



# THE RULE OF LAW AND MEXICO'S ENERGY REFORM

**Continental Energy Integration in North America: The Emergence of Nonconventional Fuels and the Restructuring of Integrative Trends**

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This study is dedicated to Stephen P. Zamora, our friend and colleague and one of the driving forces behind this project, who passed away before the completion of this study.

## About the Study: The Rule of Law and Mexico's Energy Reform/Estado de Derecho y Reforma Energética en México

The 2013 changes to the constitutional framework and the summer 2014 enabling legislation in Mexico's energy industry represent a thorough break with the prevailing national narrative as well as the political and legal traditions of twentieth century Mexico. Mexico is about to embark on an unprecedented opening of its energy sector in the midst of important unknown factors, as well as a fiercely competitive and expanding international energy market. Mexico is one of the last developing countries to open its energy sector to foreign investment, and although there are important lessons that can be learned from other countries' experiences, this does not imply that the opening will be necessarily as successful as the government promises or that the implementation of the new laws will go smoothly. Almost certainly, after the enabling legislation goes into effect, important questions of law will emerge during the implementation, and unavoidably, refinements to the legislation will have to take place.

The book "Estado de Derecho y Reforma Energética en México," published in México by Tirant lo Blanch and written in Spanish, is the culmination of a major research effort to examine rule of law issues arising under the energy reform in Mexico by drawing on scholars and experts from American and Mexican institutions in order to bring attention to the different component parts of the new Mexican energy sector from a legal standpoint.

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## Introduction

This study shows that the continental integration of energy markets in North America features the United States as a major net importer of oil and gas and Canada as the strategic partner on both fuels. Mexico also plays a key role as a net provider of crude oil to the United States, and the country offers a growing market for US oil products and gas surpluses from Texas and the refinery cluster along the Gulf of Mexico. Additionally, Mexico's recent energy reform, which openly allows private participation in the industry, entails the potential to boost its oil and gas output, including nonconventional fuels. As for electricity, the three countries are interconnected and feature policy coordination in terms of standards convergence and reliability cooperation. This study argues that integrated energy markets in the region might witness a rapid transformation in the foreseeable future, mainly due to the nonconventional hydrocarbons revolution taking place in the United States, which likely will result in a reduction of US oil imports from its North American partners—though the pace of that decline is not clear—and the region's emergence as a global gas exporter in the span of a few years. The pace of this major transformation will depend on the way the hydrocarbons industry in the three countries reacts and adapts to a mid-term scenario of weak international prices. Market, technological, and geological fundamentals will continue to drive the profile of North America's cross-border markets, and growing opportunities for policy coordination may emerge, similar to what already happens in electricity interconnections. Such policy cooperation could occur in the areas of infrastructure and security coordination, efficiency standards, and climate change mitigation.

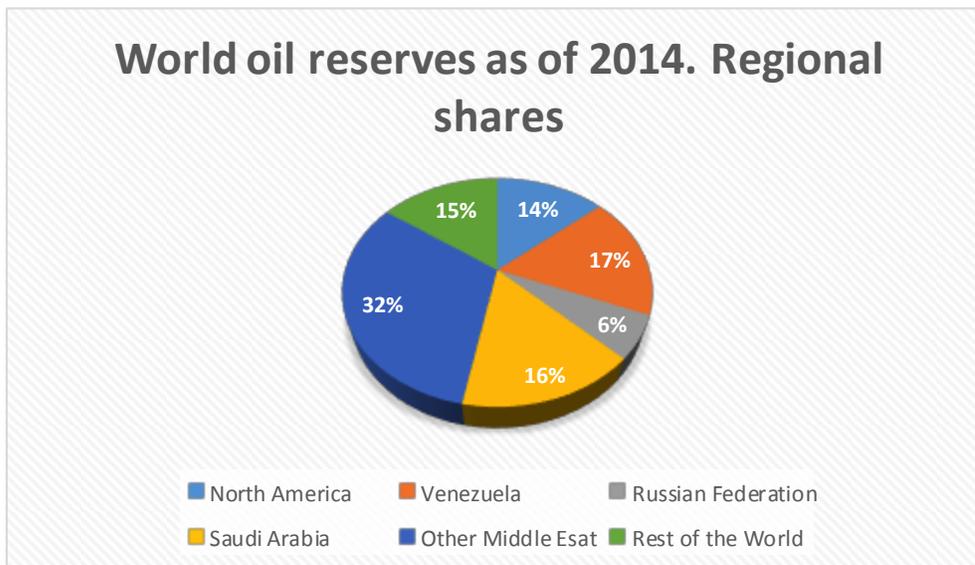
The study is divided in four parts. The first two sections analyze market and integrative trends in the oil and gas industries across the region. Section three reviews how an emerging continental market on electricity has spurred policy coordination at the transboundary level. The final section explores some economic and geopolitical implications that the major transformations witnessed in North America could have on world energy markets.

## **Toward a Self-Sufficient North America? The Impact of Nonconventional Oil in Intraregional Flows**

Though North American countries have traditionally been major world hydrocarbon producers and consumers, their positioning in world markets has changed rapidly in the last 10 to 15 years. The region is emerging as a major reservoir and producer of nonconventional fossil fuels, i.e. oil sands, oil, and shale/tight gas. While overall proven oil reserves of the region amounted to 100 billion barrels (Bbls) in 1998, that figure more than doubled to 232.5 Bbls in 2014,<sup>1</sup> accounting for 14 percent of world reserves (see Figure 1). This rapid increase was mainly due to the incorporation of Canadian oil sands in Alberta and along the Western Canada Sedimentary Basin (WCSB) at the end of the 1990s<sup>2</sup> and, more recently, tight oil resources from the United States.

Unlike Canada and the United States, Mexico’s oil reserves have witnessed a rapid decline. After a downward reclassification of proven reserves by PEMEX in 2002, the three types of reserves that the company traditionally typifies (proven, probable, and possible) have persistently declined, stabilizing at 29,327 million barrels (mb) in 2014. From this stock, proven reserves (11,100 mb) equal 13 years of current production. Nonetheless, the country still has major potential, since Mexico’s government estimates prospective resources to amount 54.5 billion barrels of oil equivalent (bboe), almost half of which are located in the Gulf of Mexico’s deep waters. Likewise, Mexico’s Ministry of Energy (SENER) in 2013 recognized for the first time the estimated prospective reserves of nonconventional hydrocarbons, which totaled 60.2 mboe (SENER 2013, 43).

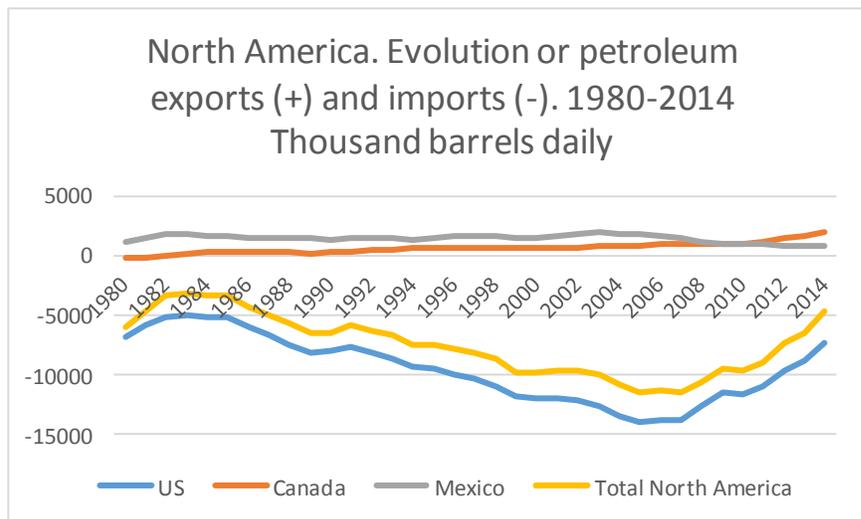
**Figure 1.** World oil reserves as of 2014, regional shares



Source: BP, 2015, statistical workbook.

Notwithstanding, North America remains a net importing oil region. The United States traditionally has been a net importing economy, while Canada and Mexico have been traditional net suppliers to the United States. Figure 2 depicts these trends, reflecting a turning point from 2006 to the present, when overall gross imports began to decline rapidly. One cause is the steady growth of Canadian supply, which increased from 2.7 million barrels per day (mbd) in the late 1990s to 4.292 mbd in 2014. The real story, however, is the United States’ increased oil production coming from tight formations.

