

RFF REPORT

North American Energy Integration

*Assessing Oil and Gas Policy Issues ahead of
NAFTA Renegotiation*

Alan J. Krupnick, Amin Asadollahi, Juan Carlos Belausteguigoitia Rius, Kristin Hayes, Isabel Echarte, Philip Gass, and Daniella Echeverria

with contributions by Charles Mason, Alfredo Orellana Moyao, and Barry Rodgers

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Abstract

Further integration of energy markets and policies across the three North American countries can only contribute to economic development and may well improve its sustainability. This report reviews a number of key policy areas, including NAFTA, related to oil and gas development in and across the three major North American countries and explores opportunities for enhanced trilateral and bilateral cooperation and policy alignment. It contains descriptions of existing policies, legislation, and regulations on transportation, climate change, royalties and fiscal structures, decommissioning and abandonment, water, and environmental safety, as well as more detailed discussions of harmonization opportunities in each of those areas. The report also highlights several fundamental differences in the broader regulatory frameworks across the three countries, as these have an impact on efforts to harmonize.

An October 2016 workshop attended by major stakeholders and held by Resources for the Future—in concert with the Department of Energy’s (DOE’s) Office of Energy Policy and System’s Analysis (EPSA) and two partners in Canada and Mexico (the International Institute for Sustainable Development and Instituto Tecnológico Autónomo de México)—significantly contributed to this report. The workshop had several purposes: first, to identify gaps, best practices, and inconsistencies with economic and environmental regulations and markets across the three countries; second, to inform the creation of legal, regulatory, and policy roadmaps for harmonizing regulations and markets; and third, to bring together individuals who can help implement greater harmonization, and also others who can offer helpful input. This report places the discussions at this workshop in the context of the three countries’ regulations and policies as well as current political climates to summarize both the workshop participants’ and the authors’ recommendations for harmonization. The recommendations include action items for different levels of government in the three jurisdictions, research groups, academics, stakeholders, and others to move toward greater harmonization of policies and markets affecting the oil and gas sector.

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Abbreviations

ASEA	National Agency for Industrial Security and Environmental Protection (Mexico)
BLM	US Bureau of Land Management
BOEM	US Bureau of Ocean Energy Management
BSEE	US Bureau of Safety and Environmental Enforcement
CCS	Carbon capture and storage
CDM	Clean development mechanism
CENAGAS	National Center for Natural Gas Control (Mexico)
CNH	National Commission of Hydrocarbons (Mexico)
CONAGUA	Comisión Nacional del Agua (Mexico)
CRE	Regulating Energy Commission (Mexico)
DEP	US Department of Environmental Protection
DOE	US Department of Energy
EIS	Environmental impact statement
EPA	US Environmental Protection Agency
FERC	Federal Energy Regulatory Commission (United States)
GHG	Greenhouse gas
IISD	International Institute for Sustainable Development
INDC	Intended Nationally Determined Contributions
ITAM	Instituto Tecnológico Autónomo de México
LGCC	Ley General de Cambio Climático
LNG	Liquefied natural gas
NAFTA	North American Free Trade Agreement
NEB	National Energy Board (Canada)
Pemex	Petroleos Mexicanos
RFF	Resources for the Future
SEMARNAT	Ministry of Environment and Natural Resources (Mexico)
SENER	Ministry of Energy (Mexico)
UNFCCC	United Nations Framework Convention on Climate Change
VOCs	Volatile organic compounds

Executive Summary

North America's three major countries—Canada, Mexico and the United States—have some of the most significant fossil energy resources in the world, both individually and collectively. Technological advancements in unconventional gas and oil development, oil sands production, and deepwater drilling have led to levels of oil and gas production on the continent that have not been seen in decades, as well as to declarations of North America as a new world energy powerhouse.¹

As production has grown, so has the interconnectedness among the three countries' energy sectors. Figure 1 provides just one example of this increasing interconnectedness over time, showing the rapid growth of US natural gas exports to Canada and Mexico over the past 10 years. Mexico's energy sector reforms were in many ways predicated on the availability of lower-cost fossil fuels from its neighbors—particularly American natural gas—and on continued robust economic ties among the energy sectors of the three countries.

