

NATURAL GAS CROSS-BORDER INFRASTRUCTURES: NEW RISKS AND REGULATORY REQUIREMENTS IN THE MEXICO - UNITED STATES ENERGY INTEGRATION¹

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Introduction

Energy relationship between Mexico and the United States has intensified in recent years. Imports of natural gas from that country to Mexico have grown significantly and have required a substantial development of infrastructure. Natural gas is Mexico's largest source of electricity generation, accounting for more than 60% of the country's generation. In the near future, more than 60% of electric capacity additions are projected to come from natural gas-fired power plants. U.S. pipeline exports to Mexico have more than doubled since 2014 to average 4.9 billion cubic feet per day (bcfd) in 2018. They flow mostly from South Texas (Eagle Ford).

Energy trade requires diverse infrastructures: gas and oil pipelines - often transboundary pipelines -, transmission lines, greater interconnections in the case of electricity, infrastructure expansion to extract, store, transport, and process natural gas. A modern energy infrastructure is fundamental for the integration of energy markets.

Growth of imports from US and the construction of new pipelines that cross the border go in parallel. The internal network of gas pipelines must adapt to those imports; they are expanding to facilitate the internal movements of gas. All this implies risks, impacts and compensation for environmental damages, as well as regulatory needs.

In the previous form of organization of the oil industry, prior to the energy reforms of 2013/2014, a self-regulated monopoly (Pemex) faced these needs, with shortcomings and inadequacies. The Agency for Safety, Energy and Environment (ASEA), created within the framework of these reforms, is now in charge of the entire oil and gas chain, from exploration and production activities to service stations. This Agency focuses on industrial safety, operational safety and protection of the environment, and must coordinate with other agencies and departments.

One of the ideas of integration in the field of energy is to favor the environment and the energy security of participating countries, taking into consideration the potential of each one. In this direction, it is important to contribute to establish a more uniform, transparent, and modern process to the construction, connection, operation, and maintenance of international border-crossing facilities for the natural gas trade between the United States and Mexico. The quality of the regulations and the mechanisms to ensure their compliance are vital to reduce to the maximum the accidents.

This is an exploratory study that opens up a field for:

- Integrate Analysis of economic, environmental and security regulation.
- Study the coherence and strength of the institutional and regulatory architecture that has been recently established in Mexico to face the situations described in this article.

¹ The antecedent of this article is a previous work: De la Vega Navarro (2018), "Nuevos riesgos y requerimientos de regulación: infraestructuras energéticas y actividades de exploración y producción en las fronteras con Estados Unidos" in Elizondo and Dussauge, *ASEA. Un nuevo modelo de institución del estado mexicano*, México: ASEA, CIDE, PIERCE.

- Explore issues of convergence and regulatory harmonization, which arise when markets and infrastructures are connected, on both sides of the borders.

1 - Rising energy flows in North America

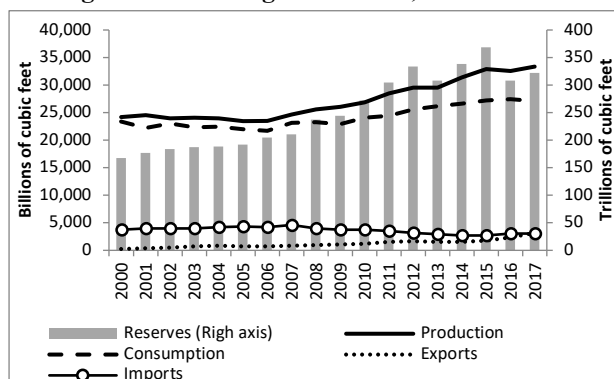
There have always been energy exchanges between the countries of North America. These exchanges have been higher between Canada and the United States than between Mexico and the United States². The markets have reached a high degree of integration between Canada and the United States—including flows of goods, services, and capital, as well as infrastructures (in particular a complex network of oil and gas pipelines)—, and companies carried out all kinds of activities in one country and another. In fact, the initial mentions of the North American energy markets integration were mainly made with reference to the relationship between Canada and the United States. For all these reasons it was stated, "we should probably think of the U.S. and Canada together "(P.L, Joskow, 2015).

Notwithstanding, the US-Mexico energy relationship plays an important role in North American energy integration, and energy is a crucial topic for both countries. For Mexico, oil and natural gas are the main primary energy sources, and oil is also important as foreign trade earnings. For the US, the role of energy could be understood in terms of energy security, but it is also important for its contribution to economic growth and for its industrial and technological impacts. For this country, energy is also a key aspect of the design and implementation of new international strategies.