**Figure 2.** Evolution of petroleum exports (+) and imports (-) in North America, 1980-2014, in thousand barrels daily

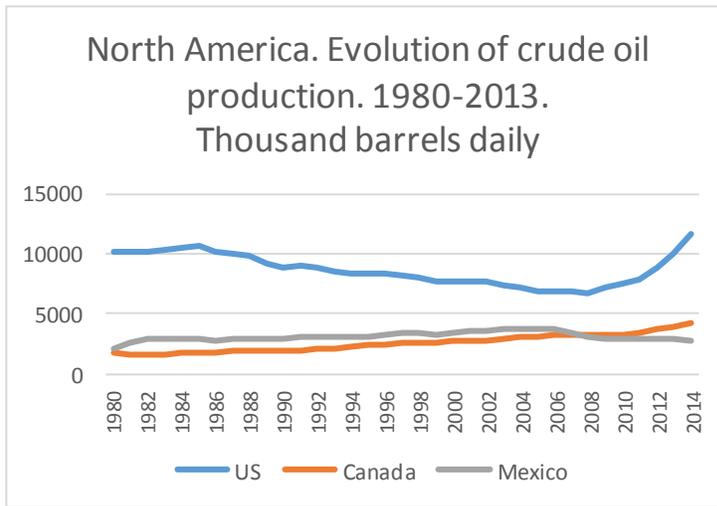


Source: BP, 2015, statistical workbook.

As shown in Figure 3, oil production in the United States reached the same level of the early 1980s, when total output peaked above 10 mbd. US tight production dramatically increased from less than 1 mbd in 2010 to 3.1 mbd in 2013 (U.S. Energy Information Administration 2015, 18), positioning the country as the world leader in the development of nonconventional hydrocarbons. This sudden increase more than compensated for the fast decline of Mexico's production due to the rapid depletion of the Cantarell Field, which peaked at 2.035 mbd in 2005 but in 2013 only supplied 439.8 thousand barrels daily (Petróleos Mexicanos 2014, 33). Furthermore, the United States in 2014 contributed an additional 1.590 mbd to the global supply, while Canada added 260,000 mbd in production (EIA 2015), 70 percent of the increase in the global supply that year.<sup>3</sup> This put pressure on an already glutted market, provoking the collapse of world prices during the second half of 2014, the consequences of which will be reviewed in the final part of this analysis.

The revival of the respective oil and hydrocarbon industries in Canada and the United States is part of a major energy revolution. Technological innovation combined with appropriate provincial, state, and federal policies, in addition to a new cycle of rising international prices at the turn of the century, made possible the development and marketing of non-conventional oil resources, i.e., tar sands in the WSCB and tight/shale oil in the United States. Mexico could eventually join this revolution, if the radical reforms the country recently enacted at the end of 2013 and the first half of 2014 are able to attract the needed capital to enhance and develop its energy potential. If Mexico becomes successful in lifting its production, North America will consolidate as a major powerhouse vis-à-vis major oil suppliers like the Persian Gulf countries or Russia, opening the possibility of becoming almost self-sufficient and able to impact global markets and geopolitics.

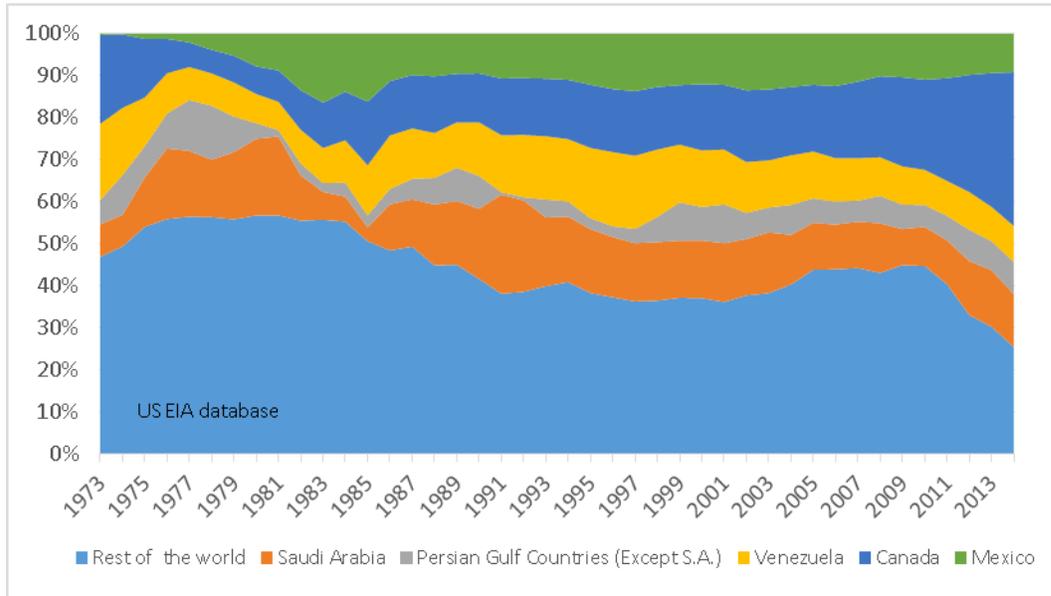
**Figure 3.** Evolution of North American crude oil production, 1980-2014, in thousand barrels daily



Source: BP, 2015, statistical workbook.

One of the consequences of these major changes in the region is Canada's upgraded position as the United States' strategic supplier, a position once held by Mexico and the Persian Gulf countries. At present, Canada provides 32 percent of overall US imports (oil and products),<sup>4</sup> while the Persian Gulf countries (including Saudi Arabia) now supply 20 percent. Mexico, which in 1983 provided 16 percent of US oil imports, currently supplies 9 percent, while Venezuela accounts for 8 percent (see Figure 4).

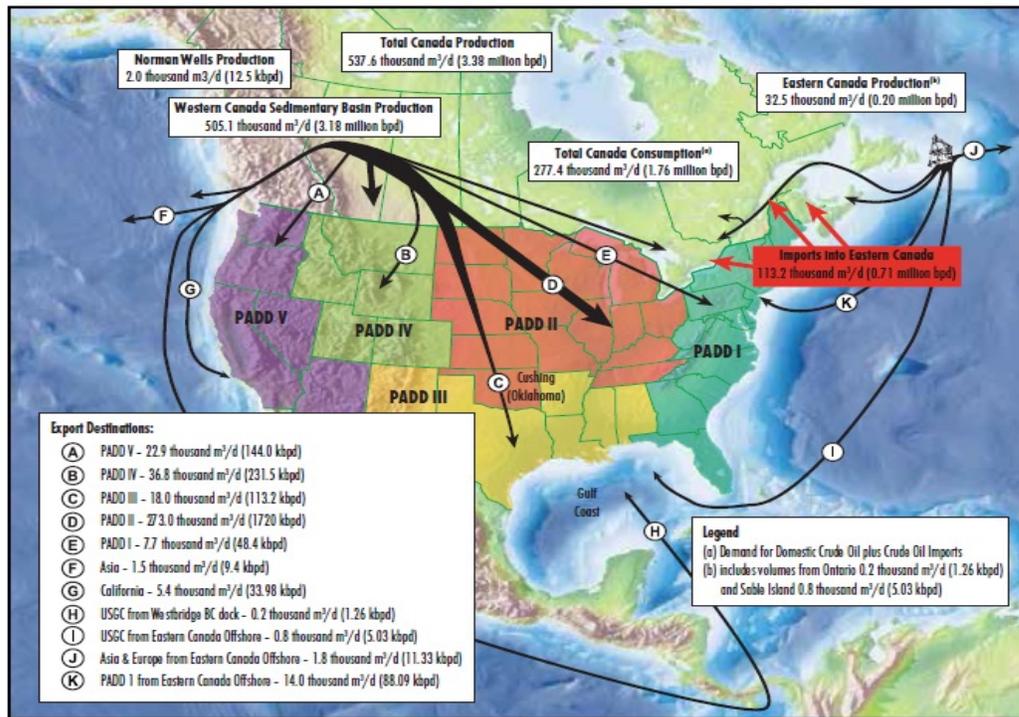
**Figure 4.** Shares of US imports of crude oil and petroleum products by main countries, 1973-2014



Source: U.S. Energy Information Administration.

