Sino-Mexican Energy Cooperation Opportunities in the Crude Oil Sector in the Context of Energy Reform

Oportunidades de cooperación energética entre China y México en el sector petrolero en el contexto de la reforma energética

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Abstract

This paper analyzes the possibilities of improving Sino-Mexican energy cooperation in the context of Mexican energy reform. To do this, we divided the article into two sections. The first section concerns opportunities for Sino-Mexican energy cooperation considering the economic and energy status of Mexico and its relationship with energy reform. The second section analyzes the challenges of Sino-Mexico energy cooperation in three areas: competition

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between international energy enterprises, domestic factors in Mexico and the uncertainty of the international energy market. This paper concludes with several suggestions for promoting Sino-Mexico energy cooperation.

Keywords: China, Mexico, energy cooperation, energy reform, crude oil.

Resumen

En este artículo se analizan las posibilidades de mejorar la cooperación energética entre China y México en el contexto de la reforma del sector energético mexicano. Para ello, hemos dividido el artículo en dos secciones. La primera se refiere a las oportunidades de cooperación energética chino-mexicana teniendo en cuenta la situación económica y energética de México y su relación con la reforma energética. En la segunda sección analizamos los retos de la cooperación energética entre China y México en tres áreas: la competencia entre las empresas internacionales de energía, los factores internos en México y la incertidumbre del mercado energético internacional. Este documento concluye con varias sugerencias para promover la cooperación energética entre China y México.

Palabras clave: China, México, cooperación energética, reforma energética, petróleo.

Introduction

In December 2013, the Mexican Congress approved a series of constitutional amendments which ended the 75-year state oil monopoly and opened up oil and gas exploration and production to foreign investment. In August 2014, the Mexican president Enrique Peña Nieto signed into law a comprehensive energy reform with the aim of radically transforming the hydrocarbon and electricity sectors in Mexico (Villiers, 2014). The federal government hoped that this reform would benefit Pemex and improve both productivity and competitivity.[4]

4. Pemex, the state oil company, was founded in 1938. It is engaged in the exploration, production, transportation, refining, storage and sale of hydrocarbons and their derivatives. Its products include petrochemicals, natural gas, liquid gas, sulphur, gasoline, kerosene and diesel. Pemex operates the following: 454 production fields, 254 offshore platforms, 19 LPG distribution terminals, six refineries, eight petrochemical complexes, over 9,000 production wells, over 7,000 km of gas pipelines and more than 4,700 km of oil pipelines. It also operates more than 10,400 service stations throughout the country (BNAmericas, 2016).

In this context the general landscape of the energy sector in Mexico looked promising. By 2014 it was the world's ninth-largest oil producer, extracting 2.8 million barrels per day (Carpenter, 2015). In addition, it has proven crude oil reserves of 9.812 million barrels (CIA, 2016), the seventeenth largest reserves worldwide. Finally, Mexico's economy was the second largest in Latin America, with a GDP in 2014 of 1.295 billion dollars and GDP growth of 2.2% (World Bank, 2016). It can be seen therefore that Mexico is a key player in the energy sector, and energy reform was considered a unique opportunity to further boost economic growth.

Despite all of the above however, the collapse in oil prices soon dampened initial optimism, and is currently the economic factor causing the most concern and uncertainty in the current international scenario. After reaching a peak of US $105.79 in June 2014, WTI oil prices fell sharply to settle below $60 in December of that year. During 2015 prices continued to fall, ending the year at around $49 USD and beginning 2016 at below $40 USD. There is no certainty about what the limit of collapse will be, or when prices will begin to recover (Centro de Economía Internacional, 2016).

At the same time as the collapse in the price of oil, the outlook for Pemex was becoming bleaker. The total Pemex debt as of March 2013 was 61,000 million dollars, which almost doubled to 106,300 million USD when unfunded employee benefit liabilities are factored in. Meanwhile, pension liabilities amounted to 48.044 million dollars, 43% of total debt (Soto, 2013). Exacerbating an already difficult situation was the steady decrease (since 2005) in Mexican oil production caused by natural production decline from the Cantarell and other large offshore fields. The rate of total production decline however has slowed in the past several years from 3'475,830 barrels per day in 2004 to 2'561,860 in 2013 (EIA, 2015a).

Due to an adverse international context and structural flaws within the company therefore, Pemex may need an injection of new capital in order to exploit recently-discovered deep-water oil and shale gas deposits. In addition, Pemex has not yet capitalized on legislation allowing the company to create joint ventures to boost production in areas where it currently has no technical capacity to do so, such as in deep-water fields. Its six refineries have deteriorated as the company has both postponed maintenance and failed to invest sufficient resources to modernize the plants. This has led Mexico to become increasingly dependent on fuel imports, especially from the United States.

In the words of José Antonio González Anaya, the Pemex CEO: "If Pemex can't find partners [...] we are going to be in deep trouble" (Williams, 2016).

As Pemex is currently under significant pressure to find partners to help resolve its problems, we suggest that energy cooperation with China may be an option as China has extensive experience in energy cooperation activities in different parts of the world. In fact, there has been some form of energy cooperation between China and Latin America dating back to the beginning of the 1960's (Sun, 2013). In addition, China has important crude oil companies with sizeable international oil and gas exploration and production operations, as well as petroleum and chemical processing, storage and transportation, and other functions related to the oil supply chain. The Chinese search for oil markets and diversification of suppliers could also help Pemex to diversify its exports, and we therefore suggest that cooperation between the Mexican and Chinese Governments in the energy sector could be a good opportunity to build a win-win relationship.

We have organized this article into three sections. First, we analyze the opportunities for Sino-Mexico energy cooperation by considering the factors on which such cooperation could be based and the attendant advantages which would accrue from such an agreement. Second, we analyze the challenges for such cooperation, ranging from competition between international energy enterprises to domestic factors and the uncertainty of the energy reform. Finally, we conclude with several suggestions which could be used to promote Sino-Mexican energy cooperation.

1. Opportunities for Sino-Mexico energy cooperation

1.1. Economy and energy status of Mexico

Oil has been vital for the development of the Mexican economy (Medlock and Soligo, 2011). The history of Mexico shows how the production oil and the expectation of economic success have gone hand in hand. Oil therefore is not only seen as important from an economic standpoint, but is also a fundamental element upon which the political and social system is based. In fact, for some time oil was significantly related to nationalism; the idea that oil belongs to the Mexican people played a key role in the legitimization of the Mexican bureaucratic elite.

