

MEXICO'S 2013 ENERGY REFORM: TOWARDS ENERGY TRANSITION?

Authors: Daniel Iglesias Márquez, Beatriz Felipe Pérez. Centre for Environmental Law in Tarragona (CEDAT) Rovira i Virgili University. daniel.iglesias@urv.cat . beatrizirene.felipe@urv.cat .

Abstract:

Mexico is an important oil producer and consumer country but its oil sector is facing many challenges. One of the most important challenges is the decrease in the oil production and reserves. In order to ensure national energy security, in 2013, the Energy Reform - a decree amending and supplementing various provisions of the Mexico's Constitution concerning the energy policy - was enacted. This note questions whether this reform fulfills the requirements to be considered as a comprehensive reform towards the energy transition to a more sustainable energy model or whether it is a political strategy to maintain an economy dependent on hydrocarbons, obtaining economic benefits with scarce environmental concerns. The note suggests that the energy transition is eclipsed by the economic interests in obtaining maximal profits from private investment while leaving by the wayside environmental and social concerns.

Key Words: Mexico; Energy Reform; Energy Transition; Energy Security; Private Investment; Unconventional hydrocarbons exploitation

Resumen:

México es un importante productor y consumidor de petróleo, sin embargo su sector de hidrocarburos enfrenta muchos desafíos. Uno de los retos más importantes es la disminución en la producción y reservas de petróleo. Con el fin de garantizar la seguridad energética nacional, en 2013, la Reforma Energética - un decreto que modifica y adiciona diversas disposiciones de la Constitución del México en materia energética – fue promulgada. Esta nota cuestiona si dicha reforma cumple los requisitos para ser considerada como una reforma integral hacia la transición energética, es decir hacia un modelo energético más sostenible, o si se trata de una estrategia política para mantener una economía dependiente de los hidrocarburos, obteniendo beneficios económicos con escasas consideraciones ambientales. La nota sugiere que la transición energética se ve eclipsada por los intereses económicos mediante la obtención de máximos beneficios producidos de la inversión privada, dejando de lado las preocupaciones ambientales y sociales.

Palabras Clave: México; Reforma energética; Transición energética; Inversión Privada; Explotación de hidrocarburos no convencionales

Summary:

- I. Introduction**
- II. Mexico's Energy Sector and its Challenges**
- III. Energy Reform Overview**
- IV. Key Environmental Aspects of the Energy Reform**
- V. New Opportunities for Private Participation and Investment in Mexico's Oil Industry**
 - 1. Background**
 - 2. Private Investment's Opportunities in the Energy Reform**
 - 3. International Experiences of Private Participation in Oil Industry**
 - 4. Mexico's Unconventional Oil and Natural Gas Development**
- VI. Conclusion and Policy Implications**
- VII. References**

I. INTRODUCTION

The use of fossil fuels (oil, coal and gas) dominates the global energy supply¹. However, since the 1973-74 oil crisis, the need to increase energy security diversifying energy sources became a main objective for almost every nation; "the era of "easy" energy is over"². In addition, the growing environmental concern related to the consequences of the massive use of fossil fuels, as climate change, is forcing transformations in the energy policy of many countries. More sustainable energy policies based on energy diversification, energy security, competitiveness and sustainability - energy transition - are urgently required.

In Mexico, the energy sector depends mostly on the country native fossil fuels; in addition, oil is a crucial component of the country's economy. Moreover, Mexico is one of the major oil producer and consumer countries worldwide. In 2012, the crude oil country production was 2,593 thousand barrels per day, ranking tenth in the list of the largest worldwide oil producer and third in the Americas. On the other hand, the country consumption was

¹ IPCC, *Renewable Energy Sources and Climate Change Mitigation*, Cambridge University Press, Cambridge, 2012. p. 10.

² UNCTD, *The Emerging Biofuels Market: Regulatory, Trade and Development Implications*, United Nations, New York-Geneva, 2006. p. 3

2,145 thousand barrels per day; it is the eleventh largest oil consumer worldwide³.

Since 1917, Mexico's Constitution establishes that oil and gas resources in national territory are property of the State, which has direct dominion over all hydrocarbon resources. Foreign ownership was prohibited and private sector was only involved through service contracts. In this sense, since 1938, the execution of all and each oil industry activities has been carried out by the State through the national company *Petróleos Mexicanos* (hereinafter PEMEX), a decentralized public organization and one of the largest oil companies in Latin America in terms of sales. Prior to the 2013 Reform, PEMEX was the only company engaged in the whole oil and gas exploration, production and commercialization scheme, the company had no competition in any area of the energy industry⁴.

Notwithstanding, the country's energy sector is facing many challenges. For instance, three key challenges are: a decreasing oil production and reserves, a growing energy demand and oil consumption and a lack on investment on the industry. In this sense, energy diversification, through its great potential for renewable energies, might contribute to overcome the above marked challenges.

In consequence, in December 2013 the Constitutional Energy Reform⁵ was enacted as a strategy to guarantee Mexico's energy security. This Reform consists on amendments to Constitutional Article 25, 27 and 28 and twenty one supporting Transitory Articles; "it will allow the government to maintain sovereignty over hydrocarbon resources, at the same time, it will ensure greater private investment through production-sharing, profit-sharing, and licensing mechanisms"⁶.

This Reform has drawn the attention not only of Mexico's society but also of the international community, particularly of large multinational corporations of the energy sector that have seen the opportunity to exploit Mexico's oil resources and benefit from them. In this sense, the adoption of this Reform was controversial since there has been a huge debate on its potential impacts

³ EIAa, *Liquid Fuels and Natural Gas in the Americas*, US Energy Information Administration, Washington, 2014. p. 12.

⁴ ASSAD, R., *Energy Reform in Mexico: Implications for the United States*, Wilson Center, Washington, 2013. p. 3.

⁵ "Decreto de 20 de diciembre de 2013 por el que se reforman y adicionan diversas disposiciones de la Constitución Política de los Estados Unidos Mexicanos, en Materia de Energía". Accessed: September 29, 2014. Available at

<http://www.dof.gob.mx/nota_detalle.php?codigo=5327463&fecha=20/12/2013>

⁶ EIA(a), "*Liquid Fuels and Natural...*" ob. cit., p. 36.

on the energy industry within the medium and long term, its environmental consequences (e.g. increasing greenhouse gases emissions, shale gas exploitation) and the relevance of the international and private investment in the country's oil industry.