There are rising energy flows between the US and Mexico, but the US energy dynamic contrasts deeply to what is happening in Mexico. In the US, on the one hand, oil and natural gas production have grown simultaneously, the price of natural gas has fallen, and refinery capacity has been adapted and upgraded to receive crude imports. In Mexico, on the other hand, natural gas production and reserves have fallen, refinery capacity has declined, gasoline and natural gas demand have increased, and consequently, imports of gasoline and natural gas have jumped too. Particularly, for the case of natural gas (the focus of this paper), Figures 1 and 2 show the contrasting energy situation in both countries during this century.

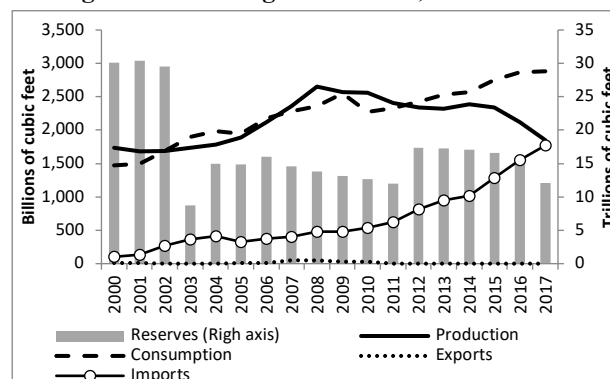
² Canada is an important supplier of oil and natural gas in the United States. In fact, Canada is the largest exporter of crude oil to the United States (4 million barrels per day in 2017), even above the OPEC exports to the US. Mexico is the third largest exporter of crude oil to the United States (682 thousand barrels per day in 2017) in spite of its falling oil exports.

Figure 1. Natural gas in the US, 2000-2017



Based on data of the U.S. Energy Information Administration.

Figure 2. Natural gas in Mexico, 2000-2017



Based on data of the U.S. Energy Information Administration.

In this context, Mexico has become a top destination for US exports, especially gasoline, diesel, natural gas, and domestic gas (LPG). According to the Energy Information Agency (EIA), exports of natural gas from the United States, a good portion of which goes to Mexico, grew 300% between 2010 and 2017 and will be doubled in two more years³. In 2017, 81% of the natural gas consumed in Mexico came from the United States. Those imports do not require SENER permissions, do not pay taxes and anyone can import natural gas, although until now the most important importers are *Petróleos Mexicanos* (Pemex) and the Federal Electricity Commission (CFE). In the United States, under the current American law, natural gas exports must receive permission from the Energy Department if they are considered of national interest. This happens almost automatically when the exports go to a country with which the United States has a free trade agreement, such as NAFTA. Renegotiation of NAFTA has introduced uncertainty on this issue.

2 - Natural gas imports demand new infrastructure requirements, both interconnecting with external markets and coping with internal expansion

The energy trade requires diverse infrastructures: oil and gas pipelines —often cross-border⁴— for hydrocarbons, and transmission lines and interconnections for electricity. Modern energy infrastructure is fundamental for the integration of energy markets. Given the rising importance of natural gas in North America, as in other places, a new interest in natural gas infrastructure transport is emerging. Building this infrastructure needs the participation of governments and other actors, huge investments, and cross border connections, and this process often implies issues of conflict and power (“pipeline politics”, Ali Dastan, 2018). In North America, there are 50 operating cross-border natural gas pipelines connecting the United States with its neighbors: 29 pipelines between the U.S. and Canada and 21 pipelines between the U.S. and Mexico (H.R. 3301). U.S. gas exports to Mexico via pipeline reached 5 bcf/d for the first time in August 2018 (EIA data).

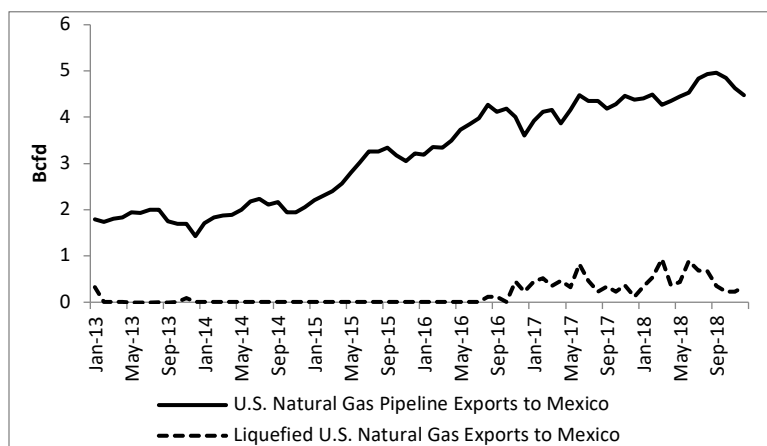
³ https://www.eia.gov/dnav/ng/NG_MOVE_POE2_DCU_NUS-NMX_A.htm

⁴ A cross-border pipeline is a pipeline that crosses the border of at least two countries. It can leave a gas or an oil producing country, cross another or others in transit and have as a final point a gas or oil consumer country.