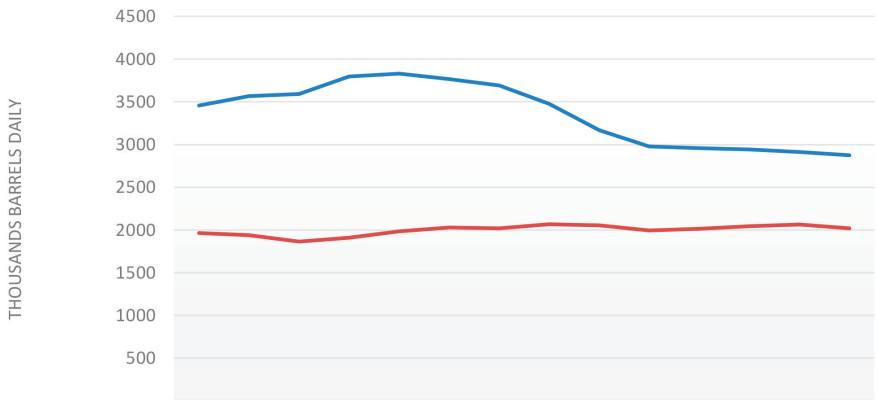
Sino-Mexican energy cooperation can be an opportunity to strengthen the capacities of Mexico as global actor in the oil sector

Mexico is currently the tenth largest producer of petroleum in the world and the fourth largest producer in the Americas after the United States, Canada, and Brazil (EIA, 2015b). Worldwide it is at 17th place for size of oil reserves, with approximately 11.1 billion barrels (Seelke, Ratner, Villareal and Brown, 2015). Oil therefore is a critical component of Mexico's economy. The oil sector generated 11% of the country's export earnings in 2011 and income from the oil industry —including taxes and direct payments from Pemex (EIA, 2015a)—. In 2014 total energy consumption in Mexico consisted mostly of petroleum (45%), followed by natural gas (40%) (EIA, 2015a).

Most oil production in Mexico —75%— is based offshore in the shallow waters of the Bay of Campeche. It is concentrated in two fields: Ku-Maloob-Zaap and Cantarell, with production in the former rising steadily since 2006, reaching almost 864,000 barrels per day by the end of 2013 (Seelke *et al*., 2015).

On the whole however, oil production in Mexico declined by approximately 20% between 2005 to 2009, with production falling by roughly 1% per annum since this period (Seelke *et al*., 2015). If we look at the bigger picture, we can see that primary energy production in Mexico diminished by an average of 0.3% per year between 2000 and 2011, while energy consumption grew by 2.08% per annum on average during the same period. If these trends continue, by 2020 Mexico will no longer be self-sufficient in terms of energy and will be dependent on external resources (Bonafé, Beltrán and Neira, 2016). Although investment in the exploration and production of hydrocarbons increased from $4.5 billion USD in 2000 to $15 billion USD in 2012, oil production reached a peak in 2004 (almost 3.5 million barrels per day) and by 2012 had decreased to 2.5 million barrels per day. At the same time proven oil reserves also fell, from 20 billion barrels of crude oil in 2003 to 13 billion barrels in 2012 (Bonafé *et al*., 2016). The decline in oil production has had a significant impact both on the country's economic output and the government's fiscal strength (EIA, 2015a).

Figure 1
Oil Production and Consumption in Mexico, 2000-2015



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Production	3456	3568	3593	3795	3830	3766	3689	3479	3165	2978	2959	2940	2911	2875
Consumption	1965	1939	1864	1909	1983	2030	2019	2067	2054	1996	2014	2043	2063	2020

Source: British Petroleum (2016). *Thousand barrels daily*.

Figure 1 shows that crude oil production has not upgraded as progressively as the total primary energy supply. This implies that the demand for oil is growing, but also suggests a diminishing capacity to export energy and make a profit. The statistics show therefore that Mexico is decreasing its capacity as a net exporter of oil in order to cover domestic requirements (Bonafé *et al*., 2016).

This was therefore the context in which the 2013 Constitutional Energy Reform was passed. This reform has redefined the institutional and legal framework of the sector and confirmed national ownership of subsurface hydrocarbons. In 2014 legislative work concluded with the approval of 21 laws and 26 regulations that define the roles and responsibilities of all stakeholders, as well as the rules under which public and private companies will develop projects in the multiple sub-sectors of the industry (Melgar, 2015). After many decades of having a market closed to private initiative and foreign investment in the energy sector, Mexico has decided to admit foreign capital, knowledge and technology to boost the potential of its energy sector. Under a framework supported by the energy reform, the Mexican government has established a new regime for the participation of private companies in

the hydrocarbon and electricity markets. According to Bonafé *et al*. (2016) these reforms are fundamental for the development of deep-water deposits, unconventional hydrocarbons, and for the modernization and expansion of both infrastructure and the electricity market. As a consequence, Mexico is changing the energy model from a state monopoly, with a view to becoming more competitive and efficient on the open market and generating opportunities for domestic and international public and private investment. This transformation aims to facilitate access to the technologies and capital required to optimize Mexico's natural resources, and establishes schemes that foster the development of new value-chains (Melgar, 2015). However, energy reform has a long way to go before these goals are reached, a particular challenge being the establishment of a regulatory structure and appropriate government agencies to regulate the sector. The aim of this is to foster better access to finance and technology and develop the human resources necessary for the field to have the workforce it needs. It is anticipated therefore that the reform will help develop the nation's potential to become a key non-OPEC producer and exporter, given Mexico's significant resource base (EIA, 2015a).

The paradox is that although Mexico is a traditional exporter of refined petroleum products, the country is a net importer of gasoline, diesel, jet fuel, natural gas, liquefied petroleum gas and petrochemicals. We consider therefore that Sino-Mexican energy cooperation can be an opportunity to strengthen the capacities of Mexico as global actor in the oil sector.