The Energy Reform is the focus of this paper. The guiding question is whether this Reform fulfills the requirements to be considered as a comprehensive reform towards the energy transition to a more sustainable energy model or whether it is a political strategy to maintain an economy dependent on hydrocarbons, obtaining economic benefits with scarce environmental concerns. Section II examines Mexico's energy sector and its challenges. Section III describes the relevant aspects of the Energy Reform. Section IV deeply analyzes the Reform's key environmental aspects and the possibility to achieve an energy transition. Section V explores the opportunities for the opening up of the energy market to private companies and its potential impacts; moreover, it provides a background of the Energy Reforms in the country (subsection 1), analyzes private investment opportunities in the Reform (subsection 2), provides an overview of international experiences regarding private participation in energy sector (subsection 3) and studies the development of unconventional oil and natural gas (subsection 4). Finally, the conclusions answer our main research question: whether this reform might be considered a comprehensive reform.

II. MEXICO'S ENERGY SECTOR AND ITS CHALLENGES

The energy sector in Mexico is a key factor for the economic, productive and social development of the country⁷. The evidence is that in 2013, the oil sector generated 13% of the country's export earnings and the 33% of the government income⁸.

One of the main challenges that the country is facing is that, although it is an important non-OPEC oil producer⁹, oil production and reserves have been falling since more than 10 years ago¹⁰. In this sense, in 2004 Mexico's oil production reached a peak when the production of the main oil field, the

⁷ MARTÍNEZ, N., "Oil policies and privatization strategies in Mexico: implications for the petrochemical sector and its production spaces", *Energy Policy*, núm. 32, 2004. p. 2036.

⁸ EIA (b), *Mexico*. US Energy Information Administration, Washington, 2014. p. 1.

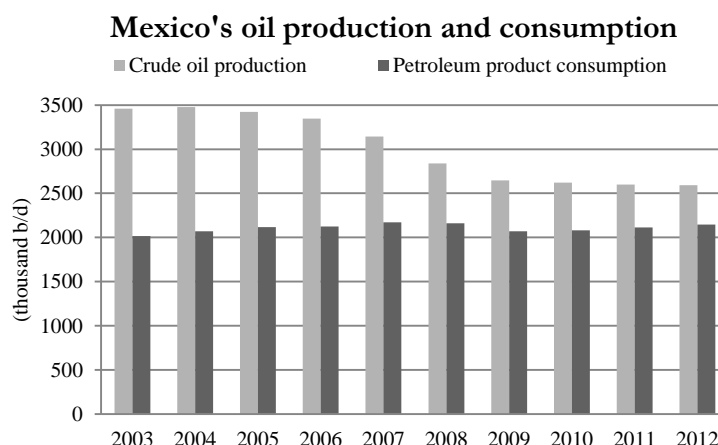
⁹ RIBANDO, C., RATNER, M., VILLARREAL, M. A., HAGERTY, C. L., *Mexico's Oil and Gas Sector: Background, Reform Efforts, and Implications for the United States*, Congressional Research Service, Washington, 2014. p. 6.

¹⁰ SENER, *Prospectiva de Petróleo Crudo y Petrolíferos 2013-2027*, SENER, México, D.F, 2013.

Cantarell Complex, declined from 2.4 million to 300,000 barrels per day¹¹. CANCINO-SOLÓRZANO et al. remark that “from 2005 onwards there was a slight reduction in crude oil production and that, in 2008, it was down to 2,793 barrels per day, an 8.3% drop on that recorded in the previous year”¹². In 2013, crude oil production was at its lowest since 1995 and continues to decline thus far in 2014¹³.

In this sense, another challenge that Mexico’s energy sector is facing is a growing energy demand, which is mainly covered by fossil fuels. In 2012, 94% of total energy consumption came from these sources – oil (53%), natural gas (36%) and coal (5%)-, while the rest came from other sources as hydroelectric (4%), nuclear (1%) and non-hydro renewable (1%)¹⁴.

Additionally, easy-to-access oil is running out in Mexico. Most of the oil reserves - 44,530 million barrels – are located offshore in the southern part of the country. These reserves consist of 31.1% of proven oil reserves (estimated for ten years), 27.7% of probable reserves (estimated for nineteen years) and 41.2% of potential reserves (estimated for thirty two years)¹⁵.



Source: Own elaboration based on EIA 2014b

¹¹ ASSAD, R., “*Energy Reform in Mexico...*” ob. cit., p. 2.

¹² CANCINO-SOLÓRZANO, Y., VILICAÑA-ORTIZ, E., GUTIÉRREZ-TRASHORRAS, A. J., Xiberta-Bernat, J., “Electricity sector in Mexico: Current status. Contribution of renewable energy sources”, *Renewable and Sustainable Energy Reviews*, vol. 14, núm. 9, 2010. p. 455.

¹³ EIA (b), “*Mexico...*” ob. cit., p. 2.

¹⁴ *Idem*.

¹⁵ IMCO, *Nos cambiaron el mapa: México ante la revolución energética del siglo XXI*, Instituto Mexicano para la Competitividad A.C., México, D.F, 2013. pp. 73-75.

In addition, PEMEX does not have the technological and financial capacity to exploit ultra-deep water and unconventional resources. The drilling costs in ultra-deep water are about ten times higher than in shallow water and one hundred times higher than those of terrestrial deposits¹⁶. Moreover, the country faces restrictions on the exploitation of fields in border sites due to the U.S.-Mexico Transboundary Agreement that plays a relevant role in raising Mexico's standards of operation in deep water¹⁷.

In sum, the above mentioned issues are important challenges for an oil-dependent country. Consequently, the need to reform Mexico's energy sector was essential¹⁸. To summarize, the key challenges that are intended to be solved with the Energy Reform are related to the oil production and reserve fall: the decline of its main oil field, the deficiencies in financial framework, the low capital investment in technology in order to harness ultra-deepwater oil resources and the restrictions on the current legal framework regarding the incorporation of new sources of investment.

III. ENERGY REFORM OVERVIEW

In August 2013, Mexico's President submitted to the Senate the constitutional decree proposal, amending articles of the Political Constitution of the Mexican United States, in accordance with Article 71, section I, and Article 135 of the Constitution. After four months, in December 2013, it was approved by the Senate, the Congress and the majority of state's legislatures and enacted by the Executive branch.