Canada’s positioning as the main oil provider to the United States becomes more strategic if we take into account that most supplies are traded to North American outlets through a cluster of pipelines that are interconnected with the US transmission system. Indeed, three companies operate most of the export pipelines to continental United States: Enbridge Inc., Kinder Morgan, and TransCanada. The latter also has a major stake in gas export lines. Those pipelines supply liquid fuels to the Illinois and Oklahoma terminals, making it possible to dominate US import markets in three out of the five “Petroleum Administration for Defense Districts” (PADD) the country has been divided into since World War II.

Figure 5. Petroleum Administrative Defense Districts (PADD) in the United States



Source: National Energy Board, 2014, “Canadian Pipeline Transportation System.”

Canadian oil represents 98 percent of overall imports in PADD II (Midwest), and 100 percent in PADD IV (Rocky Mountain). Canadian imports amount to 33 percent of PADD I (Atlantic East Coast), and 17 percent of imported oil in PADD V on the West Coast (See Figure 5). Only in the Gulf of Mexico Coast (PADD III) do Mexico, Saudi Arabia, and Venezuela play a major role as providers. However, this situation may rapidly change if the contentious TransCanada Keystone XL pipeline is finally approved. Once a new Enbridge-managed pipeline connecting Chicago, Illinois, to Port Arthur, Texas, in the Gulf of Mexico starts scheduled operations in 2015,<sup>5</sup> heavy crudes like Western Canada Select will directly compete with heavy oils, such as Maya coming from Mexico or those imported from Venezuela (NEB 2014). Canada could eventually compete with Saudi Arabia light oils if this new additional capacity is able to export synthetic oil from the WCSB. In fact, most Canadian exports to the United States (68 percent) will go to PADD II, where the new pipelines and additional capacity are scheduled.

It is hard to envision that Canadian oils will crowd out alternative supplies to PADDs I, III, and V. In 2013, Canada’s total non-US exports amounted to 30.3 million barrels, and this figure will probably increase as long as Canadian production keeps growing and the United States’ overall imports from elsewhere decline. Asian and European markets could become major diversifying outlets as long as Canada becomes a major world exporter. According to estimates elaborated before the fall of international prices, Canada could produce up to 5.8

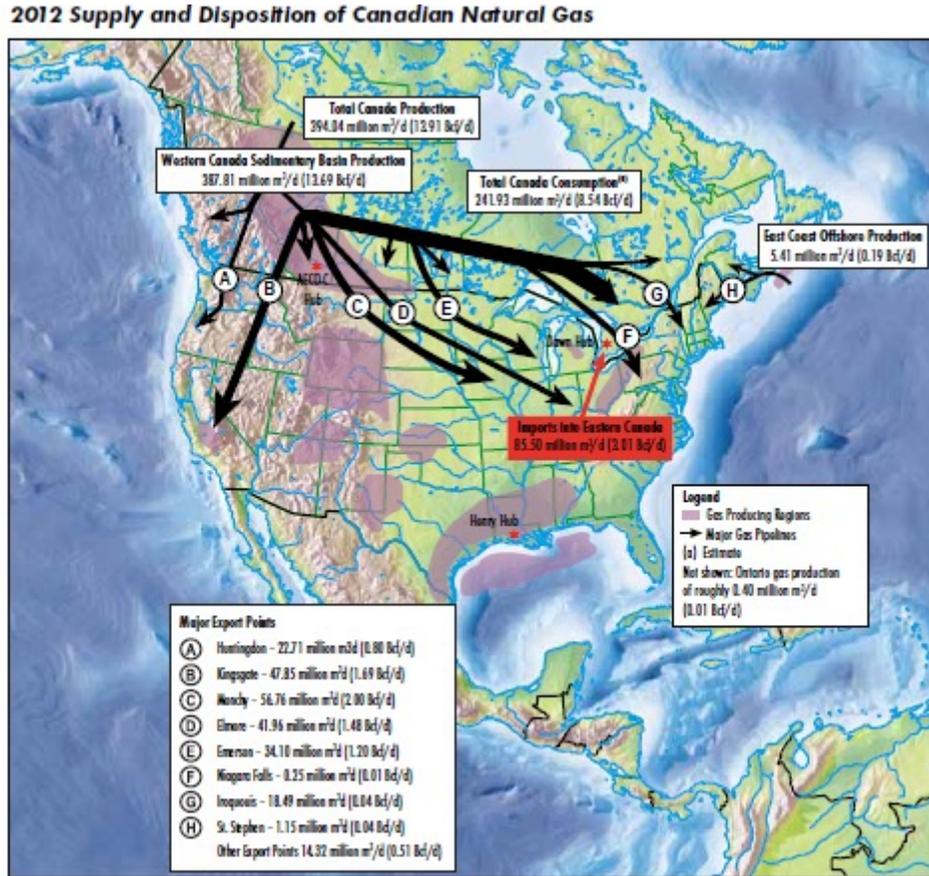
mbd by 2035 (National Energy Board 2013, 37), an amount comparable to the golden years of Iranian production at the turn of the 1970s.<sup>6</sup> At the same time, it would be difficult to conceive that the United States, for security reasons, would import from a single provider, even though Canada has proved to be a reliable and strategic partner. Mexico and other Latin American countries (Venezuela, Ecuador, Colombia, and Brazil) would remain key suppliers to the United States as long as the country remains a net importer.

However, Mexico's crude oil production peaked in 2005, reaching 3.3 mbd,<sup>7</sup> only to progressively decline in subsequent years. In 2014, the production was 2.429 mbd, a fall of 27 percent. Exports peaked as well, reaching 1.79 mbd in 2006 and declining to 1.188 mbd in 2014, 33 percent decrease (PEMEX 2014). At the same time, imports of petroleum products, especially gasoline, have increased because Mexican refineries have exceeded their processing capacity and construction has been halted on a new facility. The decline of Mexico's reserves and production is largely due to the exhaustion of Cantarell Field, the last super giant well discovered during the oil boom of the late 1970s and early 1980s. This reserve, which until quite recently supplied more than 60 percent of Mexico's total crude oil production, now contributes only 17 percent. While other wells located in the marine region have increased their production in recent years, such as the complex Ku-Maloob-Zaap fields, it has not compensated for the steep decline in the Cantarell. Will Mexico be able to recover its historical production record of 2005, given the new legislation? If Mexico succeeds in lifting its production, what would be its export options under a scenario in which Canadian exports become more competitive in PADD III which primarily imports crude oil from Mexico, and the United States continues increasing its domestic production?

## **The Impact of America's Gas Revolution**

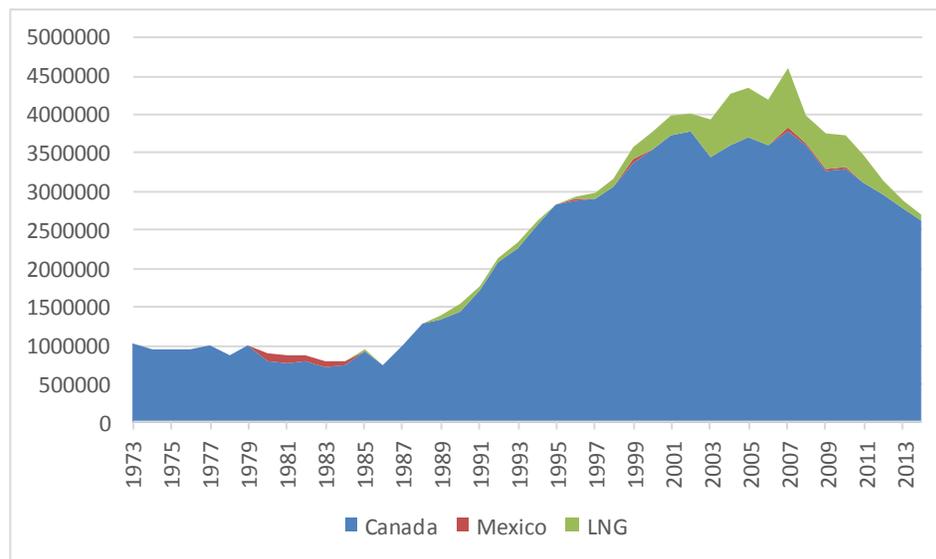
North America accounts for 5.2 percent of world-proven natural gas reserves. Canada is a net exporter to the United States, providing almost 90 percent of US imports. Similar to what prevails in cross-border oil trade, Canadian gas exports are heavily integrated into the United States via gas lines operating across the border (see Figure 6).