1.2.1. Progress of Sino-Mexico energy cooperation

Since the implementation of the "going out" strategy, the main three Chinese energy companies have begun to work more frequently with their Mexican counterparts. For instance, the Bureau of Geophysical Prospecting Inc., and the China National Petroleum Corporation (BGP) began working in Mexico in the 1990s, providing local oil companies with technical engineering services (Sun Yu, 2015). As a result, both Mata Verte, a three-dimensional seismic prospecting project, and the Petenciales BGP project enjoyed significant achievements. The Vibroseis efficient acquisition technology used in the Petenciales project improved construction efficiency by about 50% (CNPC, 2013a). China Oilfield Services Limited (COSL), an offshoot of the China National Offshore Oil Corporation, entered the Mexican oilfield service market in 2006. It provided module rigs which made significant cost savings

as well as improving efficiency, both of which were significant benefits for Petróleos Mexicanos (Pemex) (COSL, 2015). In 2007, Shengli Oilfield Co., Ltd., a subsidiary of Sinopec, won the bidding for a technical service project responsible for the construction of 300 directional and horizontal wells in Mexico (SLDT, n/d). In December 2012, the Petroleum Exploration and Development Research Institute, Sinopec and jointly-funded DS Oil Company cooperated on the EBANO project to develop technical support and conduct exploration operations. In addition, a comprehensive service project agreement was created, with a contract area of 1,584.6 km^2 and contract term of 30 years *(Sinopecnews,* 2012).

Prior to the energy reform legislation however, the Mexican energy market was completely closed. According to constitutional provisions at that time, there was a ban on the involvement of foreign capital in the exploration, development and refining of Mexican oil and gas resources, and foreign-owned enterprises were restricted to the provision of services. As a result, prior to the reforms there was very limited scope for any kind of cooperation in the field (Sun Yu, 2015).

After the reform of the sector foreign companies had the opportunity to invest in Mexico. The Chinese and Mexican governments were able to quicken the pace of energy cooperation through active collaboration, with Pemex agreeing to export oil to China through the China International United Petroleum & Chemicals Co., Ltd in April 2013. During Mexican president Enrique Peña Nieto's visit to the annual Boao Forum for Asia meeting in 2013, the company also signed a memorandum of petroleum cooperation involving technology, development and personnel training with the China National Petroleum Corporation (CNPC) (National Energy Administration, 2013b). A two-year agreement was also signed, with Pemex agreeing to raise the number of barrels of crude oil exported to China from 50,000 to 900,000 barrels monthly. Emilio Lozoya, Pemex CEO, said: "It is the first long-term agreement signed by our company with a Chinese company, which is a significant milestone", and "As a part of the agreement, the export volume of oil to China will gradually increase over time" (Huang Ye, 2013). In addition, Pemex has signed a memorandum of cooperation with Xinxing Cathay International Group Co., Ltd., with both sides hoping to conduct extensive strategic cooperation and establish a cooperation framework (The State Council, P. R. China, 2013). In the same month the Sinopec Geophysical Company (Zhongyuan Branch) won the bidding for the DS Company two-dimensional seismic acquisition project;

the first time the Sinopec geophysical prospecting team entered the Mexican market (SXCOAL, 2013).

During the Chinese President Xi Jinping's visit to Mexico in June 2013, China and Mexico signed a United Nations statement. Energy cooperation between both sides was listed in the content of the statement and the scope of cooperation was further expanded. In May the following year the Sino-Mexican Energy Fund was set up. Viewed as a nationally-strategic project, its objective was to provide financial investment services for China in the field of Mexican energy and had a subscribed capital totaling 5 billion dollars. Of this amount, 80% came from the Xinxing Cathay International Group Co., Ltd. and the rest from Pemex, with the Export-Import Bank of China and the People's Bank of China also involved in the project (Zhao, 2015). In November 2014 the China National Offshore Oil Corporation and Pemex signed a memorandum of understanding on cooperation in Beijing, witnessed by the Chinese President Xi Jinping and Mexican president Peña Nieto (CNOOC, 2014).

1.2.2. Advantages of Sino-Mexico energy cooperation

a. Good political relations

On February 14th, 1972, China and Mexico issued a joint communiqué. Over the next few decades, Sino-Mexican relations developed smoothly, and in December 2013, Chinese Premier Wen Jiabao paid a visit to Mexico. Both countries went on to establish a strategic partnership, with an inter-governmental standing committee being set up in August 2004. In July 2008 Felipe Calderón Hinojosa, the president of Mexico, visited China; subsequently both heads of state jointly announced the establishment of the Sino-Mexican strategic dialogue mechanism. After the China-friendly Institutional Revolutionary Party was returned to power, Sino-Mexican relations developed further (Lei and Yin, 2014), and in April 2013, Mexican president Peña Nieto attended the annual meeting of Boao Forum for Asia for talks with Xi Jinping. This was the first time he had visited China as president and a pivotal point in the promotion of Sino-Mexican relations. As previously mentioned, the two nations reached several mutually-beneficial agreements during the Mexican president's visit to China. Two months later Xi Jinping paid a state visit to Mexico at the invitation of the president, the first state visit received by Peña Nieto since his inauguration. Both sides signed *Joint Declaration of the People's Republic of China and the United States of Mexico* in Mexico City and agreed to

elevate Sino-Mexican relations to a comprehensive strategic partnership. A significant part of the agreement involved energy cooperation. On the eve of G20 Summit on September 4, 2013, the two leaders attended a meeting which ended with the signing of a treaty and declared the formation of a high-level investment-related working group jointly led by the Mexican ministers responsible for Finance and Public Credit and the director of China's National Development and Reform Commission (Ventura, 2014). From August 5 to August 6, 2014, Xu Shaoshi, the director of the Chinese National Development and Reform Commission, led a high-level delegation to Mexico City and co-chaired the first round of meetings for the high-level working group with the Mexican ministers of Finance and Public Credit. The Mexican Energy Secretary and the leaders of Pemex and the China National Oil Corporation also attended this meeting, with both sides reaffirming their commitment to cooperation within their industry. The improvement in Sino-Mexican relations has also brought a new dawn for energy cooperation in recent years, with good political relations between both nations closely related to their good relations in the field of energy.