A broader illustration of US oil and gas trade relationships appears in Figure 2, which highlights the relative value of four key oil and gas flows across the Canadian, US, and Mexican borders. The United States is currently a customer for Canadian and Mexican crude oil, petroleum coke, and natural gas, while trading all of these products, in addition to motor gasoline (including blending components) and distillate fuel oil, back to Mexico and Canada. All told, in 2015, this trade was valued at \$200 billion.

Reflecting this close relationship, in recent years the governments of Canada, the United States, and Mexico have increasingly worked

toward harmonizing energy-related regulations (including many on environmental safety and climate change) across the North American continent. This harmonization – and we use this term in the broadest sense -- has taken a number of forms, ranging from data and technology sharing to full-fledged planning and policy alignment, and has been driven by a desire to reduce regulatory complexity, foster additional cross-border transport of resources, address potential economic complications due to unaligned markets, and collaborate on shared objectives.

The most comprehensive statement of policy coordination came at the North American Leaders' Summit in June 2016, when then-US president Barack Obama, Canadian prime minister Justin Trudeau, and Mexican president Enrique Peña-Nieto jointly announced several goals, including reducing methane emissions from the oil and gas sector 40–45 percent by 2025 and 50 percent clean power generation by 2025 (White House 2016c).

The political landscape shifted significantly later in 2016, however, with the election of Donald Trump to the US presidency. Throughout his campaign and into the opening days of his administration, President Trump has indicated a distinct change in attitude toward both federal energy and climate policy and relations with the United States' North American neighbors. The momentum behind North American energy interconnectedness is strong, as market forces continue to move the three countries toward further cooperation. But politics are quite likely to be a major factor as to whether, in what directions, and to what extent further policy harmonization occurs—at either the federal or subnational level. And though we

¹ <https://energy.gov/articles/secretary-moniz-remarks-north-american-energy-powerhouse-ihf-energy-ceraweek-2015>.

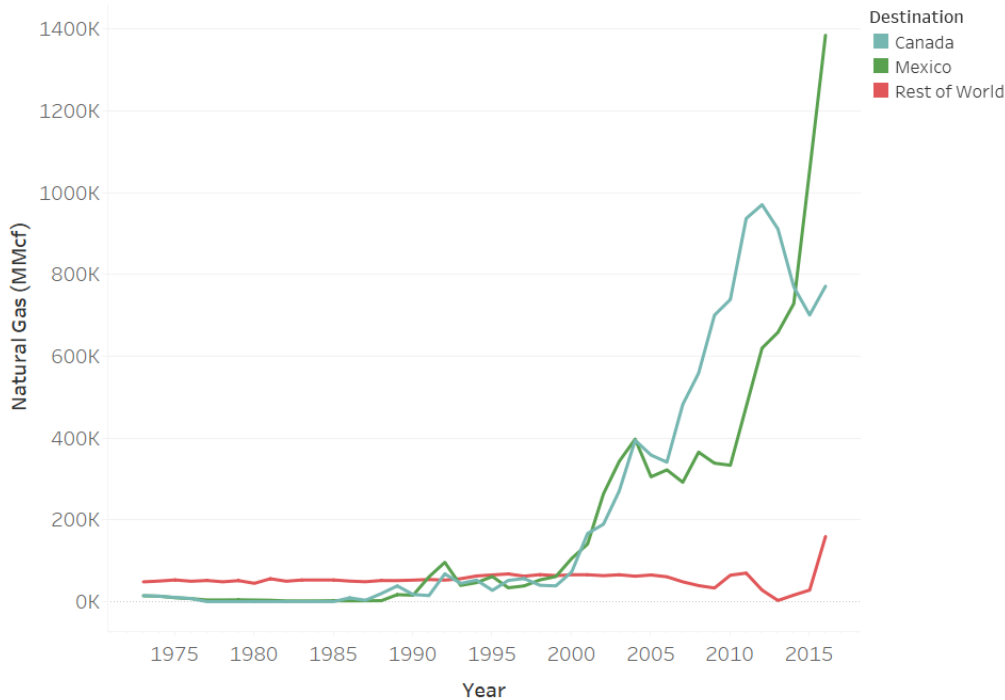
understand that some of the current administration’s goals conflict with Mexican and Canadian environmental policy objectives (as well as with some aspects of oil and gas policy harmonization itself), we believe there is some common ground in the shorter term and in the longer term, the realities of climate change and sustainable development will align these countries more closely.