The Energy Reform is considered as an effort to address the above mentioned declines of Mexico's domestic oil production¹⁹ and, moreover, as the most significant economic reform since the country entrance into the North American Free Trade Agreement (NAFTA)²⁰. It follows six strategic axes: strengthening the role of the State as rector of the oil industry, economic

¹⁶ PRESIDENCIA DE LA REPÚBLICA, (2013). Iniciativa de Decreto por el que se reforman los artículos 27 y 28 de la Constitución Política de los Estados Unidos Mexicanos. Accessed May 5, 2014. Available at <<http://www.presidencia.gob.mx/wp-content/uploads/2013/08/2013-08-12-Iniciativa-08001.pdf>>.

¹⁷ RIBANDO, C., RATNER, M., VILLARREAL, M. A., HAGERTY, C. L., "Mexico's Oil and Gas..." ob. cit., p. 7.

¹⁸ GOLDWYN, D. L., *Mexico Rising: Comprehensive Energy Reform at Last?*, The Atlantic Council, Washington, 2013. pp. 5-7.

¹⁹ EIA (b), "Mexico..." ob. cit., p. 1.

²⁰ RIBANDO, C., RATNER, M., VILLARREAL, M. A., HAGERTY, C. L., "Mexico's Oil and Gas..." ob. cit., p. 1.

growth, inclusive development, energy security, transparency and sustainability and protection of the environment. Moreover, it is based on three main pillars: strengthening PEMEX as a public productive company to compete in an open market, reinforcing regulatory agencies and their legal capacities to oversee PEMEX and private newcomers to the industry and introducing a gradual and selective liberalization of the oil and gas industry and to promote market competition²¹.

This Reform consists on amendments to Constitutional Articles 25, 27 and 28 and twenty one supporting Transitory Articles. The key modifications are the following:

The reform to Article 25 provides a basis for redirecting PEMEX and the Federal Electricity Board (CFE), in order to be value-creating state enterprises, reversing course on a mandate focused on national control²². The central aim of this change is to convert these organizations into new and more self-sufficient public commercial enterprises, with more managerial and budgetary autonomy. Since PEMEX has “been driven by over regulation, price and tax control, limited business management and heavy taxation”²³, it is expected that the company’s financial and industrial development will improve. In addition, the reform to this Article authorizes the government to employ best practices when regulating state-owned productive enterprises.

In relation to Article 27, the hydrocarbons in the subsoil remain belonging to the State but the Reform ends the monopoly of PEMEX and CFE. According to GOLDWYN, the change to Article 27 “reverses nationalization to allow for contracting with private entities”²⁴. Despite this fact, PEMEX will remain the most important player within the Mexican oil sector and it will continue as a wholly state-owned company²⁵ since the company preserves exclusive rights over conventional resources (including any other solid, liquid or gaseous hydrocarbon located in the sub-surface)²⁶. PEMEX will be able to propose to the Secretary for Energy (SENER) what part of its current acreage wishes to conserve, through the “Round Zero” (Transitory Article 6), as long as the company demonstrates the fiscal and technical ability to develop the resources. Moreover, in Article 27, the Reform removes the prohibition of the State to subscribe contracts with other actors but maintains a ban on concessionary contracts for non-state companies. However, in order to incentivize international investment (Transitory Article 4), there are four types

²¹ ASSAD, R., “*Energy Reform in Mexico...*” ob. cit., pp 2-3.

²² GOLDWYN, D. L., “*Mexico Rising: Comprehensive...*” ob. cit., p. 12.

²³ MARTÍNEZ, N., “*Oil policies and privatization...*” ob. cit., p. 2036.

²⁴ GOLDWYN, D. L., “*Mexico Rising: Comprehensive...*” ob. cit., p. 9.

²⁵ *Ibid.* p. 12.

²⁶ ASSAD, R., “*Energy Reform in Mexico...*” ob. cit., p. 3.

of contracts which should be regulated by the Congress: service, profit-sharing and production-sharing contracts and licenses²⁷. In other words, this amendment opens Mexico's energy sector (oil and natural gas) for international oil companies and other private investors. The possibility to develop unconventional oil and natural gas fields is perhaps the most attractive opportunity for these private entities.

Finally, the reform to Article 28 protects PEMEX's and CFE's abilities to be dominant market players and establishes the Mexico's Petroleum Fund for Stabilization and Development. This fund will be managed by the Mexico's Central Bank and it will be charged with administering, investing and distributing oil revenues according to secondary legislation. Its responsibilities and authorities are described in Transitory Articles 15 and 16. In addition, "the Finance Secretariat will build mechanisms to send all oil revenues (except taxes) to the fund, which will then redistribute them based on a hierarchy of obligations²⁸. Furthermore, Article 28 empowers the Executive branch with regulatory bodies to oversee the energy sector"²⁹. Among these empowered bodies are:

- SENER. It will be in charge of establishing energy policies, determining the categories of contracts to be applied, creating the bid or auction processes where applicable and granting permits for refining and processing.
- National Agency for Hydrocarbons (CNH). It will provide technical advice, procure seismic studies, collect geological information, sign contracts and approve development plans. It will also play the most important role regarding the mentioned fund, as it will be responsible for issuing the contracts, publishing the terms of the agreements and ensuring that payments are made to the Fund.
- Regulatory Board for Energy (CRE). It will allow liquid fuels and natural gas transportation by ensuring open access to pipelines and approving storage.

Additionally, a new National Agency for Industrial Security and Environmental Protection of the Hydrocarbons Sector (hereinafter, the Agency) will be created. It will be a decentralized agency of the Secretary for the Environment and Natural Resources (SEMARNAT) and it will regulate and oversee the activities of the hydrocarbons sector related to industrial and operational safety and environmental protection.

²⁷ GOLDWYN, D. L., "Mexico Rising: Comprehensive..." ob. cit., p. 9.

²⁸ *Idem.*, p. 13.

²⁹ EIA (b), "Mexico..." ob. cit., p. 3.

