, the former manager of Physical Security Management of PEMEX, on fuel theft charges (Rodríguez García, 2019).

According to Ana Lilia Pérez (2017: 365), a journalist who has written widely on PEMEX and fuel theft in Mexico, the liberalisation of refined petroleum products after the energy reform “bolstered the black market of hydrocarbons”, and the new franchisees that commercialise these products “receive a significant share of the 23,500 barrels of refined petroleum products stolen every 24 h from PEMEX, but every day [it] is more difficult [to] know in which proportion”. In 2018 PEMEX lost around MXN60 billion (around USD3070 billion) as a result of fuel theft (Presidencia de la República, 2019b). This can be considered an “assault on the nation” (Hernández, 2017); if the efforts of the Mexican

⁵ For more details on hydraulic fracture projects and the importance of the precautionary principle in Mexico see Fundar (2019).

government cannot reverse the decline of PEMEX, it could even be the theft of a nation.

On 27 December 2018, President AMLO presented the Joint Plan to Combat the Theft of Hydrocarbons and a few hours later the Secretariat of the National Defense (SEDENA) took control of PEMEX's Salamanca Refinery in the state of Guanajuato. As part of this plan, 15 secretariats of the federal government are fighting against the theft of hydrocarbons and at least 4000 personnel from SEDENA, the Secretariat of the Navy and the National Guard have been deployed.

In January 2019 hundreds of petrol stations closed and kilometres-long queues appeared as a result of the government's strategy to close the valves of at least four of PEMEX's 13 pipelines to stop the fuel theft. The fuel shortage ended as the government gradually reopened the valves of the pipelines and bought 671 tanker trucks, valued at USD92.19 million, as a complementary method of distribution. According to President AMLO there is a hypothesis in which only 20 per cent of fuel theft occurs by illegal tapping of pipelines while the other 80 per cent is carried out with “the complicity of authorities and a distribution network” (*Presidencia de la República, 2019b*). If this is correct, buying 671 tanker trucks would have a limited impact on levels of hydrocarbon theft. Moreover, this distribution strategy increases the number of trucks on the road, with the associated increases in the risk of road traffic accidents, environmental footprint and transportations costs.

To strengthen the federal government's strategy to combat the theft of hydrocarbons, the Chamber of Deputies approved the National Law of Expiration of Ownership on 25 July 2019, according to which goods produced as a result of crimes related to hydrocarbons, petroleum and petrochemicals are susceptible to expired ownership. The latter is defined as “the loss of the rights that a person has in relation to the property referred to in the law, declared by judgment of a judicial authority, without economic benefit or compensation” (*Cámara de Diputados, 2019*). While this law provides legal tools to combat the theft of hydrocarbons — or at least to make it less attractive — the enactment or reform of laws in the past did not have a significant impact. For example, the Law to Prevent and Punish Crimes Committed to Hydrocarbons which came into force on 12 January 2016 allowed for the imposition of prison sentences of up to 30 years (*Cámara de Diputados, 2016*). In practice, though, the theft of hydrocarbons increased exponentially until at least the end of 2018.

Following the implementation of the Joint Plan to Combat the Theft of Hydrocarbons, Octavio Romero Oropeza, Chief Executive of PEMEX, declared on 23 April 2019 that the theft of hydrocarbons had decreased by 95 per cent “from 81,000 barrels per day in November 2018 to 2000 barrels per day on 21 April 2019” (*PEMEX, 2019b*). According to María Novoa, coordinator of the justice section of the think tank Mexico Evalúa, this plan “does not give more detail about the strategy, actions, results and indicators for its follow-up” (*Novoa, 2019*). On the other hand, the Secretariat of Security and Citizen Protection provides a website with daily information about the theft of hydrocarbons reported by PEMEX, and its data are consistent with a substantial decrease in this illicit activity (*Secretaría de Seguridad y Protección Ciudadana, 2019*). However, data collection methods are opaque and it is difficult to obtain accurate comparative data.