Against this backdrop, this report reviews a number of key policy areas related to oil and gas development in the three major North American countries and explores opportunities for enhanced trilateral and bilateral cooperation and policy alignment. It contains extensive descriptions of existing policies, legislation, and regulations on transportation, climate change, royalties and fiscal structures, decommissioning and abandonment, water, and environmental safety, as well as more detailed discussions of harmonization

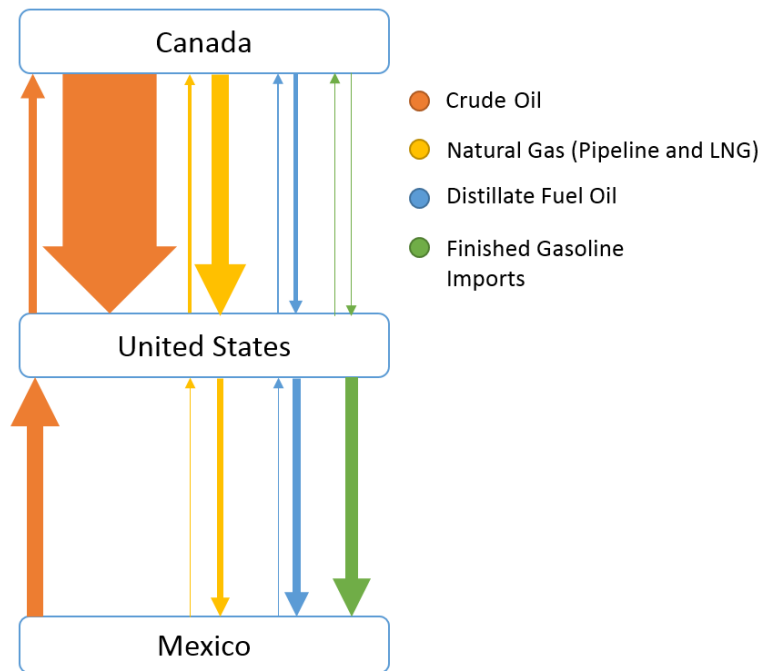
opportunities in each of those areas (sections 2–7). The report also highlights several fundamental differences in the broader regulatory framework across the three countries, as these have an impact on efforts for harmonization.

The report concludes with several recommendations that draw on the policy review, the workshop proceedings, and (ultimately) the authors’ own judgments of what might be beneficial or reasonable in terms of future harmonization efforts. Although federal cooperation on climate issues is improbable in the short-term, there may be opportunity for alignment at the federal level on issues salient to all three countries, such as infrastructure needs, comparing how permitting processes in the three countries and across their borders differ and making appropriate reforms.

FIGURE 1. US NATURAL GAS (PIPELINE, LNG, AND CNG) EXPORTS, 1973–2016



Source: Authors calculations based on 2016 US Energy Information Administration (EIA) data.

FIGURE 2. RELATIVE VALUE OF FOUR KEY NORTH AMERICAN OIL AND GAS FLOWS IN 2016

Source: Authors calculations based on 2016 US EIA data. See Table 1 for the amounts of imports and 2016 average prices that informed this figure.

Note: The minimal oil and gas traded between Mexico and Canada directly are excluded from this chart. This chart also excludes a number of other energy products traded focusing on the four most salient for this discussion. The relative widths of lines indicate the relative values of these fuels exchanged in 2016.