Figure 6. 2012 Supply and Disposition of Canadian Natural Gas



Source: National Energy Bureau, 2014, “Canadian Pipeline Transportation System.”

Prior to the US shale gas boom, it was anticipated that Canadian gas exports would not be enough to meet growing US natural gas demand,<sup>8</sup> prompting the construction of liquefied natural gas (LNG) plants in the United States. Figure 7 depicts these trends, showing a boost in LNG imports from 2002 to 2006. However, the rapid increase in US production is dramatically abating gas imports, profiling the United States as a potential world gas player in the years to come.

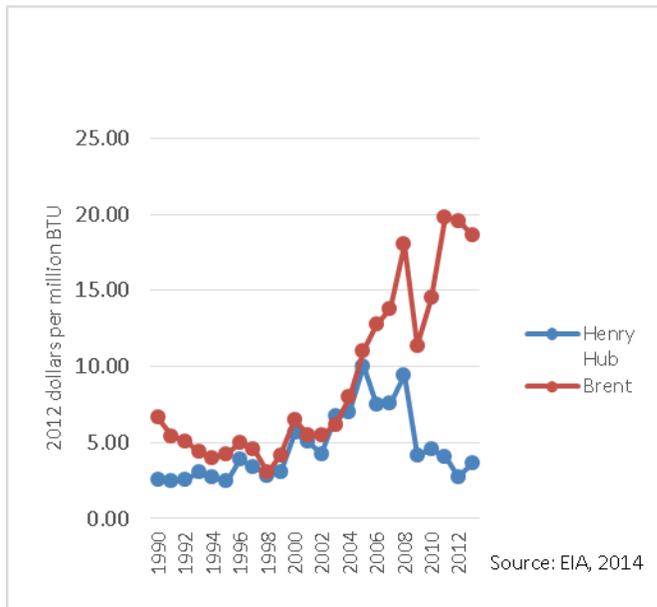
**Figure 7.** US gas imports from main partners, 1973-2014 (million cubic feet)

Source: U.S. Energy Information Administration.

Indeed, from the outset of the George W. Bush administration to the second term of the Obama era, the US energy scene has been radically altered over the last decade through a set of legislative and administrative measures. Those measures included various tax incentives that were neither consistent nor continuous, and not always introduced by the federal agencies. The Energy Policy Act of 2005 (EPA-2005) and the Energy Independence and Security Act (EISA) of 2007 were the most significant legislative and regulatory measures taken by the Bush administration. In contrast, Congress has not passed any comparable bill during the Obama administration, in spite of the president's efforts to promote a wider mix of clean and renewable energy resources. Both EPA-2005 and EISA offered a series of tax incentives and research programs with the goal of stimulating the domestic supply of unconventional fossil fuels, as well as to encourage the development of renewables and energy-saving and conservation measures.

These federal measures, together with the introduction of renewable standards enforced at the state level—through which mandatory quotas have been established for the consumption of renewable resources in electricity generation—have unchained a real revolution featuring the spectacular growth in the production of unconventional fossil fuels in the United States, especially shale gas. Gas output in the United States increased from 49.5 billion cubic feet (bcf) in 2005 to 70.5 bcf in 2014. This pace of growth is anticipated to continue in the years to come. A first consequence of this sharp increase has been a drop in gas prices vis-à-vis crude oil and the possibility that the United States may become a net exporter of gas by 2020.

**Figure 8.** US Brent oil spot prices compared to Henry Hub gas prices, in 2012 dollars, per million BTU, 1990-2013



Source: U.S. Energy Information Administration, 2014, “Annual Energy Outlook.”

Figure 8 shows how gas prices, which are measured by caloric content, became decoupled from oil prices beginning in 2005. How the decline in oil prices will affect those of gas is still uncertain. However, the North American gas market has currently become the cheapest in the world, impacting the competitiveness of gas-intensive industries in this region (bulk chemicals, paper, food processing, metals, etc.) vis-à-vis those located in Europe or Asia. In 2014, the Henry Hub price was \$3.87 per million British thermal units (BTU) in North America, while prices in Europe were above \$8.22 and more than \$16 in Japan, reflecting the country’s costs of producing LNG (BP 2015).

Table 1 summarizes the most recent assessment of technically recoverable (TR)<sup>9</sup> shale oil and gas resources in the region. It compares the nonconventional resources of each country and region with their respective proved reserves. In the case of the United States, shale gas reserves (tight gas resources are included under shale) are more than double their current proved reserves and account for 9 percent of currently assessed shale gas resources worldwide. Canada and Mexico’s cases are more impressive, because their nonconventional gas reserves multiply manifold compared to their current proved gas reserves.<sup>10</sup> As a region, North America accounts for 24 percent of current TR world shale gas potential. Only China, as a single country, rivals North America by the amount of its resources. As for nonconventional oil (tight and shale oil), North America accounts for 24 percent of overall assessed resources with the United States making up 17 percent. Though shale resources come from different geological deposits than tight resources, they utilize the same recovery technology: hydraulic fracking and horizontal drilling.

As for export surpluses, it is anticipated that the United States could eventually cease importing gas from Canada, which would prompt the latter to find new markets, probably in Asia. Under this eventual scenario, US net exports would be shipped via pipeline to Mexico and other markets as LNG. It is unclear, however, whether Mexico will be able to or interested in absorbing much of the US surplus. While import prices have become attractive, Mexico does not have the transport infrastructure needed to buy a greater volume of gas inflows.

**Table 1.** Technically recoverable shale oil and gas resources compared with proved conventional reserves in North America

Table 1. North America. Technically recoverable shale oil and gas resources compared with proved conventional reserves								
Country	Shale oil (billion barrels)	%	Oil. Proved Reserves . (Billion barrels)	%	Shale gas. (Trillion cubic feet)	%	Gas. Proved reserves. (TCF)	%
Canada	9	3%	173	10%	573	8%	71.7	1%
Mexico	13	4%	11.1	1%	545	7%	12.3	0.2%
U.S.	58	17%	48.5	3%	665	9%	345	5%
<b>Total North America</b>	<b>80</b>	<b>23%</b>	<b>232.5</b>	<b>14%</b>	<b>1783</b>	<b>24%</b>	<b>429</b>	<b>6%</b>
Russia	75	22%	103.2	6%	285	4%	1152.8	17%
China	32	9%	18.5	1%	1115	15%	122.2	2%
<b>World total</b>	<b>345</b>	<b>100%</b>	<b>1700.1</b>	<b>100%</b>	<b>7299</b>	<b>100%</b>	<b>6606.4</b>	<b>100%</b>

Source: U.S. Energy Information Administration, “Technically Recoverable Shale Oil and Shale Gas Resources: An assessment of 127 Shale Formation in 41 Countries Outside the United States”; BP Statistical Workbook, 2015.

Mexico used to export some marginal gas production to the United States, but it has currently become a net importer from Texas. After witnessing significant growth over the past decade, Mexico’s natural gas production fell from a peak of 7.0 billion cubic feet daily (BCFD) in 2009 to 6.5 BCFD in 2014. Natural gas imports have also hiked in the past few years, going from 592.5 million daily cubic feet (MDCF) in 2002 to 1,289.7 MDCF in 2013 (PEMEX 2014), as the country’s electricity generation-driven domestic consumption growth has exceeded the increase in production. Mexico’s proved reserves of natural gas amount to 12.272 trillion cubic feet (TCF), equivalent to just seven years of production. However, if we add probable and possible reserves, the overall figure amounts to 46.6009 TCF, of which 71 percent is associated with oil. Fifty percent of those resources are located onshore, mainly in the northern part of the country. PEMEX also estimates the country’s potential prospective reserves to be around 56.175 TCF, 53 percent of which are located in deep water Gulf of Mexico and 18 percent in the Sabinas Basin (Secretaría de Energía 2012, 18).