IV. KEY ENVIRONMENTAL ASPECTS OF THE ENERGY REFORM

As above mentioned, “Sustainability and Environmental Protection” is one of the six strategic axes of the Reform. In this sense, the Reform aims to mitigate the negative impacts of oil production and consumption on human health and the environment through an increase in the availability of cleaner energy resources³⁰. However, one of the major questions surrounding the Reform is whether it really promotes a sustainable development for the country and encourages the energy transition to a more diversified and cleaner model. This question is addressed in this section through the analysis of the introduction of “sustainable industrial development” in the Mexico’s Constitution, the role of the new hydrocarbons agency and the promotion of the energy diversification through renewable sources of energy.

Firstly, even though the concept of “sustainability” was already contemplated in the Article 25 in order to consider the environmental aspects into the economic development policies, this notion is now incorporated as a State's responsibility for national development. The Reform adds the concept of "sustainable industrial development" as a new principle of environmental policy, especially regarding the entry of new participants in the electric power industry. Moreover, according to Transitory Article 17, the secondary legislation will establish obligations to incorporate better practices in areas related to energy and natural resources use efficiency, reduction in the generation of greenhouse gases, decrease waste generation and emissions and reduction in carbon footprint. In addition, this Transitory Article also contemplates the creation of clean energy certificates that will be regulated by a law for the Electricity Industry in order to achieve emission reduction targets.

Secondly, as it was mentioned above, one of the most significant novelties in the Reform is the creation of the National Agency for Industrial Security and Environmental Protection of the Hydrocarbons Sector. The Agency will be a specialized and technical body with management autonomy, charged with regulating, overseeing and imposing sanctions in the field of industrial and operational safety. Some of the assigned tasks are: adoption and enforcement of international and national technical standards, prevention and contention of spills and leaks, design plans to prevent emergency situations and investigation in the cause of accidents. The Agency is also responsible for regulating, overseeing and imposing sanctions in the field of environmental protection. Its main tasks on this issue are: protection, conservation and restoration of ecosystems and natural resources, characterization and

³⁰ PRESIDENCIA DE LA REPÚBLICA, “*Iniciativa de Decreto por...*” ob. cit., p. 1.

management of waste, pollutant emissions control and to provide technical keys for Mexico's environmental and energy policies. Regarding the Agency's tasks, it must be highlighted that under the current framework some of the duties are already covered by existing authorities. For instance, the supervision of industrial safety is carried out by the Secretary for the Labor and Social Security, and, more specifically, the supervision of industrial safety applicable to the energy sector is carried out by SENER. Therefore, to avoid confusion and duplication of efforts on duties among the different authorities involved, it is important to determine the interactive role of this Agency with the existing authorities.

Thirdly, regarding the promotion of renewable energies and the energy model transition, SÁNCHEZ claims that "Mexico is one of the countries of the Group of 20 (G20) that invests less in renewable energy, although the geographical situation benefits"³¹. The country is located in one of the strips of land with the greatest solar radiation in the planet, which makes it appropriate for developing solar energy. Likewise, the air currents in the Gulf of Mexico and the Pacific Ocean are important wind resources, as well as the fast-flowing rivers and great lakes, which have an important hydraulic potential³².

On the other side, as evidence that the Reform promotes energy diversification, the reform proposal mentioned that a clean and diversified energy matrix might contribute to meeting climate change mitigation goals and having flexibility in power generation in order to reduce costs³³. In this respect, although before the Reform the efforts were mainly focused on identifying opportunities to achieve an optimal energy use resulting in economic savings for the country, the intentions for an energy model transition towards energy diversification are not new issues in Mexico. In this sense, the country was already concerned about having a secure energy supply, diversifying its primary energy sources by reducing their environmental impact and installing some of the most developed renewable energies. During the last few years, the energy policy central axe was also to reduce the environmental impact generated by traditional fossil fuels³⁴. In this regard, the National Development Plan 2007-2012 already set as a priority goal the rational and sustainable use of natural resources and the progressive reduction of

³¹ SÁNCHEZ, J. E., (2012). La crisis energética global, la posición de México en el mundo. Accessed May 2, 2014. Available at <<http://xivrem.ujaen.es/wp-content/uploads/2011/11/24-R-106M706.pdf>>.

³² CANCINO-SOLÓRZANO, Y., VILICAÑA-ORTIZ, E., GUTIÉRREZ-TRASHORRAS, A. J., Xiberta-Bernat, J., "Electricity sector in Mexico..." ob. cit. p. 455.

³³ PRESIDENCIA DE LA REPÚBLICA, "Iniciativa de Decreto por..." ob. cit, pp. 17-18.

³⁴ CANCINO-SOLÓRZANO, Y., VILICAÑA-ORTIZ, E., GUTIÉRREZ-TRASHORRAS, A. J., Xiberta-Bernat, J., "Electricity sector in Mexico..." ob. cit. p. 458.

greenhouse gas emissions³⁵. Regarding this, in 2008 the law for the Exploitation of Renewable Sources (LAFRE) was passed, its main objective was to promote the energy transition and a more sustainable energy use, it also imposed to SENER the obligation to limit the participation of fossil fuels in power generation by 65% in 2024 and by 50% in 2050. In addition, the National Energy Strategy 2012-2026 also included as a target to increase the participation of non-fossil resources for power generation by 35%. In relation to that, in 2012, the law for the Climate Change was enacted; this law promotes that at least 35% of electricity generation would come from clean energy sources in 2024. It also establishes as a goal to reduce emissions by 30% in 2020 and by 50% in 2050.

One of the many obstacles to really fulfill the transition of the Mexico's energy model is that the current model is not flexible enough to integrate renewable energies on a large scale and distributed generation. In order to overcome this gap, the reform to Article 25 proposes the creation of a competitive generation market administered by the State through independent operators, the establishment of an independent transmission and the distribution system operator. In turn, these savings from competition should be passed on to consumers, resulting in lower electricity prices.

In addition, in order to widen the range of clean energy sources and promote energy diversification, Congress is tasked with creating a framework related to the recognition, exploration, and exploitation of geothermal resources. In this regard, Transitory Article 18 points out the issuance of a law for Geothermal Energy, which regulates exploration and production of geothermal resources. In August 2014, the law for Geothermal Energy was enacted; this law might constitute an opportunity for fostering investments in geothermal energy in order to generate electricity or use it in other applications. It is worth mentioning that Mexico ranks fourth worldwide in installed geothermal capacity with about 840 MW only behind the United States (U.S.), the Philippines and Indonesia. Moreover, among Organization for Economic Co-operation and Development (OECD) member countries, it is the second largest producer of geothermal power.