At least at the declaratory level, there is awareness of the importance of energy infrastructure on the US side. The Secretary Perry remarked in July 13th 2017 at Press Event with SENER: “we could also streamline the permit process for cross-border energy infrastructure projects, which are absolutely vital facilitators of energy trade”. In fact, some legislations look for “a more uniform, transparent, and modern process for the construction, connection, operation, and maintenance of oil and natural gas pipelines and electric transmission facilities for the import and export of oil, natural gas, and electricity to and from Canada and Mexico, in pursuit of a more secure and efficient North American energy market.” (H.R. 3301).

In the case of natural gas, the majority of Mexico's imports are made through gas pipelines from the US because of geographical proximity to this producer country, with which there is a land border. New pipeline capacity additions on both sides of the border have helped U.S. natural gas pipeline exports to Mexico to jump in 2018 to their highest level (4.9 bcfd average). There is also the possibility of importing gas as LNG (liquefied natural gas transported in special vessels, liquefied at very low temperatures). This has been done in certain moments at higher prices than those defined in the hubs of southern Texas. So, more pipeline imports mean cheaper gas than LNG imports. Figure 3 shows the relative importance of these two modes of natural gas transport between January 2013 and December 2018. In 2018 Mexico purchased 1.7 trillion cubic feet of natural gas through gas pipelines and 183 billion cubic feet of LNG of which Mexico is the number-two customer of the United States (17% of all US American exports).

Figure 3. Pipeline imports from the U.S. displacing LNG imports to Mexico



Based on data of the U.S. Energy Information Administration.

In recent years the capacity of gas pipelines between the United States and Mexico has significantly grown: 226.47%, from 3.4 bcfd in 2011 to 11.1 bcfd in 2018 (EIA data). Increasing cross-border capacity has resulted in the necessary expansion of the internal network of gas pipelines within the country to adapt to imports from the United States and to facilitate domestic movements of gas in accordance with government plans⁵.

⁵ The map of natural gas infrastructure in Mexico 2018 can be consulted at https://www.gob.mx/cms/uploads/attachment/file/314343/Natural_Gas_Infrastructure_Map_2018.pdf or an

The hypothesis on which these plans are based poses problems because it is assumed that abundance of gas north of the border, low gas prices, and Mexico as a priority option for US exports will be permanent. Additionally, there are risks of lock-in of the gigantic infrastructure that is being installed to import natural gas and to transport and distribute it internally: not only dependence on an energy source, but also on a country from which most of the imports come. There are also risks of the billionaire stranded assets that have an effect on the development of renewable energies, which are evolving in the world towards lower prices. The country may soon find itself in a situation of over-construction of gas pipelines that affect this development.

3 - Cross-border transport of natural gas. Risks and regulations

"[A] cross-border pipeline must operate between differing legal and regulatory regimes", Paul Stevens [2003].

The security of energy supply is a big challenge in international infrastructures. Regarding cross-border gas pipelines, an accident in any section of the pipeline can disturb the entire chain ("network bound energy carrier"). It does not matter if the accident happens in one country or in the other. A supply break can be very expensive for producers and consumers and has important economic connotations. Moreover, there are concerns about environmental and safety regulations, whether as a result of contractual arrangements with construction companies or national legislations. Therefore, the regulatory regime must ensure a constant flow of supply taking into account environmental and safety aspects. This task could be particularly difficult if two or more legal and regulatory regimes are involved, as in the case of cross-border pipelines.

Cross-border pipelines have specific characteristics: terrestrial or maritime; transit; etc. Consequently, they must be regulated differently, especially as regards environmental aspects. Each accident is different, e.g., the extension of the gas pipeline, the areas it crosses (residential, industrial, agricultural, tourist); the proximity with lakes, rivers; the damages caused, etc. Their causes can also vary, e.g., external (one excavation), internal (corrosion), technical failures, and insufficient maintenance, among others. Much of these causes can be foreseeable. The quality of regulations and the mechanisms to ensure compliance are fundamental to reduce to the maximum the accidents related to oil and gas. Implementing preventive regulations and fulfillment of compensation for damages are problematic because different jurisdictions may be concerned. A crucial point is to know if the legal regime applicable to cross-border pipelines provides effective incentives to prevent environmental and safety risks.

Economic issues arise when regulations to minimize risks increase costs for companies. As an example: "many oil pipeline spills in Nigeria were the result of low-quality safety standards and poor maintenance by MNCs [Multi-National Companies]" (MEHDI P. D. & Michael Faure, 2014). The economic valuation can lead to extremely serious behavior: "there is a considerable tendency

for polluters to externalize their costs to local communities when the costs of compensating the victims are lower than the costs of complying with safety regulations” (Ibidem).