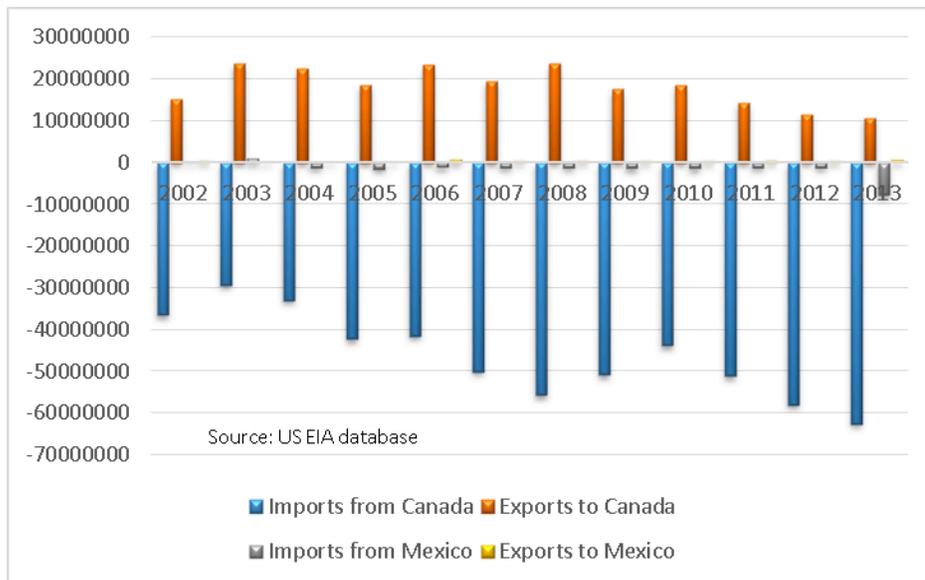
As for the potential of nonconventional gas resources, the Mexican situation looks promising. The US Energy Information Administration’s (EIA 2013, 10) well-known study assessing technically recoverable resources (TRR) of shale gas worldwide estimates Mexican recoverable resources at 545 TCF. Those resources are located in the northeast part of the country in the Burgos and Sabinas basins, a geological extension of the shale

plays located in Texas. By contrast, Mexico’s official estimations are more conservative—141.5 TCF for shale gas and 31.9 billion barrels of shale oil (SENER 2013, 44).

## Cross-Border Electricity Trade and the Future of Transnational Cooperation

Cross-border electricity markets are growing in North America, and transboundary interconnections are being built at the subregional level. Figure 9 depicts current transactions, with the United States being the net electricity importer of the region, and Figure 10 shows that cross-border trade is concentrated under the so-called Regional Energy Organizations (REO): the Western Electricity Coordinating Council (WECC), which involves Western Canada provinces, Pacific US states and northern Baja California in Mexico; the Midwest Reliability Organization (MRO), which links the Canadian provinces of Manitoba and Saskatchewan to US Midwest states; and the Northeast Power Coordinating Council (NPCC), which connects Central and Eastern Canadian provinces with US Atlantic states.

**Figure 9.** US cross-border electricity trade with Canada and Mexico, in megawatts hours

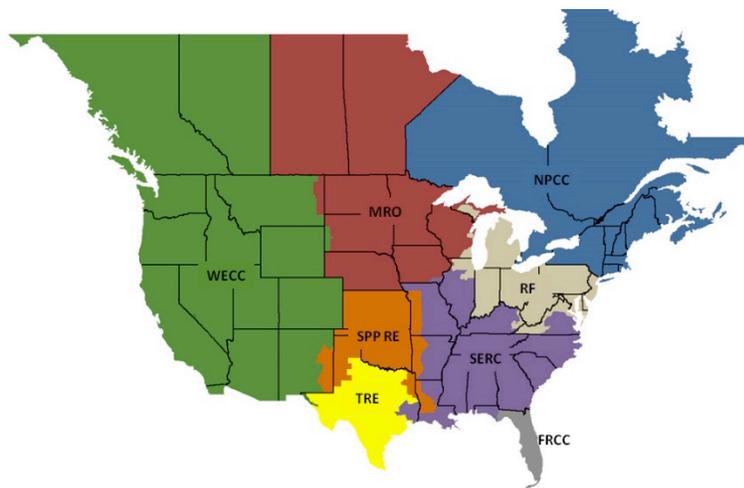


Source: U.S. Energy Information Administration.

Twenty years ago, electricity markets were heavily regulated at the local, state-provincial, and federal levels in the United States and Canada, while Mexico remained traditionally centralized under the Federal Electricity Commission (CFE), the state-owned power monopoly which now has been transformed into a “productive state enterprise” after the country’s recent energy reform. As electricity is not a commodity like other energy products (i.e., it cannot be stored, and it must be produced at the time of its consumption),

markets became very localized and heavily dependent on the vertical integration of power companies. The situation changed once the US federal government initiated the liberalization of electricity generation and transmission across the whole country. Markets became more regionally oriented, with strategic interconnections among them. The regionalization of electricity markets did not stop at the 49<sup>th</sup> parallel, as numerous REOs included Canadian provinces. These REOs are currently coordinated under the North American Electric Reliability Council (NERC), which encompasses eight councils that ensure most of the power generation and transmission in Canada, the United States, and, more recently, northern Baja California in Mexico, whose electricity grid is interconnected with that of California in the United States (see Figure 10).

**Figure 10.** North American Electric Reliability Council (NERC) Regions



Source: Electricity Reliability Organization, 2004. “Improving Operations across the Electric Reliability Organization Enterprise.”

Founded in 1968, NERC for years remained a private organization with voluntary membership and no enforcement mechanism to ensure the security and reliability of the electricity grid. When markets were locally based and regulated, private companies were able to internalize the costs of protecting the security and reliability of their operations. It was in their interest to do so, and localized price controls covered the additional costs. Once competition began to grow at the generation and transmission levels, it became less clear how to fund and operate the security of the entire grid. In fact, deregulation created a sort of regulatory patchwork of jurisdictions that overlapped or competed with the different levels of government (Nervius and Vancko 2005). While markets moved towards a regional and even transnational configuration, infrastructure and transmission development remained stuck at the state level. This patchwork provoked, among other things, a lag between the construction of transmission lines and the growth of energy demand.

The governance of the electricity grid hit a major crisis in August 2003, when the largest electricity blackout in the history of North America occurred without warning. It started with three daytime shutdowns at power plants in Michigan, mid-Ohio, and Cleveland, and quickly cascaded into a major outage affecting about 50 million customers in the United States and Canada (General Accounting Office 2003, 1-4). The joint Canada-US taskforce created to identify the causes of the blackout concluded that human errors were the major origins of the crisis, including the inability of system operators to visualize events on the system, ineffective operation communications and coordination, inadequate training of operators, and inadequate reactive power resources (North American Electric Reliability Council 2004). In other words, the reliability standards NERC members already agreed to were not respected, and there was no way to ensure their adherence and enforcement.

As a consequence of this crisis, NERC advocated for major regulatory reform to ensure the security of the continental electricity network. They called for the creation of a full oversight organization that would issue reliability standards, with compliance enforced through a mechanism of incentives (for those who comply) and fines (for those who do not). This proposal was incorporated in EPA-2005, which also called for the creation of an Electricity Reliability Organization committed to the harmonization of the industry's security standards, oversight, and enforcement. At the same time, EPA-2005 enlarged the jurisdictional faculties of the US federal regulatory body, the Federal Energy Regulatory Commission (FERC), granting it the ability to impose sanctions on organizations or firms who fail to comply with security standards and provisions. FERC also became the primary authority to design and establish National Interest Economic Transmission Corridors through which interstate transmission lines will be constructed to meet the growth and geographic changes in energy consumption. In the so-called Security and Prosperity Partnership's (SPP) June 2005 report, the three North American governments called for NERC to be converted into a continental organization, with Mexico initially joining as an observer. This is how NERC in 2007, along with the eight REOs currently coordinated, became the Electric Reliability Organization (ERO), a decentralized system for ensuring the convergence and enforcement of reliability standards under FERC oversight.