TABLE 1. VOLUMES AND PRICES OF FUELS TRADED BY THE UNITED STATES WITH MEXICO AND CANADA, 2016

Fuel	Imports from		Exports to		Price (US\$)
	Mexico	Canada	Mexico	Canada	
Crude oil (Mbbl)	213,079	1,191,578		110,115	\$43.33/bbl*
Natural gas, pipeline, and LNG (MMcf)	917	2,611,932	1,385,089	771,304	\$2.515/Mcf [†]
Finished motor gasoline (Mbbl)		11,354	120,336	11,050	\$1.40/gallon [‡]
Distillate fuel oil (Mbbl)	220	38,005	66,686	11,962	\$10.86/MMBtu [§]

Source: EIA.

Note: bbl = barrels; Mbbl = thousand barrels; Mcf = thousand cubic feet; MMcf = million cubic feet; MMBtu = million British thermal units

* West Texas Intermediate.

[†] Average of 2016 import and export average prices.

[‡] 2016 refiner wholesale price.

[§] Power generation fuel cost in 2016.

On fiscal policy, simplifying some policies, such as those affecting royalty rates, could provide the public with a more transparent process and fair returns while functioning more efficiently during periods of low oil prices. Moreover, a number of opportunities exist for cooperation on phasing out fossil fuel subsidies given the G20 commitment and an agreement among the three countries to do so.

Further, there are quite a few opportunities for subnational governments to explore harmonization of policies, rules, and regulations. In particular, subnational governments have an incentive to work together to harmonize rules around methane venting, flaring and leaks, and black carbon. Approaches to improve quantification of methane emissions provide low-cost, high-reward opportunities. By standardizing and improving emissions reporting, governments can ensure that regulations target high-opportunity areas and improve compliance. Cooperation could also help in the development of cost-effective and innovative technologies and approaches to identifying methane “superemitters.”

There may be opportunities for the three countries to work together to set coordinated standards on decommissioning, water use and disposal, and safety. It should be noted that many of these rules are either shared between different levels of government or fall strictly within the purview of subnational governments. The three federal governments could facilitate this multi-stakeholder dialogue by bringing together subnational regulators and policy departments to share information and best practices.

Finally, creating energy technology innovation exchanges and leveraging funding among the three countries could drive down both public and private costs for research and development.

Ultimately, the fates of the Mexican, Canadian, and US energy sectors are intertwined and appear likely to be so for years to come. This interdependence comes with risks—but fewer than with isolation. The three countries would best be served by continued and strengthened collaboration on oil and gas development, with credible signals that they will continue to provide each other with secure supply while addressing environmental concerns.

Significant energy trade growth has occurred within the NAFTA framework, arguing that NAFTA is not a major impediment to energy trade. Nevertheless, President Trump’s signaled commitment to renegotiating the North American Free Trade Agreement (NAFTA) presents an interesting opportunity to solidify energy trade relationships. As of July 2017, however, it appears that the Trump administration will renegotiate NAFTA and, based on the “Summary of Objectives for the NAFTA Renegotiation” released by the Office of the US Trade Representative, the emphasis will be on furthering energy-market access and “support[ing] North American energy security.”² This area is ripe for future research and thought leadership, both across disciplines (economics, law, policy) and across nations.

² Summary of Objectives for the NAFTA Renegotiation (<https://ustr.gov/sites/default/files/files/Press/Releases/NAFTAObjectives.pdf>).

Harmonization Opportunities for Oil and Gas Policy in North America

- Describe ways the three countries are already collaborating on energy and climate issues, and maintain all nonduplicative interactions.
- Define what constitutes a subsidy to the oil and gas sector, harmonize this definition among the three countries, and continue action to eliminate fossil fuel subsidies.
- Examine the extent to which infrastructure permitting processes are similar or differ across the three countries, specifically as this relates to environmental impact statements (EISs).
- Improve regulatory alignment and information sharing regarding methane emissions.
- Expand FracFocus, already in place in the United States and Canada, to Mexico.
- Continue energy technology innovation exchanges such as on carbon capture utilization and storage (CCUS), methane measurements, and water-saving technologies. Leverage the three countries' investments through joint funding for research and development.
- Develop risk-based safety and environmental inspection systems to address the Gulf of Mexico holistically in the spirit of the US-Mexico Transboundary Hydrocarbon Reservoirs Agreement. The Gulf is one ecosystem, and nature does not recognize borders. Expand existing coordination to address more issues, and look for areas where goals and objectives overlap.
- Make changes in rules across the three countries in two identified target areas: decommissioning standards and water use and disposal standards.
- Study past and present concerns regarding harmonization in NAFTA and what they mean for harmonization in this context. Examine areas where NAFTA could be updated.
- Provide Mexico with certainty regarding natural gas and oil products supply, and further policies that provide the three countries with increased energy and economic security.
- Harmonize CO₂ policies where possible, particularly at the subnational level in the short term and keeping long-term goals in mind.