V. NEW OPPORTUNITIES FOR PRIVATE PARTICIPATION AND INVESTMENT IN MEXICO'S OIL INDUSTRY

The consequences of the private investment in the country's oil industry are one of the most controversial aspects of the Reform. Regarding this, the

³⁵ PRESIDENCIA DE LA REPÚBLICA, "*Iniciativa de Decreto por...*" ob. cit., pp. 17-18.

following subsection 1 provides a brief analysis of the background on the regulation of private participation in the country's energy sector. The subsection 2 analyzes how the current Energy Reform promotes this private investment, while the subsection 3 studies international experiences concerning private investment in oil industry. Finally, the opportunity for unconventional resources development is analyzed in subsection 4.

1. Background

Since 1917, Article 27 of Mexico's Constitution stipulated the restitution of underground oil rights to the country. The first major energy reform in Mexico was driven by President Lázaro Cardenas (1934-1940) in 1938, who expropriated oil assets from private companies. Certainly, this Reform was nationalist in nature. Since then, the ownership and stewardship of the State over hydrocarbons resources was guaranteed and all concession for privates in oil sector were suspended. Nevertheless, it contemplated the involvement of the private sector in various oil industry activities. The Reform recognized the exploitation of hydrocarbons as an exclusive State right. Notwithstanding, the possibility of holding individual contracts for exploration and production activities in order to carry out them on behalf of the Federal Government was included.

Between 1946 and 1958, further reforms were adopted to allow foreign companies to carry out exploration and production activities of new fields. By 1958, foreign companies contributed with 2% of the total oil production, while the participation of these companies in providing services was even further³⁶. In order to limit the growth of the foreign presence in the oil industry, in 1958, during the period of President Adolfo Ruiz Cortines (1952-1958), the Regulatory law for Article 27 of the Constitution with respect to Petroleum was enacted. However, it was in 1960 when President Adolfo López Mateo (1958-1964) consolidated the State's monopoly; this meant that the energy sector was closed to private investment³⁷. Notwithstanding, in 1982, Mexico's economy adopted a neoliberal strategy and, consequently, the oil policy was adjusted to this strategy, "the privatization of PEMEX was proposed and it was promoted to bring the vertically integrated monopoly to an end"³⁸. The adoption of privatization measures of the government-owned basic petrochemical industry was a first step towards the opening up of the oil industry.

³⁶ GONZÁLEZ RODRÍGUEZ, J., "El sector privado y Pemex. Algunos datos sobre la normatividad aplicable al respecto", *Reporte CESOP*, núm. 66, 2013. p. 4.

³⁷ *Idem*.

³⁸ MARTÍNEZ, N., "Oil policies and privatization..." ob. cit., p. 2036.

The latest energy reform took place in 2008. Participation of the private sector in energy industry (exploration/production and construction/operation of oil refineries) was included among its objectives. Nevertheless, the restriction of the private sector in the energy industry remained. As a result, new laws related to energy sector were enacted and/or amended at that time³⁹:

- Law for *Petróleos Mexicanos*⁴⁰.
- Law for the Use of Renewable Energies and the Financing of the Energy Transition⁴¹.
- Federal Law for Parastatal Entities⁴².
- Law for Public Works and Related Services⁴³.
- Law for Acquisitions, Leases and Services of the Public Sector⁴⁴.
- Regulatory Law for Article 27 of the Constitution with respect to Petroleum⁴⁵.

It is worth mentioning that there are some additional mechanisms that encourage private investment. On the one hand, there are public works executed and financed by third parties which are payed and amortized over a certain period. On the other hand, there are also services contracts or collaboration agreements, that allow PEMEX to contract private parties for

³⁹ GONZÁLEZ RODRÍGUEZ, J., “*El sector privado...*” ob. cit., p. 6.

⁴⁰ “Decreto de 28 de noviembre de 2008 por el que se expide la Ley de Petróleos Mexicanos; se adicionan el artículo 3o. de la Ley Federal de las Entidades Paraestatales; el artículo 1 de la Ley de Obras Públicas y Servicios Relacionados con las Mismas y un párrafo tercero al artículo 1 de la Ley de Adquisiciones, Arrendamientos y Servicios del Sector Público”. Accessed: September 29, 2014. Available at <http://www.diputados.gob.mx/LeyesBiblio/ref/lopsrm/LOPSRM_ref04_28nov08.pdf>

⁴¹ “Decreto de 28 de noviembre de 2008 por el que se expide la Ley para el Aprovechamiento de Energías Renovables y el Financiamiento de la Transición Energética”. Accessed: September 29, 2014. Available at <http://www.dof.gob.mx/nota_detalle.php?codigo=5070927&fecha=28/11/2008>

⁴² “Decreto de 28 de noviembre de 2008 el que se expide la Ley de Petróleos...” ob. cit.

⁴³ *Idem.*

⁴⁴ “Decreto de 28 de noviembre de 2008 por el que se expide la Ley para el Aprovechamiento...” ob. cit.

⁴⁵ “Decreto de 28 de noviembre de 2008 por el que se reforman y adicionan diversas disposiciones de la Ley Reglamentaria del Artículo 27 Constitucional en el Ramo del Petróleo”. Accessed: September 29, 2014. Available at <http://dof.gob.mx/nota_detalle.php?codigo=5070930&fecha=28/11/2008>

services related to the processes of drilling, development and expansion of their fields under the condition that such contracts are public investment funded and operated by private individuals, which provide their financial, technological and operational capacities.

2. Private Investment's Opportunities in the Energy Reform

As it was mentioned, the amendment of Article 27 intends to open Mexico's energy sector for international oil companies and other private investors. Through the Reform, the international oil companies and other private investors will gain a relevant role in Mexico's energy sector. International companies' participation is expected to be relevant in three main issues. Firstly, international oil companies may collaborate with PEMEX (*joint venture*) in order to spread risk to areas where the company lacks comparative advantages. Once it is decided which existing fields are retained by PEMEX, the company will be able to partner in order to develop the fields that the company is not capable of developing by its own (ultra-deepwater fields). In this sense, GOLDWYN points out that the "existence of a strong national champion to partner with the private sector can play a useful role in taking extremely long-term views on investment, beyond even multidecade contracts of international oil companies that have limited time horizons to achieve their returns"⁴⁶. Secondly, international companies may carry out seismic studies for the government due to the need to assess potential reserves located in the Gulf of Mexico. Finally, international companies would be able to develop new acreages, which have not been explored or produced before. Unconventional hydrocarbons (shale gas) are also expected to be developed by those private actors.