At present, ERO has played a major role in policy harmonization to ensure the reliability of the electricity grid and its interconnections, this time at the continental level. ERO remains a cluster of private firms and associations, encompassing some publicly owned electricity utilities, as is the case in both Canada and Mexico. In the years to come, its role will be to not only ensure the reliability of transmission grids in order to prevent blackouts, but also to progressively internalize the security of the entire grid to anticipate and avoid any physical or cyber terrorist attacks.

The ERO Enterprise system also has empowered FERC as a backup authority in transmission matters and other energy decisions. Since FERC is the ultimate authority to determine sanctions in cases of noncompliance with reliability or any other security standards, it has prompted a convergence of standards among federal energy regulatory bodies in Canada and Mexico. These two countries still have highly regulated and vertically integrated electricity markets. However, Canadian companies exporting to the US—in an

effort to enlarge their export markets—already have introduced transmission rates modeled on the FERC tariff. Now that FERC has become more powerful for the supervision of the continental power grid, existing regulatory practices in both Canadian and Mexican electricity markets will have to adapt to the new continental trend.

ERO's role in assuring the reliability and eventually the security of electricity provision in North America could become a standard for how the combination of a market-based approach (involving multiple stakeholders, decentralized private organization, incentives, and fines) with a strong regulatory mechanism (where electricity is seen as a necessity) could be implemented in other energy-related areas. ERO has in fact instituted a new governance body of transboundary, subregional regulation throughout North America. This sort of "privatization" of security operations has proved to be more functional and cost effective for regulators, since market organization and stakeholder involvement is very similar in the United States and Canada. Excluding weather-related events, ERO has been successful in reducing significant system events from nine per year on average between 2008 and 2011 down to two events in both 2012 and 2013, respectively (Electricity Reliability Organization 2014). ERO Enterprise could become a model of future transboundary policy coordination among North American stakeholders in critical areas in which integrative energy trends provoke externalities, such as environmental degradation (Healy, VanNijnatten, and López-Vallejo 2014), climate change adaptation (Craik and VanNijnatten 2013), or cross-border infrastructure development.

## **Market and Policy Factors Shaping the Future of North American Integrative Trends**

Energy cooperation in North America became a reality during the negotiations of the Canada-US Free Trade Agreement (CUSFTA) in 1989. Based on CUSFTA, Canada guaranteed energy supplies to the United States. After the North American Free Trade Agreement (NAFTA), Mexico began a liberalization of cross-border energy trade in gas and electricity, although maintaining the state monopoly on upstream and downstream activities. From the NAFTA to the present, security concerns—mainly coming from the United States—have spurred cooperation and coordination framed under ad-hoc mechanisms, such as the North American Energy Working Group (NAEWG) created in 2001 or the SPP, launched at the trilateral level by then-President George W. Bush in 2005 as a response to the September 11, 2001 terrorist attacks.

Indeed, energy security returned at the forefront of US energy and foreign policies beginning in 2001, when then-Vice President Dick Cheney released the National Energy Policy (NEP) which called for funding for most of energy bills and initiatives discussed by Congress, some of which remained in effect from that time to the present, including during the two terms of the Obama administration. The NEP was released shortly before the September 11 tragedy took place. Energy challenges were then defined as a threat to America's prosperity and standard of living if the growing imbalance between its energy production and consumption was not tackled. The Cheney report advocated conservation

through technological innovation, infrastructure development, the increase of domestic energy supplies—both nonconventional fossil fuels and renewable sources—and stronger links with both Canada and Mexico as major policy steps to enhance the country’s security (National Energy Policy Development Group 2001). After the terrorist attacks in New York and at the Pentagon, and the president’s decision to launch preemptive military action in order to justify a US-led war against Afghanistan and thereafter against Iraq, it became clear that energy security would remain a major component of both US domestic and foreign policies. Thus, Canadian and Mexican energy markets were reframed under a “continental” perspective. Energy became a major pillar of the SPP.

Though the SPP was initially launched by the Bush administration to reinforce border security in the region, its June 2005 report<sup>11</sup> called for the creation of a “policy environment” in which a sustainable supply and efficient use of energy could be promoted. It also recognized that energy had become “critical to the prosperity and security” of nations. Both NAEWG and SPP released data, studies, and declarations highlighting the importance of considering members’ energy policies through a continental view, but they did nothing to create a “policy environment” for enhancing continental cooperation on energy matters. Under the Obama administration, the governance of energy issues in the region came back as part of the bilateral agendas for each country, but neither the SPP nor any other “continental” initiative was continued. It was, in fact, the rapid development and output increase of US shale gas and oil plays from the second part of the last decade that framed the pace and scope for the evolution of energy markets in the region.

Though the NAFTA and the SPP failed to establish a “cooperative regime” on energy matters among the three nations, the driving force leading energy integration in the region entail the potential to spur the emergence of “cooperative regimes” at the transboundary regional level, similar to what is currently happening in electricity markets where interconnections, policy, and security oversight are better managed at the transregional level. The final part of the study reviews some of the major market and policy trends that may eventually reshape the continental logic and integration of North American energy markets in the short- to mid-term.

### *The Reconfiguration of Regional Markets according to Technological and Geological Factors*

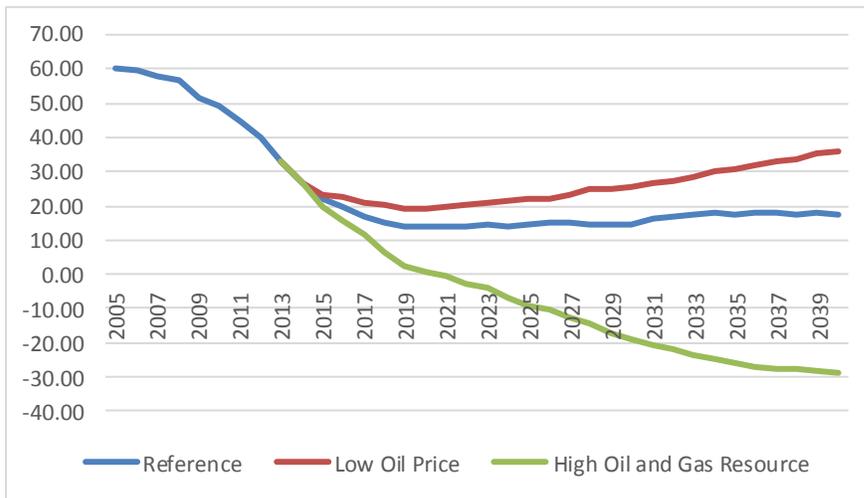
Over the past two decades, US technological innovation in terms of the exploration, exploitation, recovery, and consumption of energy resources has proved to be crucial in explaining the new supply boom of nonconventional energies and renewables. Estimating the new plateau of US production becomes essential to figuring out the decline of oil and gas imports coming from the two other NAFTA partners. How the decline of international oil prices will affect production in the United States and Canada is another major uncertainty for the future of existing continental markets.

According to a base line scenario considered as the reference case, elaborated by the US Energy Information Administration (EIA) in April 2015—that is, after the decline of international prices—the tight oil boom will continue through 2020, during which overall

crude oil supply would peak at 10.6 mbd then drop to 9 mbd in 2040, an amount still above the 2014 level. However, this peak could be higher (16.6 mbd by 2039) or lower (9.8 mbd in 2021) before declining (EIA 2015, 18), since the recovery rate for the extraction of nonconventional fossil fuels is different than that of conventional fossil fuels. It might increase or decrease depending on the geological characteristics of the fields, as well as the technological improvements in drilling and extraction. In other words, the projections presented in a scenario should be taken with caution. Consequently, there is a possibility that prospective resources become lower than estimated, or, on the contrary, higher. The productivity of the wells is independent of both the economic conditions of exploitation and the policies implemented to encourage the deployment of the industry. In case productivity becomes higher than the reference scenario, the United States could eventually become self-sufficient around 2020 and a major net exporter in 2040, which would compel Canada and Mexico to find new markets outside the region.