b. Fast-developing economic and trade relations

Chinese-Mexican bilateral trade has seen a significant increase since 2000, with total trade volume reaching an annual growth rate of 34.6% at its highest point. In subsequent years the growth rate has been maintained at over 20%. Bilateral trade declined for a short time after the subprime mortgage crisis in the US, but rebounded strongly in 2010 (Guo Delin, 2011). In 2014, China surpassed Canada as Mexico's second-largest trading partner, second only to the US. It is currently the third largest export destination and the second-largest importer of Mexican resources (Xia and Li, 2015). According to Chinese customs statistics, the total volume of trade between China and Mexico in 2015 was 43,854'000,000 USD. The total value of goods imported by China from Mexico was 10,061'000,000 USD, with the total value of goods exported by China to Mexico being 33,793'000,000 USD (China Customs, n/d).

c. Mutually beneficial and win-win energy cooperation relationship

There are currently several areas in the energy industry in which both nations cooperate and from which mutual benefit is derived. After reform, Mexico needs a good deal of foreign investment as well as technical support and know-how. Since implementing the "looking outwards" strategy, Chinese energy

companies have boldly exploited overseas markets (including in the US), and have gained significant experience in international operations. Traditionally most Mexican crude oil has been exported to the United States. However, US oil and gas production has increased in recent years, and this has had significant consequences for Mexican oil revenues. It is therefore extremely urgent for Mexico to look for new export markets, and engaging in energy trade with China contributes to satisfying this need for export diversification.

Secondly, in the field of energy production, there is great potential for both sides to cooperate in order to enhance oil recovery in old fields and for land exploration and development projects. In Mexico exhausted oil fields still have an important role in the energy industry as most have not been involved in enhanced oil recovery technology. There is in fact great potential for enhanced oil recovery, and, subsequent to the energy reform, enhancing recovery from old fields has become increasingly important. Chinese companies can make use of their expertise in this area to successfully do business in Mexico (Zhu Yingchao and Guo Yao, 2015).

Thirdly, Mexico is considered "a country floating on the oil sea". However, the country has a weak refinery capacity; a number of refineries are in dire need of funds to update old equipment and upgrade infrastructure and require new techniques to improve their refinery capacity, a requirement which Chinese companies are well able to provide. From a political standpoint, cooperating with Chinese energy companies can "make those who are afraid that the field of open energy will be controlled by America feel better" (Yuan, 2013). From a geopolitical perspective, Mexico is an important actor both for United States and China because occupies a strategic position on the continent. Pemex has significant debts and the level of production in established oilfields is in decline. As the sector has previously been starved of funds both maintenance of equipment and new exploration and development have been impeded. Chinese companies with solid financial resources can make a big difference to the future of Pemex.

China is the world's largest energy consumer. Cooperating with Mexico not only contributes to realizing energy import diversification and ensuring national stability, but also helps to "open the channel of North America-South America, allocate regional resources and perfect the strategic layout of energy companies in America" (Lei and Yin, 2014).

2. Challenges: Domestic Factors

2.1. Fierce international competition

After Mexico opened its energy industry to outside investment, many countries began to express an interest in involvement. The consequence of this is that China faces significant international competition, and, in the eyes of some scholars, it is debatable whether or not Chinese energy companies entering Latin America have the capacity to challenge the trade and investment activities of Europe and the US (López, 2014). Developed western nations have important ties with the energy industry and long-standing cooperation with Mexico. For example, the Spanish Ray Pschorr Company currently holds 9.5% of Pemex shares (Wang, 2013). In addition, the geographical proximity of the US gives it a significant geopolitical advantage in the Mexican energy market. Due in part to their geographical proximity, both the energy market and politics of the US and Mexico are highly connected. The US has been constructing a North American energy security system (Sun, 2014), and even before the energy reform the Mexican refinery industry and energy trade relied heavily on the US, despite the fact that US energy companies could not be directly involved in the exploration and development of Mexican oilfields. At the same time as Mexico discovered significant oil deposits in the Bay of Campeche Back in the 1970s, the US Congress was conducting an investigation into the extent of Mexican oil reserves, crude oil output and output service life (Ding Yi, 1982a). The report clearly showed that energy would become the focus of US-Mexican relations and noted US interest in Mexican oil and gas resources, along with a desire to eliminate US dependence on Middle Eastern oil by exploiting Mexican resources (Ding Yi, 1982b). After Mexico's significant oil wealth was confirmed, the country was elevated by the US to priority foreign country status on its diplomatic agenda, and the US government subsequently began to work actively with its neighbor to actively operate and establish a bilateral energy cooperation mechanism in order to ensure its own energy supply. During the North American Free Trade Agreement (NAFTA) negotiations, both sides were unable to reach an agreement on the issue of energy. Although negotiators finally made some concessions, ultimately "Mexico stands its ground of maintaining sovereignty in principle" and the US failed to open the door to Mexican energy (Chen, 1993). However, with the current energy reform, China and other countries

can search for its own niche in the Mexican oil sector. In fact, China National Offshore Oil Corporation (CNOOC), won two blocks to explore offshore fields in December 2016 with other international companies as Exxon Mobile and Chevron. As Malkin and Krauss argue, CNOOC has a strong presence in Latin America and could become a big player in Mexico (Malkin and Krauss, 2016).

Despite the failure of US negotiators at the NAFTA talks to reach the desired outcome in relation to energy, the US continued to pay close attention to ongoing changes in the Mexican energy sector and continued to actively seek cooperation, and in 2010 bilateral discussions was held on cross-border oil and gas development. In 2012 the US accurately predicted the return to power of the Institutional Revolutionary Party (Partido Revolucionario Institucional, PRI), a strong advocate of energy reform. When PRI won the election, Secretary of State Hillary Clinton signed the Agreement on Cross-border Oil and Gas Exploration in the Gulf of Mexico. The agreement was signed with Patricia Espinosa from the Mexican Foreign Ministry at an informal meeting of G20 foreign ministers, and created a legal framework for joint management of the Gulf of Mexico and joint exploration of cross-border oil and gas resources. The agreement was ratified by the US Congress in December 2013, and, according to Pemex, implied 50% of Mexican oil reserves. Some scholars argued that the signing of this agreement meant that Mexico gave the green light for foreign countries to exploit oil in Gulf of Mexico (Zhang and Zhang, 2013). After Peña Nieto decided to carry out the energy reform, the immediate response of US was to release an assessment report of its effects on the long-term energy security of the US. The report viewed Mexican energy reform as a part of the energy security of the North American continent in general and the US in particular, and advised Congress to seize the opportunities in the agreement due to both bilateral interests and the strategic value of Mexico to the US (CNPC, 2013b). Mexico responded favorably to US overtures for cooperation, and immediately after taking office the newly-elected Mexican president held talks with his US counterpart. Subsequent to the meeting an article was published in the *Washington Post* stressing that the focus of US-Mexican relations should be shifted from drug crackdown and security assurance to economy and trade (Zhang and Zhang, 2013). It can be seen therefore that there is significant motivation towards cooperation on both sides.