Regarding the above mentioned, it must be stressed that the primary driver of foreign direct investment (FDI) growth in Latin America is oil and gas extraction, thus Mexico becomes a promising destination for largest international oil companies which seek comparative advantages (cheap labor, low raw material prices, the proximity to energy sources, local tolerance of hazardous and polluting industries and the existence of an adequate infrastructure) and relocate part of their production capacity⁴⁷. The Reform raised new opportunities for the private sector in order to solve the above mentioned challenges that the Mexico's oil industry is facing. Therefore, the Reform intends to be a solution to the current situation by removing the prohibition of the State to conclude contracts for oil industry activities, such as gas processing and oil refining, as well as transport, storage, distribution and marketing of these products and their derivatives.

⁴⁶ GOLDWYN, D. L., "*Mexico Rising: Comprehensive...*" ob. cit., p. 22.

⁴⁷ MARTÍNEZ, N., "*Oil policies and privatization*" ob. cit., p. 2043.

It is expected that private participation will contribute to achieve oil reserve recovery rate higher than 100%. Moreover, the increase in oil production will be accompanied by the discovery of equal or larger reserves. It is also expected that oil production will increment from 2.5 million barrels to 3 million in 2018 and 3.5 million in 2025. Gas production will increase from 5 billion 700 million cubic feet per day to 8 billion in 2018 and 10 thousand 400 million in 2025. In addition, according to PRESIDENT PEÑA NIETO, achieving the above mentioned goals would increase the gross domestic product and employment in the country as well as it will serve to obtain financial resources which would be used to improve quality of life and the competitiveness of Mexico⁴⁸.

The investment in Mexico's energy sector carried out by international companies might also correct sector failures. First and foremost, investing in mid and downstream oil processing will improve the country's trade balance; however, there is no prediction that it might reduce the price of gasoline. Despite the fact that Mexico is a large exporter of crude oil, it is a net importer of refined petroleum products, such as gasoline and diesel fuel. In 2012, daily oil production reached 2.5 million barrels of crude oil, nevertheless, only 1.5 million barrels were refined. The lack of full refining capacity to meet its domestic demand for refined products has risen gasoline imports from 25% in 1994 to 49% in 2012. Most of oil exports go to the U.S. refineries on the Gulf Coast, which then sends some of the refined products back to Mexico⁴⁹. It is expected that the Energy Reform also encourages private investment in downstream assets; this will allow a sufficient gasoline supply at competitive prices.

Finally, opening up of Mexico's natural gas sector to international companies might cover the high demand of natural gas by increasing natural gas production. Currently, most electricity generation comes from natural gas, which, according to SENER, had a share of 29.3% in 2002, and by the year 2012, it doubled achieving 50% of the total of national electricity generation⁵⁰. The presence of various companies would involve a real competition, lower-cost fuel options and expansion of gas pipeline infrastructure.

3. International Experiences of Private Participation in Oil Industry

The opening up of the Mexico's oil market has been influenced by international experiences. Before Mexico, several countries followed this trend

⁴⁸ PRESIDENCIA DE LA REPÚBLICA, "*Iniciativa de Decreto por.*", ob. cit., pp. 15-16.

⁴⁹ RIBANDO, C., RATNER, M., VILLARREAL, M. A., HAGERTY, C. L., "*Mexico's Oil and Gas...*" ob. cit., pp. 11-13.

⁵⁰ SENER, "*Prospectiva de Petróleo...*" ob. cit. p. 93.

with a wide range of economic and socio-environmental consequences. The cases of Brazil, Venezuela and Norway are briefly analyzed in the next paragraphs in this subsection.

The Brazilian model has been cited as an example to be emulated and improved by the Mexico's government⁵¹. Like in Mexico, exploration, exploitation and processing of crude oil were carried out by one state-owned company: PETROBRAS. This company held a monopoly for over 40 years when, in 1995, the Brazilian Congress approved a Constitutional Amendment in order to attract the largest possible amount of investment in the sector and to take advantage of the Brazilian basins. The aim of the Amendment consisted in turning its systems from state monopoly into a concessions regime, allowing the private sector to carry out activities of exploration, development, processing, production and import of oil and natural gas⁵². The reform attracted a considerable number of foreign companies such as Shell, Texaco and El Paso. In addition, PETROBRAS was reformed to allow it to operate in the same way as a privately owned company, with private investment but majority control firmly held by the Brazilian State⁵³. While the Brazilian model has made great achievements, it also has shortcomings. On the one hand, the country has multiplied its national oil reserves and achieved oil independence; national supply has equaled national consumption for the first time in history⁵⁴. On the other hand, many profits were not remaining in the country. In order to tackle this, Brazil adopted a more interventionist approach in recent years, determining that PETROBRAS must be a majority partner in all operations. In 2010, a series of mechanisms to intervene in technical and operational decisions were created and the Brazilian government purchased shares of PETROBRAS in order to mitigate the transfer of oil revenues to foreign shareholders of the company⁵⁵. Consequently, investors have been put off and have lost interest. Moreover, PRETROBRAS has

⁵¹ GOLDWYN, D. L., "*Mexico Rising: Comprehensive...*" ob. cit., p. 22.

⁵² GUILHOTO, J. J. M., MASSARU ICHIHARA, S., SLAIBE POSTALI, F. A., DE SOUZA REGUEIRA, K. W., CANELAS, A., DA FONSECA, M., CUNHA, N., (2007), *The Oil and Gas Sector in the Brazilian Economy*. Accessed March 14, 2014. Available at: <<http://mpira.ub.uni-muenchen.de/31520/>>.

⁵³ WILSON CENTER, (2012) *A New Beginning for Mexican Oil: principles and recommendations for a reform in Mexico's national interest*. Accessed September 7, 2014. Available at <http://www.wilsoncenter.org/sites/default/files/wood_new_beginning_mexico.pdf>.

⁵⁴ *Idem*.