There are bilateral or multilateral agreements relevant to the case of cross-border gas pipelines in spite of the absence of a uniform international legal regime; each cross-border pipeline has its specific legal framework. These agreements may result from contracts between oil or gas companies, including state ones, or commanded via government contracts with investors or operators. The agreements can be ad hoc, with two models: the interconnector model and the unified model. Several gas pipelines have been built based on the first one, according to which each section of the cross-border gas pipeline falls under the jurisdiction of the State whose territory it crosses and is regulated based on the national laws of that State. The ownership of the gas pipeline and the gas transported is transferred to another State at the border. Regarding the unified model, it establishes a legal framework for the entire extension of the pipeline and is built based on uniform regulations. Generally, a consortium of multinational firms acts as an operator along the entire length of the pipeline and implements uniform regulations and standards, without consideration for possible conflicts with national and local regulations of the receiving State. However, this State will seek to apply its own legislation to protect its interests if its bargaining power permits it.

As mentioned above, Canada and the United States have an intense energy trade, as well as interconnected infrastructures. In this case, as in others of the same type, "framework agreements of general applicability" are implemented, which means that all terms including environmental and safety standards apply to all cross-border pipelines between those countries. In some cases, these standards are elaborated by advisory bodies that take into account the legislation of the States and must receive all the information from the parties involved, as well as having access to the pipelines when necessary. This elaboration, complementary to general agreements, becomes essential to take into account the specificity of the pipelines.

Additionally, there is the possibility of taking into account international or regional agreements that could be relevant although they do not specifically address issues related to the construction and operation of pipelines or to the environmental and safety regulation of cross-border pipelines. Some general instruments that address cross-border pollution and their provisions can be extended and applied to cross-border pipelines, e.g., the United Nations Convention on the Law of the Sea (UNCLOS, 1982), the Energy Charter Treaty and the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991). Although these agreements offer possibilities to analyze security of cross-border pipelines, they could be not satisfactory to address integrally all the challenges:

Currently, existing conventions, such as UNCLOS and the Espoo Convention, do not sufficiently guarantee externalization of transboundary pollution via cross-border pipelines. **The creation of a more appropriate international legal framework with clear and harmonized safety and environmental standards is needed.** This legal framework should allow public authorities to effectively enforce compliance, thus preventing the externalization of pollution costs to local communities across borders (MEHDI P. D. & Michael Faure, 2014, highlighting by myself).

For the case of cross-border gas pipelines between the US and Mexico, there is no a clear framework for regulating them. A report prepared with the participation of the Mexican Council

of Foreign Relations (COMEXI) suggested a similar gap in the electricity sector, but we consider that the reference fits for the energy sector in general: "...there is no such a thing as an energy agenda for the border region: no true market for electricity across the border, no binational plan for electricity generation or transmission, and no program to develop new technologies or energy reserves" (COMEXI and Pacific Council on International Policy, 2009).

Regarding these and other problems, it was thought that Mexican energy reform (2013-2014) would facilitate an US-Mexico energy relationship clearer and safer, in the NAFTA framework. From this view, opening national and foreign investment would allow recovering the Mexican oil and gas natural production and reserves levels, improving in that way energy supply in the country. Likewise, while optimal levels of extraction and transformation were achieved, private investment would be responsible for importing and ensuring the necessary infrastructures, adapting to the new institutional and regulatory frameworks.

However, to the best of our knowledge, the security of the gas pipelines that connect the US-Mexico border to supply natural gas to Mexico have not been addressed enough. Uncertainty exists not only because of the orientations and measures taken by the administration presided over by Donald J. Trump, but also because of regulatory issues, as it has been pointed out in the United States Congress itself:

The expansion of cross-border energy transportation infrastructure —pipelines for oil and natural gas and transmission lines for electricity— is necessary to enable increased energy trade. A number of new projects are currently under construction or proposed to further expand cross-border capacity, but they face considerable Federal regulatory uncertainty (WALDEN, 2017).

One would think that the regulatory frameworks of Mexico's partners in North America are impeccable and that it is enough to copy them to move forward. However, there are gaps in all three countries at different levels. In Mexico and the other two countries of North America, local levels are often ignored. One US attorney general said: "Federal Energy Regulatory Commission has disregarded the perspective of state and local governments, ratepayers, and other stakeholders, and approved new gas pipelines without a full evaluation of regional needs and advances in energy policy" (McKenna, 2018).

Mexican energy reform favors private and private/public investment to develop the necessary infrastructure that is parallel to natural gas market liberalization. The pipelines operate through "open access" permissions, which are regulated and supervised by the Energy Regulatory Commission (CRE) and the Agency for Safety, Energy and Environment (ASEA), the latter from an environmental and security perspective. Pemex, now subject to asymmetric regulation, had to give its transport infrastructure to National Control Center for Natural Gas (CENAGAS), an independent operator of the system. CENAGAS organizes "open seasons" to auction capacity rights of the pipeline network in the country and cross-border interconnections. Any actor interested on developing oil and gas activities must obtain an environmental impact authorization from Ministry of the Environment and Natural Resources (SEMARNAT).