From a political point of view, the relationship between China, the US and Mexico is very complicated. Since the reforms which initiated the opening up of China the nation has witnessed rapid economic development and become

an important player on the international scene. After the collapse of the Soviet Union, the US began to consider China its main competitor. In recent years there has been a resurgence of US interest in the Asia Pacific: the US has actively promoted TPP and excluded China, with the aim of building hegemony in the process of establishing new trade rules. In terms of the relationship between Mexico, China and the US, the latter has to both acknowledge the existence of China and try to make a profit from the subtle trilateral relationship on the one hand, and maintain its leadership in the region on the other (González, Mendoza and Zhang, 2015). For the Chinese government, balancing the new relationship between its domestic interests and new model of global-power relations between China and the United States is an important challenge. In the eyes of Mexico, China is certainly could be a good partner for cooperation in the energy field, although the main goal is the development of economic and trade relations rather than political relations (López, 2014). At the same time however, the position of the US also needs to be considered.

As for energy companies, US companies with international interests not only enjoy the benefits of a favorable geographic position, but also cast a shadow over the development of Chinese energy companies in Mexico due to their competitiveness. The open resources of Mexico are mainly deepwater and shale gas projects and Chinese energy companies do not have significant experience in deepwater exploration and development. In addition, the two kinds of projects have great technical difficulties and high risks, giving those western countries represented by the US a greater chance of success. Compounding the issue is the geographical distance separating China and Mexico: oil and gas transportation security and costs between the two cannot compare with the advantage the US enjoys. The difficulties inherent in the desired incursion of Chinese energy companies into the Mexican market are only likely to be compounded by linguistic and cultural differences. In addition to the US, Canada, another NAFTA member, enjoys a relatively stable energy relationship with Mexico. Further afield Japan, lacking resources of its own, is also eyeing up the Mexican energy market, with Mitsui was awarded the US-Mexican cross-border natural gas pipeline construction project in April 2013 (Yuan, 2013). Mitsui were in competition with energy companies from India, another emerging economy looking to lessen its energy dependence on the Middle East and satisfy increasing demand by actively seeking out new sources of energy globally. When the Indian oil minister Dharmendra Pradhan visited Mexico in September 2014, ONGC Videsh, a wholly-owned

subsidiary of India's largest oil and gas developer ONGC, signed a memorandum of understanding with Pemex to cooperate in the upstream oil and gas industry (Wang Lin, 2014).

2.2.1. Anti-reformers and uncertainty of the energy reform

The current energy reform has been the most significant change in the Mexican oil sector since 1938, when President Lázaro Cárdenas nationalized oil. Since this time the oil industry has been a source of national pride in Mexico. In the collective imagination oil became property of all Mexicans, and for a long time a common slogan signifying social cohesion was "The oil is ours" (Doherty, 2015). Oil became the basis for national development (Vega y León, 2015).

Oil was considered emblematic of national sovereignty despite the overtures of transnational oil companies, and the idea of oil in Mexican hands became a source of national pride. Pemex was recognized as the most important Mexican company, not only due to its ability to compete internationally, but also because it was a world leader in the field. In addition, the oil boom experienced in Mexico in the late 1970's led to the belief that oil, the new source of wealth in the hands of the State, would be the key to overcoming poverty and achieving development. Although dreams of splendor vanished with the economic and financial crisis that hit Mexico in the 1980s, the idea that oil is an exclusive possession of the state remained unchanged.

In fact, prior to the adoption of the current energy reform, several governments expressed an interest in changing the status quo. However, the changes that were made proved insufficient and ineffective as the constitutional reform required for them to succeed was not forthcoming. The Constitution established that "underground wealth" belonged in its entirety to the nation, and the state was the only institution authorized to exploit and commercialize it. Any constitutional amendments therefore required the agreements of diverse and competing political forces.

In 2012 the election of Peña Nieto as president provided the requisite conditions for the launch of the long-awaited energy reform, with the main political parties signing the "Pact for Mexico". This document defined the plurality of Mexican society and that as diverse political parties had received a mandate from their respective electorates to represent them that diversity should be recognized by all. The document furthermore recognized that no

one political force could, alone, impose its own vision or single program on the country. The reforms that Mexico needed were impossible to undertake without a clear majority agreement; thus, the main political parties pledged to promote the structural reforms that the Mexican state required in order to boost economic growth in a globalized and competitive economic environment (Pacto por México, 2012). Reforms were subsequently forthcoming in the areas of energy, education, finance, telecommunications and labor. Energy reform however was regarded as the most significant of these due to its historical significance, as it was necessary that diverse political conditions be fulfilled due to the sensitivity of the issue.

In addition to the conditions outlined above, the decline and loss of competitiveness of Pemex alarmed the bureaucratic elite and inspired the reforms necessary to strengthen the Mexican energy sector. It was the congressmen therefore who agreed on the urgent need to transform the oil, gas and electricity sector in order to reverse the negative trends affecting Mexico.

Although Pemex is the second largest company in Latin America and among the largest oil companies in the world, three major factors have caused a significant decline in its fortunes (Samples, 2016). The first of these is the natural depletion of the large traditional fields like the Cantarell, which once was the richest deposit in the world. In 2004 however yields from the Cantarell field began a natural and predicted decline. In 2003 production from Cantarell represented 63.0% of the total national yield, while in 2010 it represented only 19.0% (Pemex, 2010).

The second factor relates to the excessive taxes levied against Pemex, which have hindered the company for decades (Samples, 2016). In real terms this means that the government has taken over 80% of operating profits in taxes and duties (Padierna, 2015). Among energy companies, Pemex ranks behind only Exxon Mobil in pre-tax profits, but falls to eighty-sixth place after taxes (Samples, 2016). In 2015 Pemex reported a negative cash balance of 146 thousand 856 million pesos as a result of this significant tax burden, despite reporting a positive balance of 732 thousand 852 million pesos before taxes and duties (Tapia y Barbosa, 2016).