1. Introduction

In recent years, there has been movement towards harmonizing environmental and climate change regulations and policies among Canada and the United States, and increasingly, Mexico. The term *harmonization* is used to convey the full range of possible interactions from data and technology sharing through coordination and ultimately aligning standards and other rules to be consistent or even identical. During the Obama administration, the drive to harmonize was influenced by a desire to collaborate on shared objectives, such as the announced intentions to work together on the implementation of the Paris Agreement and on a host of climate, energy efficiency, pollution, and natural resource issues through the North American Climate, Clean Energy and Environment Partnership signed by all three leaders in June 2016.³ In other cases, collaboration has been driven by a desire to address any potential economic and market barriers due to an unaligned market. For instance, Canada has adopted an alignment approach with the US greenhouse gas (GHG) standards for vehicle efficiency. This change in a harmonization of standards across borders (McCarthy 2012) enabled a smoother market exchange in manufacturing and trade of automobiles.

Against this backdrop, RFF, ITAM, and IISD seek to highlight regulatory issues in the upstream oil and gas sector in North America, focusing on regulatory and legislative frameworks in the three countries, existing harmonization efforts, and areas that would benefit from future harmonization.

The report is informed by a draft paper and a workshop held in Washington, DC, by

Resources for the Future (RFF) on October 3–4, 2016, called Oil & Gas Development in North America: Opportunities for Regulatory Harmonization. The workshop brought together regulators, practitioners, policy experts, and civil society groups to discuss opportunities for harmonization across the sector. This report reviews a number of key policy areas related to oil and gas development in the three major North American countries and explores opportunities for enhanced trilateral cooperation and policy alignment. Sections 3–7 describe existing policies, legislation, and regulations on transportation, infrastructure, and safety; climate change; royalties and fiscal regimes; well decommissioning; and water. In addition, fundamental differences in the broader regulatory framework across the countries are examined, as they have an impact on efforts for harmonization. Section 8 reports on information, recommendations, and action items from the workshop. Section 9 concludes with recommendations from the authors that may go beyond what was said at the workshop and take into account political realities stemming from the election of Donald Trump, who indicated a distinct change in attitude toward both federal energy and climate policy and relations with the United States' North American neighbors.

1.1. Overview of Legislative Frameworks

In Canada, subnational governments manage oil and gas resources (except on federal lands), while environmental regulations fall under both subnational and national jurisdiction. Currently, the National Energy Board (NEB) is Canada's overall regulator for energy transmission as well as oil

³ For more information:

<https://obamawhitehouse.archives.gov/the-press-office/2016/06/29/north-american-climate-clean-energy-and-environment-partnership-action>.

and gas development in specific areas.. The NEB's responsibility is outlined in 17 acts, including the Canada Oil and Gas Operations Act,⁴ Canada Petroleum Resources Act,⁵ and Energy Administration Act.⁶ Joint federal-provincial boards manage offshore developments in the Atlantic region, and there is a moratorium on development in the Pacific region. The Canadian environmental assessment process is one of the fundamental tools for the federal government to assess potential effects of projects on areas of federal jurisdiction and is primarily overseen by the Canadian Environmental Assessment Agency. Subnational governments also conduct environmental assessments, and these processes are harmonized as much as possible. Climate change and water impacts are often raised as concerns by groups opposing resource projects and have influenced the assessment process.