⁵⁵ JIMÉNEZ, J., "La explotación petrolera y el capital privado", *Reporte CESOP*, núm. 66, 2013. p. 31.

repeatedly failed to meet its production targets, it has begun to report losses and the industry has witnessed an inflationary spiral for services⁵⁶.

On the other side, Venezuela is the largest player in the Latin American energy sector; the country is one of the largest oil exporters in the world and a founding member of the Organization of the Petroleum Exporting Countries⁵⁷. Like Mexico, Venezuelan legislation did not allow, except in certain cases approved by Congress, concessions and shared-risk contracts to any private participation in oil production in accordance with the 1975 Regulatory law for the Industry and Trade of Hydrocarbons⁵⁸. However, service contracts were allowed in order to carry out activities such as drilling and seismic surveys, but these were supposed to be pure service contracts, not contracts mimicking production sharing agreements that effectively granted the contractors a participation in the business⁵⁹. These service contracts “ceded control over petroleum operations in huge areas for 20 years, and compensation was based on the volume and value of production”⁶⁰. In addition, services providers obtained more than half the value of production and were subject to the non-oil income tax rate of 34%⁶¹. Consequently, “state company actually lost money for each barrel of oil produced, after accounting for the royalty owed to the State”⁶². In 2005, the Venezuelan Government required migration of the operating service agreements to a new structure of mixed company, which were subject to combined royalties and special advantages as well as the 50% oil income tax rate. Thus, this new scheme reduced the participation of private oil companies.

Finally, the Norwegian model is considered as one of the most successful, not only in economic terms but also concerning technological development, environmental protection and its benefits to population⁶³. Norway was introduced into the oil industry when large oil fields were discovered in 1969⁶⁴ and since the beginning of the oil and gas activities, international oil companies were present. According to AASHEIM -former Norwegian Ambassador to Mexico-, Norwegian oil adventure would not have been possible without the presence of foreign oil companies as, at that time,

⁵⁶ WILSON CENTER, “*A New Beginning for...*” ob. cit., pp. 17-18.

⁵⁷ ISBELL, P., STEINBERG, F., “El Nuevo Escenario Energético en América Latina”, *Economía de la Energía ICE*, núm. 842, 2008. pp. 117-118.

⁵⁸ JIMÉNEZ, J., “*La explotación petrolera...*” ob. cit., pp. 31-33.

⁵⁹ KAHALE, G., “The Uproar Surrounding Petroleum Contract Renegotiations”, *A Quarterly Journal for Debating Energy Issues and Policies*, núm. 8, 2010.

⁶⁰ *Ibid.* p. 4.

⁶¹ JIMÉNEZ, J., “*La explotación petrolera...*” ob. cit., p. 32.

⁶² KAHALE, G., “*The Uproar Surrounding...*” ob. cit., p. 4.

⁶³ ROMO, D., PÉREZ, F., JIMÉNEZ, R. V., “La industria Petrolera de Noruega ¿Experiencias aplicables en México?”, *Mundo Siglo XXI*, vol. 8, núm. 30, 2013. p. 51.

⁶⁴ JIMÉNEZ, J., “*La explotación petrolera...*” ob. cit., p. 31.

Norway had no experience in the exploitation of oil resources⁶⁵. Attracting international oil companies was both a necessity and a successful strategy⁶⁶. Nowadays, the country is one of the world leaders in oil exploration and production in deepwater. In this sense, another highlighted aspect of this model is the investment of research and technological development. Through various strategies, the Norwegian government has been tasked to support research and technological development in the oil industry, which has given the country a competitive advantage, especially for the development of deep water activities. The high level of technological development is due to engagement and interaction between oil companies, industry and research institutions. These advances have opened the doors to Norwegian industry, through its state-owned company, for operating in Brazil and the Gulf of Mexico, where oil deposits are located at great depth. In addition, the country also represents a role model to follow in relation to the distribution of economic benefits among the population. Private participation is regulated by the Petroleum Act of 29th November 1996 which gives companies exclusive rights to oil and gas exploration and production through tendering; in other words, companies become the owners of the oil produced. The rent from the petroleum industry in Norway includes taxes, exploration and production licenses and dividends from Statoil (state-owned oil company)⁶⁷. The tax burden on profits generated in the year per oil companies is a compound rate of 78%; an ordinary corporative tax of 28% and special tax on oil production of 50%⁶⁸. In order to ensure that oil revenues are used for the benefit of current and future population of Norway, the “Petroleum Fund” was created (now known as a Government Pension Fund-Global)⁶⁹. Indeed, the above mentioned Mexico’s Petroleum Fund for Stabilization and Development is inspired by the Norwegian Fund.

The outcomes of the explained models depend on the circumstances and background of each country. However, they can be taken into account in order to apply various strategies aiming to improve PEMEX performance in the worldwide oil sector, to foster research and technological development and not only production, to encourage technical and human capacities, to define the role of the State, to manage the oil revenues and to avoid socio-environmental conflicts.

⁶⁵ AASHEIM, A., “El modelo noruego,” *Reporte CESOP*, núm. 66, 2013. pp. 49-53.

⁶⁶ *Idem*.

⁶⁷ WILSON CENTER, “*A New Beginning for...*” ob. cit., pp. 15-16.

⁶⁸ AASHEIM, A., “*El modelo noruego...*” ob. cit., p. 51.

⁶⁹ ROMO, D., PÉREZ, F., JIMÉNEZ, R. V., “*La industria Petrolera...*” ob. cit., p. 58.

4. Mexico's unconventional oil and natural gas development

Even though Former Mexico's President Felipe Calderon's administration (2006-2012) rejected the unconventional hydrocarbons exploration project since it was considered unprofitable due to the high costs and complexity of extraction⁷⁰, the possibility to develop unconventional oil and natural gas fields is the most alluring part of Mexico's Energy Reform for large international oil companies. Before the Reform, the prohibition for private sector in exploration and production activities maintained a scenario that hampered the access to technology and increased the profitable of unconventional resources. Thus, in order to achieve a successful and profitable production, the constitutional reforms were needed to attract international investors that might provide the technology and assume the high cost of shale gas development. The major question surrounding Mexico's development of shale gas is: Does this development respond to external pressures or to the country's social demands?