Although gas pipelines are generally considered a safe means of transport, the crucial point is that they move particularly dangerous substances. The leaks of a gas pipeline emit chemicals

that cause air, soil, and water pollution, and it can affect different species, even marine ones if the accident occurs in a submarine pipeline. Gas pipelines connect with a complex infrastructure with a high degree of vulnerability: production, storage and distribution, etc. Therefore, environmental and safety regulations pursue to prevent and minimize the risk of accidents and their consequences. Likewise, compensations for environmental damages are important elements to tackle accidents, and they have been established by the ASEA, as its law indicates. Unfortunately, the ASEA operates in a difficult context and many restrictions. The Agency tackles several challenges that could be sorted in collaboration with other agencies and actors. These two topics are discussed in the following sections.

4 - The role and restrictions of the Mexican Agency for Safety, Energy and Environment (ASEA)

“the history of regulation both here and abroad suggests that how we think about regulators, and how they think of themselves, has a profound impact on the work they do. The political scientist Daniel Carpenter, in “Reputation and Power,” his magisterial new history of the F.D.A. (one of the few agencies that’s been consistently effective), argues that a key to the F.D.A.’s success has been its staffers’ dedication to protecting and enhancing its reputation for competence and vigilance. That reputation, in turn, has made the companies that the F.D.A. regulates more willing to respect its authority. But that’s a rare success story. In most other cases, as the idea of regulation began to seem less legitimate, regulators became less effective and companies felt more free to ignore them” (SUROWIECKI James, 2010).

In the previous form of organization of the oil industry, prior to the energy reforms of 2013/2014, a self-regulated monopoly (Pemex) faced several environmental and safety aspects, with shortcomings and inadequacies. Pemex failed to develop a safety culture for high-risk activities or a capacity to respond and review its procedures in the event of catastrophes as the BP oil spill in the Gulf of Mexico, a consequence of the Deepwater Horizon Platform accident on April 22, 2010⁶.

Without enough knowledge about how the accidents happened neither systematized nor safeguarded information, it was difficult to make recommendations and to take actions. At the time of this accident, the CEO of *Pemex Exploración y Producción* in 2010, Carlos Moreno Gil, argued that there was no reason to modify the drilling program in the Perdido Folding Belt, where the Maximino well was going to start being drilled in a water depth of 3128 meters, a depth greater than that of the "Macondo Prospect", where the accident took place⁷. It is worth noticing that at that time Mexico lacked specific environmental and industrial safety regulations for deep and ultra-

⁶ However, it should be noted what was mentioned in the launch of the bi-partisan commission appointed by President Obama to investigate the catastrophe and make proposals: “the five major oil companies relied on a common and clearly inadequate plan for responding to a major offshore spill” (Broder, 2010).

⁷ In 2010, after the accident, Adrián Lajous (2015) wrote: “the official silence that has prevailed in Mexico over the possible consequences of the accident [of BP in the Gulf of Mexico] was only altered by imprudent statements by *Pemex Exploración y Producción* director, which categorically denied that it would affect its own deep-water exploration program. Juan Carlos Zepeda, president of the CNH, also made clear his concerns about Pemex's plans in ultra-deep waters because of its lack of experience in these activities and its lack of preparedness to face a serious accident or spill oil. His statements appeared in the Mexican press and also in an interview in *The Wall Street Journal*, February 15, 2012.

deep waters, a surprising regulatory gap in the face of the risks of environmental damage from infrastructures installed or under construction and from exploration and production of hydrocarbons.

It is necessary to gather information about the catastrophic accidents that Pemex has suffered over the years, without really developing a culture of safety and serious attention to the environmental consequences of oil activities. Surely there were preventive measures and actions, but without public scrutiny, as is usual in self-regulating monopolies. Therefore, it is also necessary to gather information about possible recommendations made and how they were implemented by Pemex and its contractors, as well as if there were conversations with the US authorities to coordinate guidelines and regulations in wells near the border of that country.

Until now and despite having spent several decades, there is little information about what happened in the accident of Ixtoc I in 1979⁸. Another accident occurred on October 23, 2007, when the Usumacinta drilling rig of *Perforadora Central* lost control of one of the wells of the Kab 101 production platform, 18 km from the Puerto de Frontera, in shallow waters of the Tabasco coast. In this accident 22 people died (more people than in the Deepwater Horizon) and the well remained uncontrolled for 51 days, releasing gas and oil into the environment. These cases are important precedents in terms of industrial safety and regulations on environmental protection in shallow, deep, or ultra-deep waters. It would be interesting to find out the traces that have remained of all of them, now that the Mexican part of the Gulf of Mexico, adjacent to that of the United States and Cuban territorial waters⁹, has been opened.