In the United States, oil and gas development is regulated at the state level, with the major exceptions of federal lands and offshore development. This state-by-state approach creates variations in how the sector is regulated in general, although the federal government has a role in regulating through its powers on environmental issues, such as air, wildlife, and water impacts. In regard to shale gas, fracking regulations are set at the state level and focus on site and well design, drilling procedures, and monitoring and handling of material and waste. Environmental testing is determined by the individual states (ALS, n.d.). Offshore development is regulated by the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental

Enforcement (BSEE), both within the US Department of the Interior (DOI). These bureaus are responsible for updating rules governing offshore activities and ensuring compliance. In 2016, the Obama administration published final regulations for offshore oil and gas (DOI 2016a), which are intended to prevent an offshore oil disaster similar to the Deepwater Horizon event (Davenport 2016). The DOI also plays a role in safety and environmental protection regulations.

Mexico's oil and gas sector had been under state control until recently. For decades, the national oil company, Petroleos Mexicanos (Pemex), had sole rights to the full life cycle of oil and gas activity in the country, but in 2013, President Enrique Peña Nieto signed a constitutional energy reform that opened up the sector to private companies, allowing them to bid on contracts and pay royalties. This was in response to a decline in the sector and was meant to address the inefficiencies within Pemex as well as boost overall efficiency, productivity, and transparency in the sector (Tapia 2013). The Ministry of Energy (SENER) is responsible for policymaking in the sector, including contractual models for licensing, shared production, and services. The National Commission of Hydrocarbons (CNH) provides technical advice to SENER and is also responsible for regulating upstream activities, serving as the administrative body for contracts with national and private companies. The Regulating Energy Commission (CRE) is responsible for regulating mid- and downstream activities in the sector; this includes administration of

⁴ Canada Oil and Gas Operations Act (R.S.C., 1985, c. O-7). <http://laws-lois.justice.gc.ca/eng/acts/O-7/>.

⁵ Canada Petroleum Resources Act (R.S.C., 1985, c. 36 (2nd Supp.)). <http://laws-lois.justice.gc.ca/eng/acts/C-8.5/>.

⁶ Energy Administration Act (R.S.C., 1985, c. E-6). <http://laws-lois.justice.gc.ca/eng/acts/E-6/>.

contracts to access the transport and storage infrastructure (CEFP 2014). A new player in the regulatory framework is the National Agency for Industrial Security and Environmental Protection (ASEA), which was created following the energy reform in 2014. ASEA serves as the regulator to the sector's industrial security and environmental issues and is a decentralized administrative body of the Ministry of Environment and Natural Resources (SEMARNAT).⁷

1.2. North American Energy Trade at a Glance

Energy flows among the United States, Mexico, and Canada are complicated and multifaceted (see Figure 2 above). The United States is currently a customer for Canadian and Mexican crude oil, petroleum coke, and natural gas, while trading all of these products, in addition to motor gasoline (including blending components) and distillate fuel oil, back to Mexico and Canada.

In 2015, energy exports from Canada to the United States totaled US\$53 billion, almost all of the total Canadian energy exports (EIA 2017b). Canadian oil accounts for 43 percent of total US crude oil imports Canadian natural gas furthermore accounts for 97 percent of US natural gas imports (Government of Canada 2016a). The United States also exported US\$14 billion in energy products to Canada in 2016 (EIA 2017b). This volume of trade requires a compatible energy transportation network through the development of pipelines and rail access. It is expected that energy trade between Canada and the United States will continue to grow in coming years (Snow 2014).

Mexico's energy trade with the United States has been changing in recent years. Mexico used to have a surplus, with crude oil exports to the United States dominating. With the fracking revolution in the United States and production problems of Pemex, as well as increased Mexican demand for refined products and natural gas, that surplus has turned into a deficit, with energy exports to the United States of US\$8.7 billion and energy imports from the United States of US\$20.2 billion in 2016 (EIA 2017c). Underlying part of this turnaround is a 31 percent increase in US natural gas exports to Mexico from the previous year (see Figure 1 on page 2), along with a doubling of gas pipeline capacity from five years ago and another doubling forecast one to two years in the future.