Although the reference case also estimated that US net imports would decline to 13.75 percent of consumption in 2020 (when tight oil production peaks) then increase to more than 17 percent between 2030 and 2040, this scenario was grounded under the supposition that international prices will progressively recover to the pre-2014 level in 2029, reaching \$141 per barrel in 2040. Though EIA's reference case scenario is feasible, the same agency has also elaborated a scenario in which prices would remain low instead: \$57.70 per barrel in 2020 (in real terms) and \$75.52 in 2040 (EIA 2015, ES-2), an amount that reflects current market trends after the collapse of international prices during the second half of 2014. Under a low price scenario, and with no higher productivity per well from the reference case estimate, US net imports would start to increase in 2022 and represent 36 percent of consumption by 2040, a figure still below the 2012 level of 40 percent (EIA 2015, ES-4). At present, this seems to be the most plausible scenario in the short- and mid-term, suggesting that both Mexico and Canada will continue to have a share the US oil market. However, access to it will become more and more competitive, depending on increased pipeline capacity from Canada to the Gulf of Mexico, the quality of crudes, and the price discounts of competitive products coming from Venezuela or the Persian Gulf (see Figure 11).

**Figure 11.** US net import shares of petroleum and other liquid fuels over total consumption under three scenarios, 1990-2040



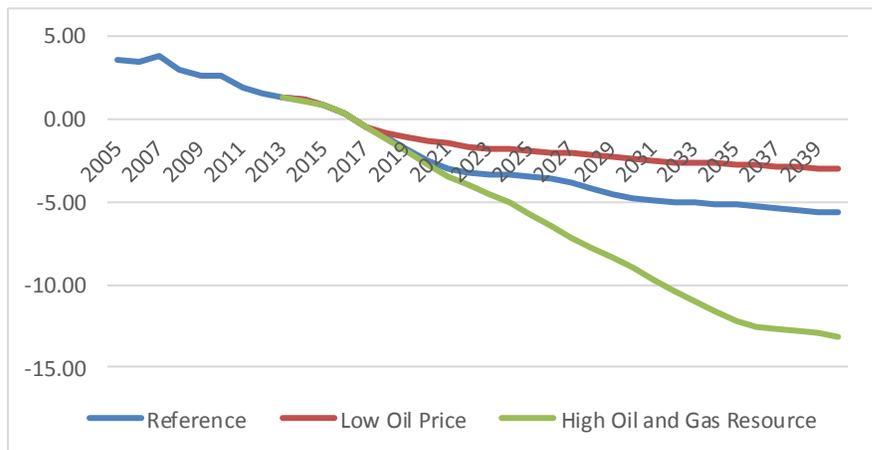
Source: U.S. Energy Information Administration. 2015. “Annual Energy Outlook.”

As for natural gas market trends, the plausible scenario seems to be quite different. As previously stated, gas prices in the US market have been delinked from oil prices since 2005. According to US EIA estimates, the gap between gas and oil prices in terms of their calorific content will continue in the years to come, although it will not be as high as it was in 2012, when oil was seven times more expensive than gas. Gas will remain highly competitive in key industries like power generation as well as all energy intensive sectors such as chemicals, paper, food processing, metals, and even freight transportation. EIA’s reference scenario, released in April 2015 for future US production and foreign trade of natural gas, takes into consideration the same factors impacting the United States’ future oil production. Figure 12 presents three prospective outcomes, measured in terms of net gas imports. It is interesting to highlight that in all scenarios presented herein, shale gas production features a permanent increase, the rate of which depends on the factors taken into consideration by the forecasts. In all three scenarios, the United States becomes a net gas exporter beginning in 2017. Under the reference case, crude oil prices behave according to the projections estimated for oil markets presented in Figure 11, and Henry Hub prices reach almost \$5 per BTU in 2020 and \$7.85 in 2040—that is, barely double the current price. Under these suppositions, US net exports reach 5.6 TCF annually in 2040. If shale plays turn out to be more productive than anticipated, net exports could reach 13.11 TCF in 2040, or just 3 TCF if oil prices remain lower than the reference forecast (see Figure 12).

Under the three scenarios, US net imports from Canada radically reduce, if not collapse, while exports are shipped via pipeline to Mexico and other markets as LNG. It is unclear, however, whether Mexico will be able to, or would be interested in, absorbing much of the US surplus. While import prices are attractive, Mexico does not currently have the

transport infrastructure needed to buy a greater volume of gas inflows coming by pipeline from the United States. On the other hand, the country has considerable potential in both conventional and nonconventional oil and gas resources, but the technological and institutional capabilities for developing those resources has yet to be built up.

**Figure 12.** US net imports of natural gas under three scenarios, 1990-2040 (in trillion cubic feet)



Source: U.S. Energy Information Administration, 2015. “Annual Energy Outlook.”

Needless to say, under low international prices, US natural gas production could be less than anticipated—and, consequently, exports—vis-à-vis the reference case outlook, because cheap oil fuels could deter the use of gas for freight transportation and make LNG less attractive. At any rate, Canada is witnessing growing pressure to diversify current surpluses going to the United States to other export outlets—that is, to enter the growing LNG network in order to find new markets in Europe or Asia, where low gas prices will be very attractive. By contrast, cheap US gas coming from Texas plays might discourage the development of the Mexican fields located in the Sabinas and Burgos basins—a natural geological continuity of the Eagle Ford play—as long as both gas and oil prices remain low. Under this panorama, it makes sense that the Mexican government invests in infrastructure development at the US-Mexico border in an attempt to ship most of the cheap resources available from the US side of the border.

### *Will North America Become a Price Setter?*

After the “oil shock” of 1973, which occurred in the midst of a major geopolitical confrontation in the Middle East (the October War), world oil markets entered what could be considered an “expensive oil” phase. Cheap oil conventional reserves—located mainly in Persian Gulf countries—were not enough to satisfy a growing world demand, and new nonconventional reserves needed to be developed in order to reach a new equilibrium price. From the end of World War II through 1973, international oil prices averaged \$15 per barrel (at 2013 prices). But from 1974 until 2014, the average price was \$56—that is, near the

March 2015 price for Brent oil (\$59). Does this mean the equilibrium price for nonconventional oil should be between \$60 and \$70 per barrel? This is, in fact, the “low price” scenario elaborated by US EIA.

If so, prices above that threshold will become “rents” for producing countries, especially if their stock consists of conventional resources. Needless to say, those producing countries are all in the Middle East, which still accounts for 48 percent of the world’s proved reserves. This explains why the Organization of the Petroleum Exporting Countries (OPEC), led by major producer and exporter Saudi Arabia, has been able to function as a price setter from 1974 to the present, taking advantage of geopolitical uncertainties and risks. As the “swing producer,” able to increase or reduce its output with large flexibility, the Saudis could flood the market or cut production by imposing quotas on major OPEC producers in order to manipulate prices. This “rent-seeking” model has been more or less successful in imposing a Saudi hegemony within OPEC and in world oil markets.

Nonetheless, the hegemonic position of the Saudis is intrinsically unstable: It is persistently challenged by more income-needy countries that need to increase their oil income in order to finance their military or regional ambitions, such as Iraq, Iran, Venezuela, and other countries with similar circumstances. Historically, these countries often attempt to optimize their rents at the expense of the Saudis or other OPEC producers. At the same time, since the end of the 1970s, OPEC producers have had to deal with pressures coming from non-OPEC production, which includes more and more nonconventional output from private firms. Mexico has become the last example of this major trend by putting an end to the state oil monopolism regime that prevailed for almost 65 years. In other words, the rent-seeking model is being challenged not only by opportunistic behavior from key OPEC producers, but by a market-oriented approach coming from stakeholders extracting non-OPEC resources. Is the fall of prices in 2014 a sign that the Saudis are losing their hegemony in the oil market and that non-OPEC producers, located mainly in North America, are becoming “price setters”?

Oil prices dropped during the second part of 2014 because 2.6 mbd of oil were added to the market and global demand was sluggish at prices above \$100 per barrel. Eighty-one percent of this additional production came from non-OPEC countries, with the United States contributing 61 percent and Canada providing 10 percent. Furthermore, the shale/tight boom taking place in North America anticipated a growing input coming from these two countries until at least 2020, when US production would eventually peak. These two facts were enough to put pressures on prices. However, they collapsed to current levels after the November 2014 OPEC meeting in Vienna, where the Saudis and all members decided not to cut production under current quotas of 30.2 mbd. The message was clear that if nonconventional production is putting pressure on the market, reductions must come from that side of the equation and not from OPEC.