The third factor is the lack of potential new sites capable of replacing the decline in production of the current fields, with most large deposits currently being exploited and a lack of new discoveries to replace them. In other words, there is no ascending curve of conventional and easy-to-reach deposits (Shields, 2015). In 2004, Pemex invested 12 billion dollars a year in

order to produce 3.4 million barrels of oil per day; in 2014 an investment of 24 billion dollars was necessary. Despite this investment, Pemex produced 33% less oil than 2004, and requires technology and investment that Pemex does not have (Shields, 2015). The company lacks not only the technology and capital necessary to develop deep-water resources but also the know-how (Samples, 2016).

Not only was there a lack of agreement among political actors about the urgent need to modernize Pemex, there was also no consensus about how such modernization should be carried out. Within the country an intense debate about the future of the energy sector divided society. Some politicians proposed that a referendum was needed to validate this reform. The case was however subsequently denied by the Supreme Court.

Those who argue against energy reform have diverse reasons for doing so. Among these are that the aggressive strategy of oil extraction behind the reform is itself driving the rapid depletion of reserves, or that there is a lack of focus on raising the productivity of the economy in general. Others argue that the tax burden on Pemex should be increased, foreign investment in general should be encouraged, outward wealth-flow and income inequality should be addressed as should the encouragement of saving among the population and the development of poverty-reduction strategies (Saldaña, 2014). In short, as pointed out by Senator Dolores Padierna, the principal opposition to energy reform focused on the possibility that Mexican hydrocarbon resources were controlled by multinational companies (Padierna, 2015).

In this context, energy reform has been an important step forwards in the modernization of the Mexican economy. However, there are some elements of risk that could prevent the reform being successful. In our opinion, the most important of these are the following:

a) The decline in oil prices. In 2012, when the Pact for Mexico, providing the consensus necessary for commencing the energy reform was announced, a barrel of Mexican oil was selling for $101.96 USD. Since then the price has collapsed, reaching its lowest level in January 2016 when the price was $23.91 USD. Although there are prospects for an increase in price, in the medium term it is unlikely that this will top $50 USD. Obviously, in an oversaturated market, Mexican oil becomes less attractive and the possibility of finding partners for Pemex will be more complicated.
b) The inescapable fact is that in the future, producing a barrel of conventional oil will be more expensive, even with better technology. The reality

is that easy and cheap access to Mexican oil is a thing of the past: it will become increasingly expensive to obtain. If financial conditions are not attractive, it is hard to imagine how energy reform will be able to generate investment in the sector. So far, tendering for oil-field exploration and exploitation has not failed to attract interest, and as yet, world-class multinational companies have not participated as expected in the two tenders promoted by the government.

c) The need to create a highly skilled workforce, with international standards, in an industry capable of developing its own technology to take advantage of the new benefits brought by energy reform. It is estimated that the energy sector will create 212 thousand new jobs, both directly and indirectly (Notimex, 2015). Many of these jobs will require highly skilled people. However, there is uncertainty about whether Mexican universities are prepared for this not inconsiderable challenge.
d) In recent years, the Mexican population has grown at a rate of 1.7% per annum, with the economy expanding by an annual average of 3%: both of these increases exceed the growth of the oil sector. In fact, as previously mentioned, oil production in Mexico is declining and there is a risk that in the medium term the country will become a net importer of oil.
e) Finally, in order to generate a climate of trust and commitment to progress in the goals of the reform it is necessary to strengthen the constitutional framework to improve transparency and accountability and aggressively promote the adoption of vanguard anti-corruption practices.

2.2.2. Influence of the political environment

Enrique Peña Nieto was not the first Mexican president to advocate energy reform. The previous president, Felipe Calderón Hinojosa, submitted the energy reform scheme to Congress in 2008, but at that time the scheme did not involve amending the Constitution (IEA, 2014). The reform advocated by Peña Nieto had ramifications for the entire nation due to its unprecedented intensity, wide scope and long-term vision of Mexico's future. The implication therefore is that the domestic political environment of Mexico has a direct bearing on whether or not Chinese energy companies will see Mexico as a stable investment option.

The first consideration is whether or not both the President and parliament support energy reform. Mexico is a federal Presidential Republic, and

the legislative, judicial and administrative powers are separate. The federal parliament, composed of the Senate and House of Representatives, wields legislative power and is mainly concerned with supervising treaty ratification and presidential appointment of senior officials in the courts, financial sectors, diplomatic service and army. It also oversees amendments to the Constitution, approves presidential visits to foreign countries, appoints a provisional president when necessary, etc. The president holds the highest administrative power, and is directly appointed as the head of state and government by a general election. The office of president is limited to a six-year tenure which cannot be extended. As an administrative organ of the government, the cabinet is directly led by the president. The different Mexican states draw up their own constitutions, but state governments are bound by national fundamental law. It can be seen therefore that reform of the energy sector is a long process requiring different legal provisions. Though both the constitutional amendments and secondary legislation necessary to allow the reform to take place have been completed, whether or not the president and parliament will continue to make concerted efforts in the future to promote it to the extent required, as they have previously committed to doing, remains to be seen.

At present, the largest three political parties of Mexico are the Partido Revolucionario Institucional (PRI), the Partido Acción Nacional (PAN), and the Partido de la Revolución Democrática (PRD). Peña Nieto is a member of the PRI, which not only supports energy reform but holds more seats in both the House of Representatives and Senate: 207 and 52 respectively, than the other parties. When added together however the sum of seats belonging to the PAN and PRD is greater than that of the PRI. In the early days of the reform Peña Nieto encountered issues due to differing political opinions. However, he was initially able to ally successfully with the PAN, although the PRD strongly opposed energy reform. This being said, there were considerable disagreements within the PRI about the constitutional amendments required for the reform to take place, and ultimately these contradictions delayed the process (National Energy Administration, 2013a). During the process of formulating and passing secondary legislation, Peña Nieto ran into similar problems. The PAN wanted to first solve the issue of electoral reform, while the PRD was adamantly opposed to energy reform; this ultimately meant that passing the legislation was a long-drawn out and convoluted process. The next presidential election in Mexico is due to be held in 2018, and whether or not

the new incumbent will be such an outspoken proponent of energy reform and gain the support of parliament remains to be seen.