These changes in energy production and consumption within the three countries, absent political actions, will likely facilitate cooperation on energy issues. With these changes, the three countries have even greater incentive for increased coordination and expanded trade, as policies can "effectively foster economic growth and technological development, and have the potential to improve some aspects of environmental protection" (Krupnick, Shawhan, and Hayes 2016).

But politics are likely to be a major factor in whether and how harmonization might take place. Prior to President Trump's administration, Mexico and the United States were moving toward integrating their energy systems in a way that was comparable to how Canada and the United States had integrated their power and gas markets (Lee, Klump, and Gronewold 2017). On the one hand, as

⁷ *Ley de la Agencia Nacional de Seguridad Industrial y de Protección al Medio Ambiente del Sector Hidrocarburos.*
http://www.diputados.gob.mx/LeyesBiblio/pdf/LANSI_110814.pdf.

Mexico is currently reliant on US energy imports and is expected to see that dependence grow in the short term (Lajous 2017), and as President Trump seeks to boost the US energy sector, expanding cross-border infrastructure in a harmonized fashion could well occur. On March 24, for example, he approved the Keystone XL pipeline and called it “the first of many infrastructure projects” (Dennis and Mufson 2017). On the other hand, a border tax, which the president has discussed, could prevent such coordination and would additionally harm the US oil and gas industry and Mexico-US relations more broadly (Lee, Klump, and Gronewold 2017). Mexico, given its current reliance on US imports, has a lot to lose should the political climate hinder energy trade and cooperation. US producers, however, would likewise be harmed by such a change. Overall, the three countries have much to gain from continuing existing momentum that has occurred due to market changes as well as cooperation among federal and subnational governments.

2. Fuel Transport, Infrastructure, and Safety

A number of recent events have made the issues of safety and infrastructure highly salient, particularly in the United States and Canada. The 2013 Lac-Mégantic rail disaster in Canada, which caused 47 deaths following the derailment of a train carrying US crude oil, brought to light issues with transporting fossil fuels, and safety issues with rail specifically, an area where the United States and Canada have aligned their regulations in a nearly identical fashion. Additionally, Trump administration pronouncements notwithstanding, the “keep it in the ground movement” in the United States, coupled with concerns over the safety of pipelines, have complicated the issues of siting and approval for such infrastructure projects. In Mexico, rail and pipeline transport have also become salient with the energy reforms, as safety regulations are revised and infrastructure

expansions are planned. The 2010 Deepwater Horizon oil spill in the Gulf of Mexico has served as a catalyst for discussion of safety issues and regulatory reform for the offshore oil and gas sector as well. This incident was furthermore a precursor to greater discussion of cooperation (if not harmonization) with the development of the US-Mexico Transboundary Hydrocarbons Agreement (DOS 2013). These issues, in combination with increased trade among the three countries in recent years and increasingly linked electricity markets, make harmonization in these areas both more likely and more necessary.

To better understand oil and gas transport and infrastructure in North America, we examine each country in turn below, noting transport issues and their similarities and differences across borders. These issues are closely related to safety, as the expansion of oil from the Bakken in particular has placed stress on rail networks and led to calls for increased pipeline capacity by some in the United States. (See US–Canada rail networks for energy trade illustrated in Figure 3.) As explored below, the response has come in the form of revisions to rules on railcar safety, which led to harmonization of rules to the highest safety standards across the Canadian and US border.

2.1. Canada

2.1.1. Environmental Impact Statements

The environmental assessment process in Canada is controversial, with the development of pipelines being a major issue in addition to oil and gas exploration and development. The previous government introduced changes to multiple pieces of legislation to streamline the review process for major projects. Some stakeholder groups heavily criticized the changes (Adams 2016), indicating that the new process was introduced without meaningful stakeholder engagement and minimized the ability to properly study and understand the potential impacts of projects.

FIGURE 3. CANADA-US RAIL NETWORKS FOR ENERGY TRADE



Source: CAPP (2015).