A low price scenario will definitely reduce nonconventional oil production in both the United States and Canada, but it will not be accomplished through production quotas, nor will it stop such production altogether. Firms working in the emerging plays are prepared

to operate in a highly competitive environment in which technological innovations and cost-efficiency decisions prevail. Rent-seeking is not their operation model; rather, they are profit-takers in the risk-intensive phase of developing nonconventional resources. Successful firms could eventually become hegemonic in a know-how and technology-needed environment, such as the era beginning now in nonconventional oil production, as witnessed by the current prospective possibilities in Brazil, Argentina, and Mexico. In other words, business is not only anchored in the stock of resources, but in the technology and services industries that make their commercial feasibility possible. If this becomes a long-term trend, firms and stakeholders operating in nonconventional oil (and gas) resources will progressively become the price setters of the global market, whose demand is driven by countries not involved in the Organization for Economic Co-operation and Development (OECD), such as China and India. Until the present, those firms are concentrated in North America; the United States and Canada, and potentially in Mexico, whose resource potential will now be exploited following the North American model.

As for natural gas, it is still difficult to say that we are heading towards a global market, similar to what prevails in the oil market. As previously stated, gas markets have become regionalized and the shale revolution has made the Henry Hub spot price the lowest price. Since LNG prices in Asia are the most expensive, a growing supply coming from North America—including Mexico—will definitely have an impact on price behavior outside the region. North American gas could eventually compete with production by Russia and Qatar, impacting not only the economic fundamentals of a global gas industry but also its geopolitics.

## Conclusions

Twenty years after the NAFTA came into force, and almost a decade after the launch of the SPP, North American energy markets have become more integrated and are witnessing a rapid transformation that is impacting world energy markets. Canada is currently ranked third in terms of proven oil reserves and has become a major oil net exporter, thanks to its massive tar sands reserves. Canadian production will keep growing in spite of the current decline of international prices. The United States is witnessing a gas revolution, which already has impacted world gas prices and is making it possible for the country to become a net gas exporter within two years. This will impact North American gas markets, prompting Canada to find new overseas outlets (mainly in Asia) and forcing Mexico to decide whether to rely on cheap gas imports from its northern neighbor or to set the right policy incentives for developing its own huge shale gas potential in the years to come. Furthermore, US domestic oil production is rapidly increasing, thanks to newly developed tight/shale oil resources, and liquid fuel consumption is about to witness a major transformation if markets for hybrid and electric vehicles are consolidated. Mexico's new energy legislation passed at the end of 2013 and the first half of 2014 allows private firms, both national and international, to invest and/or participate in Mexico's oil, gas, and power industries. This will transform Mexico's energy industry in a way that was unthinkable when the NAFTA and the SPP were launched. North America could become an energy self-sufficient region in the near future.

All these major transformations, however, have not been the result of intergovernmental cooperation or policy coordination among the three North American partners, as called for in the NAFTA, the Cheney report, and the SPP. On the contrary, the sudden policy changes that North America is witnessing have been the product of policy and technological responses taken at the national and subnational levels. Though the energy revolution started with Canadian oil sands, the US policy environment that developed during the first term of the George W. Bush administration was decisive in explaining the nonconventional hydrocarbons revolution that is taking place in this country. This revolution has made the United States and Canada “nonconventional” energy powers.

Until recently, the major players in the international hydrocarbons market were divided among major producers/exporters of crude oil or gas (Saudi Arabia, the key OPEC countries, Russia, Norway, Mexico, Qatar, and Bolivia) and large consumers/importers (the United States, Japan, and continental Europe). Under those circumstances, it became crucial to estimate the demand for exports from major producers to major consumers, taking into account the asymmetric allocation of energy resources. At present, the North American energy revolution is impacting both production and consumption patterns. This seems to be a structural trend that will continue during the next two decades with economic and geopolitical impacts on world energy markets, as witnessed by the fall in prices during the second half of 2014.

Traditionally, a great producer/exporter, such as Saudi Arabia or Russia, could influence world prices and articulate a resource diplomacy based on its wealth. Large consumers/importers could coalesce and coordinate contingency measures—such as the use of strategic reserves—or implement common policies geared to the containment of demand. This was in fact the rationale for the establishment of the International Energy Agency (IEA) shortly after the first oil shock between 1973 and 1974. Today, the United States, grounded on its deeper energy integration with its two other North American partners, can have an impact on both fronts and has the leadership to articulate a resource diplomacy that would simultaneously promote a shift to nonconventional fossil fuels and the marketing of alternative and renewable resources. Among other factors, the United States’ leverage is based on its endowment of nonconventional energy resources, policy measures implemented to develop those resources and, most importantly, the technological innovation transforming the exploitation, marketing, consumption, substitution, and replacement of energy resources.

Needless to say, this major revolution, driven by policy incentives and market and technological changes, has had a decisive impact on Mexico’s energy policy choices. Post-NAFTA energy reforms traditionally attempted to widen the scope of private participation in Mexico’s energy sector in order to increase competition without modifying constitutional mandates. In this sense, the energy reform recently passed by Congress in December 2013 came as a major breakthrough with regard to previous attempts for transforming Mexico’s energy industry. President Enrique Peña Nieto’s proposal directly challenged the monopoly regime by which energy resources had been managed in the

country. It opened competition to all the value chains of these industries, though this is not a magic key to guarantee the revival of Mexico's hydrocarbon and power industries.

At any rate, the continentalization of energy markets in North America will continue to become deeper in the years to come. The cooperative regime that failed to come into fruition during the NAFTA and SPP will probably be reactivated in order to better exploit and regulate economies of scale, cross-border pipelines and exchanges, environmental externalities, price fluctuations, and resource allocation in a petroleum and electricity industry whose cross-border regionalization is more and more driven by rapid technological changes and shifting market preferences. A new cooperative regime will not necessarily follow the classic intergovernmental pattern of collaboration, as in the NAFTA or the SPP. Most probably, it will emerge from transboundary initiatives that already exist at the subnational or subregional level, such as the ERO Enterprise, Western Climate Initiative (WCI), or others created to address specific needs and challenges provoked by a growing intertwining of the energy industries located in the three North American partners. Under this emerging multi-level governance architecture, the future of those interdependent industries will be commanded not just by addressing the policy choices coming from government agencies or firms, but also by taking into consideration the needs and policy preferences of private firms, consumers, technology innovators, environmental organizations, and other actors capable of impacting a multi-dimensional energy agenda.

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## Endnotes

<sup>1</sup> All figures depicting historical trends in production, consumption and exports come from BP, 2015, unless otherwise stated.

<sup>2</sup> Canada is currently ranked third, after Venezuela and Saudi Arabia, according to the amount of proved oil reserves.

<sup>3</sup> Iraq, Brazil, and Iran were the rest of the surplus contributors, with 330,000 mbd, 250,000 mbd and 180,000 mbd, respectively (EIA 2015)

<sup>4</sup> Canadian net exports grew from 739.23475 thousand barrels in 2000 to 1.9 mbd in 2013. Over the past decade, net oil exports have increased by 184.2 percent. All official figures retrieved from Canada's National Energy Board (NEB) database, accessed on February 27, 2015.

<sup>5</sup> One major constraint for expanding Canadian exports to the United States is infrastructure and transmission pipelines, which are subject to regulatory mandates and environmental concerns, such as the controversial TransCanada's Keystone XL pipeline when attempting to connect Alberta with Nebraska (EIA 2012, 10).

<sup>6</sup> Under a "low price scenario," which seems to prevail at present and the years to come, Canadian production could be reduced at 4.4 mbd by 2035, 25 percent lower than the reference case (NEB 2013, 45)

<sup>7</sup> Natural gas liquids and condensates are not included in this figure.

<sup>8</sup> Canadian gas output has, in fact, declined from 18 BCF in 2001 to 15.7 BCF in 2014.

<sup>9</sup> Technically recoverable resources means that they could be exploited at present, regardless of their economic and environmental costs. Economically recoverable reserves consider the cost/benefit rationale of their exploitation.

<sup>10</sup> Mexico's most updated official estimates for shale oil and gas prospective reserves amount to 31.9 billion barrels and 141.5 TCF. The latter figure is significantly lower than the estimate used by the U.S. Department of Energy. For Mexico's estimations see, SENER 2013, 44.

<sup>11</sup> Security and Prosperity Partnership of North America. 2005. "Security and Prosperity Partnership of North America. Report to Leaders, trilingual version."