In any case, if there were insufficiencies and deficiencies in the previous form of organization of the oil industry as a public industry, new problems are now up and coming by the incursion of new private actors, which must be submitted to the same demands that are now made to Pemex¹⁰. The Agency for Safety, Energy and Environment (ASEA), recently created within the framework of energy reforms of 2013-2014, is now in charge of the entire oil and gas chain, from exploration and production activities to service stations. This Agency focuses on industrial safety, operational safety and protection of the environment, and must coordinate with other agencies and departments. Since the ASEA started operations in March 2015 until now, their regulation efforts have focused on the needs of the implementation of energy reforms.

⁸ Some research about Ixtoc I was made near the date of the disaster, e.g., JERNELÖV Arne and LINDÉN Olof [1981] from the University of Stockholm and HOWARTH Robert W. [1984].

⁹ The US and Cuba have a cooperative relationship around environmental aspects derived from the BP accident of 2010 and from the deep-water Cuban projects in its exclusive economic zone (EEZ). There have been meetings as the one sponsored by the Brookings Institution and the Environmental Defense Fund (EDF): *A new era for U.S.-Cuba Relations on Marine and Coastal Resources Conservation*. During this meeting, there were identified areas of collaboration aimed at the protection of shared marine and coastal ecosystems in the Gulf of Mexico, the Caribbean Sea and the Atlantic Ocean. Other institutions, such as the Harte Research Institute (HRI), promote tri-national approaches to understanding the Gulf of Mexico ecosystem, shared between Mexico, the United States, and Cuba.

¹⁰ Pemex has been characterized by its inefficiency due to both its contribution to public finances and corruption. If Pemex will be judged as any contractor from now and then, this must be associated with a better competition framework and the same standards to everyone who enters the industry.

In relation to these reforms, the strategic initiatives of ASEA consist of establishing critical regulation to implement them, publishing the regulations needed to not delay them, and preventing the published regulations from being a bottleneck for their implementation. All the projects submitted for the bidding rounds have been evaluated taking into account these initiatives, with an emphasis on those related to new oil developments and gas transportation pipelines. As the energy reform progresses, new concerns will surely appear related to impacts and compensation for environmental damages¹¹, derived from the exploration and production of hydrocarbons and their transport, storage, distribution, and commercialization.

The activities of ASEA are characterized by its large size and complexity, which contrast with a small scale of human and financial resources¹². The ASEA must regulate a wide chain of activities (exploration and production; wells in deep water, shallow water, and on land; gas pipelines, refining, and process plants; storage and distribution of gas; and thousands of service stations) and has just 465 people as management and administrative staff and 90 people as inspectors. In contrast to the ASEA, for example, the Bureau of Safety and Environmental Enforcement (BSEE) of the USA are focused almost exclusively on wells in deep water and has twice as many staff as the ASEA.

Nowadays, the objective of the ASEA is attending accidents comprehensively. The ASEA has demanded Pemex and other energy firms to make serious 'root cause analysis' (RCA) of the accidents, as well as to take actions to avoid new accidents¹³. The Agency makes inspection programs of the offshore installations in the Gulf of Mexico, identifying measures to eradicate the most recurrent risks. It is necessary to have specific studies on accidents that analyze why certain preventive measures failed, the type of damages incurred and how they were compensated. It is essential to have records that contain detailed information.

Insurance is another element considered by the ASEA to influence the way in which the regulated actors manage risks and their impacts. As a regulator, however, it is not convenient to rest exclusively on what the insurers or reinsurers do to mitigate the risk. It is necessary to visualize the insurance as an instrument that allows obtaining resources (when insurance compensation applies) in case of environmental catastrophe. But even so, insurance is not a replacement of

¹¹ The environmental damage is difficult to quantify. However, the Federal Law of Environmental Responsibility (LFRA) predetermines the damage to be measurable to consider it as such. This may generate inconsistencies in the understanding of the environmental damage and even exempt an environmental offender from any liability. The LFRA foresees the creation of an environmental responsibility fund for possible environmental catastrophes, but there is no public information about its constitution and operation.

¹² These circumstances are not exclusive of ASEA. The pace and exigency of the Mexican energy reform have had to tackle limited material, human, and normative conditions in several agencies, which makes difficult to regulate the diverse contractual relationships. This situation can have environmental consequences because of the risks that emerge of these relationships interacting with a weak regulator unable to control or minimize the risks. It also has implications with regard to the use of insurance, as an instrument to obtain resources that, in the case of appropriate indemnities, could be used in environmental matters.