More importantly, the smooth progress of energy reform depends upon the support of the population. According to a survey carried out by the strategic consulting company Vianovo, while a quarter of Mexicans considered energy reform the most important issue currently facing the state, only a small majority of people supported it (O'Neil, 2013). Up to 40,000 people attended a protest in Mexico City on August 31, 2013, hoping to block approval for the secondary legislation necessary for the reform to take place. Cuauhtémoc Cárdenas, the founder and spiritual leader of PRD, also took part in the demonstration. This was particularly significant as he is the son of general Lázaro Cárdenas, a hero of the 1938 Mexican energy nationalization. The younger Cárdenas was pessimistic about the prospect of energy reform and shared the popular belief that the involvement of private companies would harm the nation's energy security. According to some scholars, such emotional resistance to privatization was ubiquitous throughout Latin America, where in general people prefer economic liberalization and welcome high-quality and inexpensive goods, but remain cautious about privatization. The reasoning behind this is that privatization generally heralds price rises for both power and communications (O'Neil, 2013). On December 1, the first anniversary of Peña Nieto's election win, a large demonstration once more took place in Mexico City against government policies, including energy reform. Andrés Manuel López Obrador, Peña Nieto's main rival, held rallies during the parade and encouraged those present to express their opposition to energy reform (Turchiano, 2013). Mexican citizens were afraid that energy reform would not only fail to solve the problems of Pemex but could also increase its tax burden. They did not believe that either the economy or living standards would benefit from energy reform, but that a resource belonging to the nation would be extracted from Mexico for use abroad (Alpizar-Castro and Rodríguez-Monroy, 2016).

Compounding the issue is the requirement to address the concerns of another interested body: the Mexican Oil Workers Union, the members of which would be directly affected by the opening up of the oil market. Workers fear that the entry of foreign companies into the sector would result in wage decreases and mass redundancies (McCrummen, 2013). As a result of the reforms introduced by Peña Nieto the union saw a loss of influence, impacting their bargaining position in relation to the significant pension issues which

both the government and Pemex are struggling to resolve. In addition, both the government and Pemex are keen to strike a deal on the reduction of labor costs in return for improved international competitiveness (Montes, 2015). Compounding the problem is the unwritten rule that the leader of the union should be a committed PRI supporter. This places them in the unenviable position of being obliged to support the reform even though it is against the interests of union members *(The Economist,* 2014). Meanwhile the problem is compounded by the fact that the government must negotiate against its union allies if any solution the Pemex debt issue is to be reached, risking losing a significant traditional supporter in the process. The government must succeed in balancing the interests of the different groups if the energy reform is to succeed. The issue will also have a direct influence on energy cooperation between China and Mexico.

2.3. Uncertainty of international energy market

The price of international crude oil has dropped dramatically since the autumn of 2014. The WTI crude oil price reached a peak (USD 105.79 per barrel) in June 2014, but the price continued to drop into 2015, hovering at around 49 USD per barrel. The price plummeted to 40 USD per barrel at the beginning of 2016 and despite a subsequent slight increase remained below 50 USD. Based on market analysis, various theories were put forward to explain the price fluctuation over this two year period. The three mainstream explanations of phenomenon were conspiracy theory, a mismatch in supply & demand and the appreciation of the US dollar.

Of the three explanations, the former was the most widely accepted and had two main arguments. The first of these maintained that the US was attempting to weaken the Russian economy by decreasing the price of crude and that Saudi Arabia was following the lead of the US. Saudi Arabia therefore helped to suppress oil and gas exporters such as Russia but also Iran in order to create for itself an advantageous position in the competitive US shale oil market, the ultimate intention being to stop production of shale oil and cut it out of the energy market. According to this line of thought the fall in the price of crude oil could actually be viewed through the lens of geopolitics as political problems extending into the field of international economics (Tang, 2014). Those who adhered to this particular conspiracy theory also connected the downfall of the Soviet Union with the recent decrease in the price of

crude oil, believing that the US had deliberately set out to weaken the Russian economy through artificial price-manipulation. The second conspiracy theory put forward a view that the root of plummeting crude oil price lay in Saudi Arabia, and that oil price war was in fact a competition between traditional and non-traditional energy. This version maintained that the depressed oil price was in fact a heavy blow to the US shale oil industry and that the US was not the actual planner of this conspiracy, but instead was the victim. Saudi Arabia's wealth however acted as a buffer against the depressed markets and allowed it to reach certain political and economic objectives. Saudi Arabia was able not only to cause significant difficulty for shale oil manufacturers, but it was able to dominate other geopolitical opponents —Iran and Iraq, as well as bolster Russian support for the Assad regime in Syria— (Energy web, *China Energy Newspaper,* 2014; Ifeng, 2015).

Although these conspiracy theories enjoyed some popularity, they were also subject to some criticism. Many academics argued that the mismatch in supply & demand in the international energy market was behind the oil price slump. From the perspective of supply, the development of unconventional fossil energy largely boosted crude oil output, and helped the US in the development of the fledgling shale oil industry. In 2014, the price of crude oil dropped dramatically, while US oil output hit a historical high (BP China, n/d). This not only altered the dynamic in terms of US dependence on oil imports but also caused the break-up of the original energy-market structure. In terms of demand, the emerging economies, as represented by China, were experiencing slowing growth while economies in developed countries were still suffering the effects of the subprime crisis, causing a corresponding downturn in the demand for oil. Regarding the mismatch in supply and demand therefore, the international energy market as a whole experienced an increase in supply and a significant decrease in demand, causing an overall fall in the price of crude oil.

The third mainstream explanation attributed the oil price slump to the appreciation of the US dollar. Proponents of this theory argued that the price of crude oil was calculated and settled in USD all the time; therefore the decrease in price must be closely connected with the position of the dollar. There were two main arguments supporting this opinion. The first argument was that the appreciation of the US dollar caused the slump in the price of oil, and that the two remained joined in a negative paradigm. The economic recovery in the US strengthened the dollar considerably, and this depressed

the USD price of international crude oil (Zhong, 2015). The second argument was related to the first of the two conspiracy theories: proponents of this argument maintained that the depreciation in the dollar was a direct result of currency manipulation by the US aimed at negatively affecting the Russian economy (Chen Wei, 2015).