Firstly, Mexico is among the top 10 countries with technically recoverable unconventional hydrocarbons resources⁷¹. According to the U.S. Energy Information Administration, technically recoverable shale resources, estimated at 545 Tcf of natural gas and 13.1 billion barrels of oil and condensate, are potentially larger than the country's proven conventional reserves⁷². The greatest known shale potential exists in the portion of the Eagle Ford shale that extends into Mexico's Burgos basin from South Texas. Shale gas resources might support the increase of natural gas reserves and production. Indeed, SENER highlighted the role of shale gas in order to ensure gas supply in the long-term and, moreover, it pointed out economic benefits as job creation, investments attraction and greater energy sector competitiveness.

In this sense, the rapid production and relevant effects of shale gas –especially in the U.S. - has drawn international attention. Several countries have taken the first steps to develop these unconventional sources. In fact, the shale gas development was already included in the Mexican National Energy Strategy 2012-2026. Notwithstanding, President Peña Nieto's proposal showed great willingness to trigger the potential of these resources. In the proposal, the drilling permits granted to develop unconventional oil and natural gas fields in the U.S. and Mexico were compared: while 9,100 permits were granted to 170 companies in 2012 in the U.S., in Mexico only 3 were granted⁷³. Moreover, the

⁷⁰ GONZÁLEZ, E., “Hallazgo de Petróleo...” ob. cit., p. 38.

⁷¹ EIA (b), “Mexico...” ob. cit., p. 9.

⁷² EIA, *World Shale Gas and Shale Oil Resource Assessment*, US Energy Information Administration, Washington, 2013. Ch. II

⁷³ PRESIDENCIA DE LA REPÚBLICA, “Iniciativa de Decreto por...” ob. cit., p. 3.

President highlighted that, in the U.S., the shale gas production increased 8 times since 2000 until nowadays and it represents roughly 40% of the whole natural gas in that country⁷⁴. This development and its benefits have been used to hype the shale gas production in Mexico. Currently, only seven wells have been drilled, with two not commercially productive, three dry gas producers, two gas and condensate producers and only one successful as an oil and gas producer⁷⁵. Regarding this, U.S. companies - as EOG Resources, Chesapeake and ConocoPhillips - might have the greatest interest in these new opportunities in Mexico's energy sector. Moreover, Mexico's shale gas resources might contribute to U.S.'s energy security strategy aiming to achieve North America energy independence. The abundant production of natural gas allows the U.S. not only to reduce their dependence on other sources of supply, but also to become a gas exporter⁷⁶.

The Reform considers all the possible economic benefits through shale gas production, but it leaves aside the socio-environmental matters that this activity involves. The impact that the hydraulic fracturing (*fracking*) –technique used to drill natural gas and oil underneath the ground – entails, especially on water resources must be highlighted. On the one hand, this technique requires vast amounts of water, roughly five million gallons per well⁷⁷. For this reason, the hydraulic fracturing seems not feasible since most of these unconventional resources are located in the northeast regions in Mexico where there is considerable water scarcity⁷⁸. On the other hand, water pollution linked to fracking also influences the environment and affects human health; this has led to social conflicts in several states in the U.S. Finally, this technique produces huge amounts of methane gas, which is a big contributor to the greenhouse effect. According to HOWARTH et al., (2011, p. 679), “the methane emissions from shale gas production are at least 30% more than and perhaps more than twice as great as those from conventional gas. The higher emissions from shale gas occur at the time wells are hydraulically fractured and during drill out following the fracturing”⁷⁹.

⁷⁴ *Idem*.

⁷⁵ LOZANO, J. R., “The United States experience as a reference of success for shale gas development: The case of Mexico”, *Energy Policy*, núm. 62, 2013. p. 72.

⁷⁶ VARGAS, R., BARRIOS, H., “El impacto geopolítico de la revolución del gas de esquisto: consideraciones para México”, *El Cotidiano*, núm. 177, 2013. p. 66.

⁷⁷ LAUBE, A., *Chale con el gas shale*. Greenpeace México A.C., México, D.F., 2012. pp. 5-6.

⁷⁸ LOZANO, J. R., “*The United States experience...*” ob. cit., pp. 70-80.

⁷⁹ HOWARTH R. W., SANTORO R., INGRAFFEA, A., “Methane and the greenhouse-gas footprint of natural gas from shale formations. *Climate Change*”, vol. 106, núm. 4, 2011. p. 679.

VI. CONCLUSION AND POLICY IMPLICATIONS

The Energy Reform might help to overcome the important challenges that Mexico's energy sector is facing, among them: fossil fuel production and reserves falling, an increase in energy demand and a lack of investment in technology development. It might also promote the transition to a cleaner energy model, less dependent on fossil fuels with higher participation of renewable sources. However, even if the Energy Reform could represent the path to overcome the above mentioned challenges, it seems that the efforts are more focused on the economic growth through the foreign direct investment than in the transition to a more environmentally friendly energy model.

In this sense, it must be recognized that the Reform contemplates steps towards a more sustainable energy model, for instance: the creation of the National Agency for Industrial Security and Environmental Protection of the Hydrocarbons Sector, as well as the promotion of developing geothermal resources. However, these are minimal efforts when taking into account that cleaner energies, which may be an alternative to the country's energy sustainability, are not fostered as fossil fuels. Moreover, the Reform puts great emphasis on unconventional hydrocarbons resources (shale gas through *fracking*), omitting the claims that fracking has raised concerning the socio-environmental conflicts that it entails.

The Reform emphasizes the need for making maximum profit from the national resources through opening up the energy sector for private investment. In this sense, the exploitation of mature fields, deep-water and unconventional resources might represent greater private investment for the country. Through the Reform, not only are expected incomes related to the exploitation of these resources, but also from the taxes from private corporations on up and down-stream operations. Notwithstanding, in relation to the opening-up of the energy sector to private companies, the international experience has shown a wide range of results from which Mexico must learn. In addition, beyond the economic benefits, the potential socio-environmental conflicts that might be derived from the private investment carried out by multinational corporations should also be taken into account.

So far, the Reform is at an early stage. At the moment these lines were written, the secondary legislation to regulate the constitutional reform in the energy sector was approved by the Congress and the term to choose the fields that PEMEX desired to maintain in order to continue the extraction or exploration elapsed. The following phases of the Reform might be decisive for the future of Mexico's energy industry and will be crucial in determining

whether the Reform really promotes energy diversification and a more sustainable energy model.

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