¹³ The root cause analysis (RCA) could be the historical data for the ASEA, although it is necessary to analyze diverse implications, particularly legal ones. In the cases in which the regulated party has insurance and possible reinsurers (when some of the risk is transferred), the information generated in sinister case is for the internal use of its insurer. The same happens with the measures implemented to minimize the risks and prevent future accidents.

preventive efforts that must be made to avoid harm to people, the environment and properties, and insurance does not modify the need of defining clear procedure and actions that must be carried out once the damage or catastrophe occurs (with and without the demarcation of responsibilities). Some of these issues as well as on other points of interest and future research lines are discussed by González Mares (2017), like the following:

- In the international market, there are liability insurance and environmental impairment liability ones to obtain coverage for the environmental risks associated with contractual energy relations. In particular, it is advisable to supervise the contracting of insurance for major contractors and subcontractors, including Pemex, while generating the most suitable type of oil contract for the country and standardizing the most appropriate *environmental insurances* based on the environmental risks associated with oil contracts.
- It is essential that the regulatory apparatus be regularized and strengthened so that it supplements or complements what Pemex has covered so far, both in the operating part and in its insurance policies with liability and pollution coverage.
- The socio-economic impact of the Federal Law of Environmental Responsibility was intended to be favorable, but the opposite was true due to its limitations:
 - there is no public record on the constitution and operation of the environmental responsibility fund;
 - there is no public record on the constitution of the national environmental risk insurance system;
 - it has not been possible to fully comply with international commitments in environmental matters, such as better regulation and in accordance with international standards;
 - there are too many extenuating factors for environmental violators;
 - just one of the ninety and one Official Mexican Standards on Environmental Protection is specifically related to the subject of hydrocarbons;
 - the right and legitimate interest of inhabitants of the community directly affected are not recognized to take action and sue environmental responsibility;
 - the prescription has not been homologated, while the one foreseen in the Federal Law of Environmental Responsibility is twelve years, the one foreseen in the General Law of Ecological Equilibrium and Protection of the Environment is five years.

The ASEA has adopted an inspection based on risk prioritization taking into account its shortcomings and limitations. The ASEA's Executive Director has publicly admitted that the Agency has a limited inspection capacity, e.g., 80 inspectors are not able to review the 60,000 kilometers of pipelines in the country. Given this situation, the ASEA operates with a risk-based strategy to identify the key points and attend them (González and Amador, 2017). A component of this strategy is to systematize the evaluation of projects, authorizations and records that contribute to the reduction of risk. With a preventive approach, it is proposed to focus supervision, inspection and surveillance based on risk, understanding risk as the probability of occurrence of an undesirable event measured in terms of its consequences on people, facilities, the environment, and the community.

Given that Mexico has land and sea borders, which already have—or will soon have—a diversity of connected infrastructures, international information is essential. In this sense, the

ASEA has proposed a planning for risk management with an emphasis on the analysis of national and international information. Some experts go further:

What Mexico needs is strong guidance from the United States [...] Best practices, training and resource sharing are critical steps needed to help the government regulators manage the looming challenge of a greatly expanded oil-and-gas sector (Sellers, Christopher C, 2016).

In any case, the ASEA has defined objectives in its guidelines based on international information and experiences, and these guidelines are placed on certain points above its partners in North America or other producing countries, particularly with regard to hydrocarbons not conventional¹⁴. The central objective is that the regulated activities cause the least damage to the environment:

- Prevention of water pollution on the surface or in underground areas by drilling or fracturing liquids establishing minimum distances between wells and bodies of water and protocols for the containment of hydrocarbons and the aforementioned liquids.
- Defining standards for the handling of chemical additives. It is mandatory to inform about the list of additives used in fracturing liquids, including their chemical composition and their quantities.
- Prevention of soil pollution derived from any type of leaks banning the building of dams or cavities to store the fluids that return from drilling; instead, liquids should be stored in closed containers.
- Prevention of air pollution from the release of polluting gases into the atmosphere restricting the venting and burning of gas to situations of strict emergency or to examine certain systems.

Additionally, there are social aspects that need to be considered. The hydrocarbons law specifies the need to carry out free, previous and informed consultation with indigenous people in the area of influence of the projects. It also establishes the new figure of social impact assessment and links it to the environmental impact assessment of each project (DE RÉGULES Carlos [s.f.]).

5 - The coordination of the ASEA with other agencies. Possibilities for regulatory convergence and harmonization

A new conception of energy regulation is derived from the energy reform of 2013/2014. According to this, different agencies take charge of certain fields and specific aspects of the operation of the energy sector but allowing for coordination among them. The National Hydrocarbons Commission (CNH) — which existed before the reform and which underwent changes and adaptations with the new institutional framework— are in charge of exploration and production activities, either offshore or onshore¹⁵, in deep or shallow waters, for conventional or non-conventional

¹⁴ A question that probably already has an answer: could the efforts of the ASEA evolve to Official Standards?