6. Conclusions

There are real energy policy implications to President AMLO's 4T, focused on the construction of the Dos Bocas refinery, the development of unconventional resources with public investment, the government's plan to rescue PEMEX, and its fight against illegal extraction and theft of hydrocarbons. Making Mexico self-sufficient in energy in the medium term is the main objective of the new energy policy, and building the Dos Bocas refinery is consistent with this plan. AMLO's administration

has little room for manoeuvre considering PEMEX's hefty debt, the construction costs for the new refinery, the decline in oil and gas production, and sluggish growth in the economy: during the second quarter of 2019 the economy ‘grew’ just 0.1%. However, the government has a plan to improve PEMEX's governance, which aims to foster public and private investment. Nevertheless, under these constrained conditions, farmouts (PEMEX-private sector ventures) or private investment in sectors such as deep water exploration cannot be discarded.

Maurin and Vivoda (2016: 381) conclude that the effectiveness and utility of shale gas production depends on technology and how the extractive process is governed, and claim that environmental risks can be minimised if this activity is properly regulated and risks are strictly monitored. While issuing specialised guidelines was a commendable effort to enhance the governance of the development of unconventional resources, enforcing these guidelines is a major regulatory challenge (*Hernández Ibarzábal, 2018b*). Currently, the above-ground conditions constitute an insurmountable burden. Effective regulation and strict monitoring are unlikely to occur in some municipalities of Puebla, Veracruz and Tamaulipas (states with the largest proven shale gas reserves) which are characterised by violent crime and fuel theft, thus increasing the likelihood of social and environmental impacts. The below-ground conditions are also particularly challenging. Hydraulic fracturing volume is associated with induced earthquake productivity (*Schultz et al., 2018*), and any proposal to develop unconventional resources on a commercial scale requires strict monitoring of possible links between hydraulic fracturing and activity of Popocatepétl volcano and fracking-related earthquakes, especially in the Valley of Mexico due to its ground features and recent history of devastating earthquakes.

The Federal Government of Mexico has given mixed signals on the development of unconventional resources and this article identifies the critical need for more clarity and an informed debate on this issue. It is inherently difficult to govern shale gas development (*Konschnik and Boling, 2014*) and Mexico's particular conditions only increase that complexity. Under these conditions, President AMLO's commitment to ban fracking is consistent with applying the precautionary principle. However, this commitment is currently unenforceable and needs to be expressed in legislation. If the commitment to ban fracking translates into law or is followed in practice by CNH, SENER and PEMEX, the 4T should receive broad national and international recognition. Alternatively, if fracking goes ahead during this administration it will initially be carried out by PEMEX and not by private ventures. In the foreseeable future gas imports from the United States will continue, giving Mexico access to gas at an affordable price. However, this access is not assured and this strategy does not increase energy self-sufficiency.

PEMEX plays a dominant role in the 4T's energy policy. To rescue PEMEX, the federal government needs to implement a successful financial plan and stop fuel theft. This will be pivotal in improving the company's and the country's finances. The latter will require the timely and sufficient supply of fuels for Mexico's development, which is unlikely to be possible in the face of continued fuel theft. Therefore, if it is successful — as the promising early data presented by the government suggest — the fight against fuel theft could significantly reverse the decline of PEMEX and improve Mexico's finances.

Following the 2013 energy reform, the debt of PEMEX and imports of petroleum products almost doubled, while oil and gas production fell and theft of hydrocarbons sky-rocketed. Therefore, the energy reform did not increase the rule of law and did not improve energy sovereignty, as expected. The good intentions of this reform were widely publicised but outshone its performance. Nevertheless, all the contracts signed under the energy reform have been honoured under the AMLO administration. The latter's energy policy aims to strengthen energy self-sufficiency in the medium term. It must be recognised that a ‘collateral effect’ of increasing the production of petroleum fuels and petrochemicals is to increase dependence on hydrocarbons. If it is to craft a

sustainable energy policy which promotes energy security and energy sovereignty, AMLO's 4T needs to prioritise electricity, clean and renewable energy and technological innovation over extractivism. It is in these areas that Mexico might find some of the answers to its energy dilemmas; further research in these areas is therefore vital.

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