The above analysis of the reasons behind the slump in the price of oil can be used to help forecast the influence that the fluctuating oil price will have on energy cooperation between China and Mexico. If the slump in the price of oil is due to a conspiracy between the US and Saudi Arabia, then Mexico will be collateral damage as it has higher oil extraction costs than Saudi Arabia with smaller reserves and thus is more vulnerable to the negative effects of cheap oil. A low oil price therefore will not help Mexico break into foreign energy markets, and, at the same time, the pressure exerted by oil-producing countries such as Saudi Arabia on non-conventional energy resources makes energy reform in Mexico even more difficult. At the same time, the pressure exerted on non-conventional oil & gas producing industries by such countries as Saudi Arabia creates unfavorable circumstances for the implementation of energy reform in Mexico, particularly when the reform involves bids from foreign energy enterprises. If traditional oil-producing countries such as Saudi Arabia insist that current output be maintained, then the exploitation of non-conventional oil & gas fields becomes a less attractive prospect for foreign companies.

If the reason for the substantial fall in the price of oil and gas is due to the mismatch in supply and demand globally, then it might be some time before Mexico is able to benefit from these resources. The latest prediction by BP is that in the medium-term demand for primary energy will continue to fall, particularly with the growth slow-down in non-OECD (especially China) countries which have recently experienced fast-growing industrialization and electrification. Growth in energy consumption is not predicted to take place before 2035 (BP China, n/d). However, OPEC countries such as Saudi Arabia insist on maintaining current output despite prices being at record lows, which will have a knock-on effect on other oil producing countries (Yu, 2015). If this situation continues, then the global mismatch in energy supply and demand will intensify, a situation which will influence enthusiasm for energy cooperation between China and Mexico.

If the reason behind the historically low price of oil is the appreciation of the US dollar, experts predict that this situation may continue for up to two

years due to the recovery of the US economy. From the beginning of 2014 to the beginning of May 2016, the dollar has continued its upward trajectory, a trend which has negatively affected emerging markets due to the collapse of the Bretton Woods System. Both China and Mexico are emerging markets and the "slow appreciation of the RMB to the USD continued to be a source of global stability" for a substantial amount of time (Dollar, 2016). If, as experts predict, the USD continues to rise, then both China and Mexico are likely to witness slow economic growth which would negatively affect their capacity for energy cooperation.

It is evident therefore that no matter the true reason for the continuous decrease in the price of oil, the current situation has created some uncertainty for the possibility of energy cooperation between China and Mexico. The first twelve months of low oil prices saw a dramatic drop (56.1%) in Pemex profits (Yu, 2015). The Mexican economy is heavily reliant on oil revenue, and if the situation outlined above were to continue, it would have a significant effect on national finances as well as repercussions for the smooth development of energy reform and Chinese investor confidence.

In terms of future trends in the price of oil, previous confidence in price-resilience has been dashed due to the historical market lows which have been experienced. At this time it is not possible to predict when the price will begin to recover, and shifting international energy structures will present challenges to cooperation between China and Mexico in this field.

Conclusions

As one of the largest oil producers in the world, Mexico has abundant oil and gas resources, and the development of the energy industry has become an important factor in the development of the Mexican economy. However, over the past decade, Mexico's crude oil production has been dropping steadily and energy consumption has been increasing continuously. Although the nation is a traditional exporter of crude oil, it is a net importer of refined oil products: Sino-Mexico energy cooperation therefore would help to enhance Mexico's position as a major player in the global energy market. The energy reform has greatly accelerated the process of this cooperation as it has fostered positive interaction between the two governments, leading to the signing of a number of energy cooperation agreements which have both broadened and deepened the relationship.

Sino-Mexico energy cooperation has many advantages. Firstly, the two sides have established a comprehensive strategic partnership, heralding a new dawn in the relationship. Secondly, the rapid development of trade and economic relations has created a solid foundation for energy cooperation, and thirdly, various complementary advantages mean that energy cooperation has significant potential to create a win-win scenario.

Energy cooperation however is not without significant inherent risks. For example, after Mexico started reforming its energy sector, many countries were attracted to the possibilities it offered, meaning that Chinese companies will inevitably face fierce international competition. The United States considers Mexico a vital part of North American energy security system and the complex relationship between China and the United States is also reflected in the competition for energy between the two nations. The strength of US enterprises is also a factor that cannot be ignored and, in addition, Canada, Japan, India (among others) are also interested in becoming involved in the Mexican energy sector.

Sino-Mexico cooperation is also subject to stress factors emanating from within Mexico. One of these is Mexican public opinion, which views oil as a great source of national pride. The Pemex Company is regarded as the most important enterprise in Mexico, but its decline could be damaging. Although there is a consensus that reform is necessary, the form that this should take is the subject of much debate. Although the reform is currently underway it still has some problems: in a saturated market, the higher production costs involved in oil-extraction in the Gulf of Mexico make investment a less attractive proposition. Without the appropriate fiscal conditions, attracting new investment will be challenging due to the need to improve the level of highly-skilled labor and to strengthen transparency, accountability and anti-corruption systems.

Whether or not Chinese energy companies can obtain a stable investment environment depends on the political environment in Mexico. Both the president and congress need to consistently push for reforms, especially after the end of a political cycle. It is also vital that the main political parties, oil workers' unions, and Mexican citizens in general support reform in the long-term.

Since the fall of 2014 steadily-retreating oil prices have made the trajectory of the international energy market difficult to predict. Regardless of whether the reason for low oil prices is due to covert manipulation by the US

and Saudi Arabia, the mismatch between supply and demand or the appreciation of the dollar, the uncertainty has affected energy cooperation between China and Mexico.

In this context, we consider that it is necessary to improve Sino-Mexican Energy cooperation in order to strengthen Mexican energy sector. Also, Chinese energy enterprises need to focus on selecting appropriate investment objectives and cooperating with independent energy companies in order to successfully confront competitors. In addition, Chinese investors should understand the local investment environment and focus on stakeholder groups. Finally, Mexico needs to strengthen the scientific and technological education and oil production sectors in order to consolidate its supply of human capital.

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