¹⁵ Offshore extractive activities present different conditions to those carried out on land; for this reason, it is difficult to define on which side of the border there is an affectation. In these cases, the United States and Mexico (through the Mexican Secretary of the Navy) have proposed to work together to solve the incidents that arise. When an emergency situation occurs on land, ASEA provides technical assistance if it occurs on the Mexican side; when it occurs on the other side of the border, the United States takes care of it. If the mishap occurs in a diffuse point of the border, the mechanism would be similar to that which takes place at sea. It will be necessary to deepen the real coordination capabilities that ASEA has to face cross-border incidents.

hydrocarbons. The ASEA must coordinate with the CRE and the CNH for the granting of permits, the improvement of regulations and an adequate supervision of the procedures.

As we mentioned above, the central functions of the ASEA are industrial safety, operational safety and protection of the environment, but it is necessary to clarify its specific contributions and responsibilities respect to the other agencies. Particularly in case of accidents, the protocols to deal with them must be clearly coordinated between the ASEA and different ministries and dependencies: Navy, Government, Health, among others. It is indispensable to develop a real capacity for coordination with institutions and actors, often stronger and endowed with more resources than the ASEA.

Moreover, if this coordination at the national level implies challenges, coordination at the international level implies more and more complicated challenges. However, this attempt becomes an imperative because of the integration process. There is talk of "harmonization", which ranges from simply sharing information to full integration, through the coordination of existing bilateral or trilateral institutions and the alignment of processes and regulations. At all these levels there is much to be done among the three NAFTA partners. Canada and the United States have advanced more, even so there are shortcomings that become evident in specific situations, such as the explosion of an oil-laden rail convoy in a town in the province of Quebec¹⁶:

“The tragedy in Lac-Mégantic was not caused by one single person, action or organization. Many factors played a role, and addressing the safety issues will take a concerted effort from regulators, railways, shippers, tank car manufacturers, and refiners in Canada and the United States” (Transportation Safety Board of Canada, 2014).

In the case of deep waters, it is normal for Mexico's regulatory regime to converge with the United States. A significant part of the Gulf of Mexico is shared, many of the oil companies or services operate on both sides of the maritime border and producing locations (or potentially producing locations) are close or are fields whose exploitation can be shared, being through the maritime border shared by the two countries. For that reason, Orellana Moyao (2018) affirms that after the opening of the oil sector, Mexico has systemic management of industrial risk according to the most developed practices in mature markets. The Gulf of Mexico has a fairly similar regulation on its two coasts and with it, so security is similarly guarded throughout the marine space.

Perhaps it was only necessary to add that if the regulation is equivalent to the two sides of the maritime border that is because the model has been carried out by institutions such as the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEM), after BP oil spill in 2010. With this homologation of the regulation, the ASEA sought to incorporate the best US practices in the Mexican regulatory standards to estimate and deal with the risk in the operations in the best way possible.

The Safety and Environmental Management System (SASISOPA) is a mandatory risk management, prevention and remediation system for all infrastructure operators in the energy sector in order to guarantee the safety management of operational and industrial processes. The

¹⁶ See, for example, de la Vega Navarro (2015).

system is intended to prevent injuries to people, material damages to facilities and the environment, and it comes directly from the mandatory Safety and Environment Management System (SEMS) for oil operators in the United States offshore. The later published guidelines regarding exploration and production activities in onshore conventional and non-conventional fields (see above and in the bibliography) are complementary to SASISOPA and expanding its regulation.

Final considerations

This article could be viewed in a context in which it is possible to integrate analysis of economic, environmental and safety regulations. Aspects of each of them were approached, but it is necessary to make a more systematic articulation. With regard to the economic approach, it is necessary to deepen, for example, the instruments of economic valuation to face impacts of accidents that cause environmental damage.

The subject of insurance - which should be deepened - was addressed by pointing out some lines for future work. Its importance is clear when considering that one of the elements contemplated by the ASEA to influence the way in which actors regulated manage the risks and their impacts are precisely the insurance.

Energy trade requires diverse infrastructures: pipelines -often cross-border-, transmission lines and interconnections, in the case of electricity. A modern energy infrastructure is fundamental for the integration of energy markets.

As in other fields of action of the regulatory agencies, it would seem that the activities and responsibilities of the ASEA stop at national borders. As the energy relationship with the United States increases, which translates into new pipelines, cross-border connections, exploration and production activities at maritime borders, new situations will be faced that can affect human lives, economic activities and cause environmental damage of various kinds. When this is done on both sides of the borders, there is a need for regulatory coordination and to explore possibilities for regulatory convergence and harmonization. For this it is necessary to analyze international experiences on risks, legislations and regulations of cross-border infrastructures. Not to copy them, but with the purpose of having useful references for own elaborations, according to national, regional and local realities.

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