The current government has launched a review of environmental and regulatory processes with the intent to restore public trust in major project reviews. The review is also focused on modernizing the NEB, restoring lost protections, and introducing modern

safeguards to the Fisheries Act⁸ and the Navigation Protection Act.⁹

While this review takes place, projects are being assessed under the current legislative framework and interim principles that were announced in January 2016.¹⁰ The interim principles emphasize that decisions will be

⁸ Fisheries Act (R.S.C., 1985, c. F-14). <http://laws-lois.justice.gc.ca/eng/acts/f-14/>.

⁹ Navigation Protection Act (R.S.C., 1985, c. N-22). <http://laws-lois.justice.gc.ca/eng/acts/N-22/>.

¹⁰ Interim Measures for Pipeline Reviews. <https://www.canada.ca/en/natural-resources-canada/news/2016/01/interim-measures-for-pipeline-reviews.html>.

based on science, knowledge of First Nations, and other relevant evidence; the views of the public and affected communities will be sought and considered; First Nations will be meaningfully consulted, and where appropriate, impacts on their rights and interests will be accommodated; and direct and upstream GHG emissions linked to the projects under review will be assessed. The government of Canada (2016c) released a methodology for estimating the upstream GHG emissions associated with major oil and gas projects undergoing federal environmental assessments in March 2016.

2.1.2. Transportation Infrastructure

Energy transmission infrastructure is an identified area of uncertainty for Canada. Major pipeline proposals include Keystone XL (800,000 barrels) and Trans Mountain pipeline expansion (590,000 more barrels per day), and Energy East pipeline project (1.1 million barrels). In 2015, the estimate for oil moved by rail was 140,000 barrels per day of crude oil, roughly 4 percent of western Canadian energy production (CAPP 2015). The safety of this energy trade is also a major issue (Figure 4). The Transport of Dangerous Goods Act and associated regulations cover rail transportation, including cross-border, outlining procedures that must be in place for various products, among them energy products such as natural gas and crude oil.¹¹

Furthermore, Canada has seen a renewed focus in railcar standards and safety, particularly since the accident in Lac-Mégantic. Changes have been made to Canada's Rail Safety Act to remove from operation railcars that are particularly vulnerable to leaks or spills.¹² Following this move by Canada, the US Department of Transportation and Transport Canada have collaborated on new rules for transport of flammable liquids.^{13 14} Policy harmonization was a key goal, and the new specifications are nearly identical. New tank car specifications have been put in place to require greater strength and reinforcement. At the same time, operating speeds have been reduced, and Canada has adopted a more robust risk assessment and more accurate products classification. NEB has the authority to regulate pipeline safety in Canada and in 2014 was granted increased authority to enforce safety compliance with the Pipeline Safety Act.¹⁵ A major focus is an increase in operator liability, to Can\$1 billion (NEB 2016b), with increased inspection and fines for noncompliance. Provincial regulators have jurisdiction over interprovincial pipeline regulation. In terms of safety, incident reporting requirements vary widely across jurisdictions in terms of the types of incidents reported, the amount spilled before reporting is required, and the types of products that require reporting. In Alberta, for example, any release of hydrocarbons requires reporting (Alberta Energy Regulator, n.d.a), whereas

¹¹ Amended *Transportation of Dangerous Goods Act, 1992* (June 16, 2009). <http://www.tc.gc.ca/eng/tdg/act-menu-130.htm>.

¹² *Railway Safety Act* (December 28, 2016). <http://laws-lois.justice.gc.ca/eng/acts/r-4.2/>.

¹³ 49 CFR Parts 171, 172, 173, 174, and 179, Fed. Reg. 80(222). (November 18, 2015). <https://www.federalregister.gov/documents/2015/11/18/2015-28774/hazardous-materials-enhanced-tank-car-standards-and-operational-controls-for-high-hazard-flammable>.

¹⁴ Regulations Amending the Transportation of Dangerous Goods Regulations (TC 117 Tank Cars). (April 30, 2015). <http://www.gazette.gc.ca/rp-pr/p2/2015/2015-05-20/html/sor-dors100-eng.php>.

¹⁵ Pipeline Safety Act (S.C. 2015, c. 21). http://laws-lois.justice.gc.ca/eng/annualstatutes/2015_21/page-1.html.

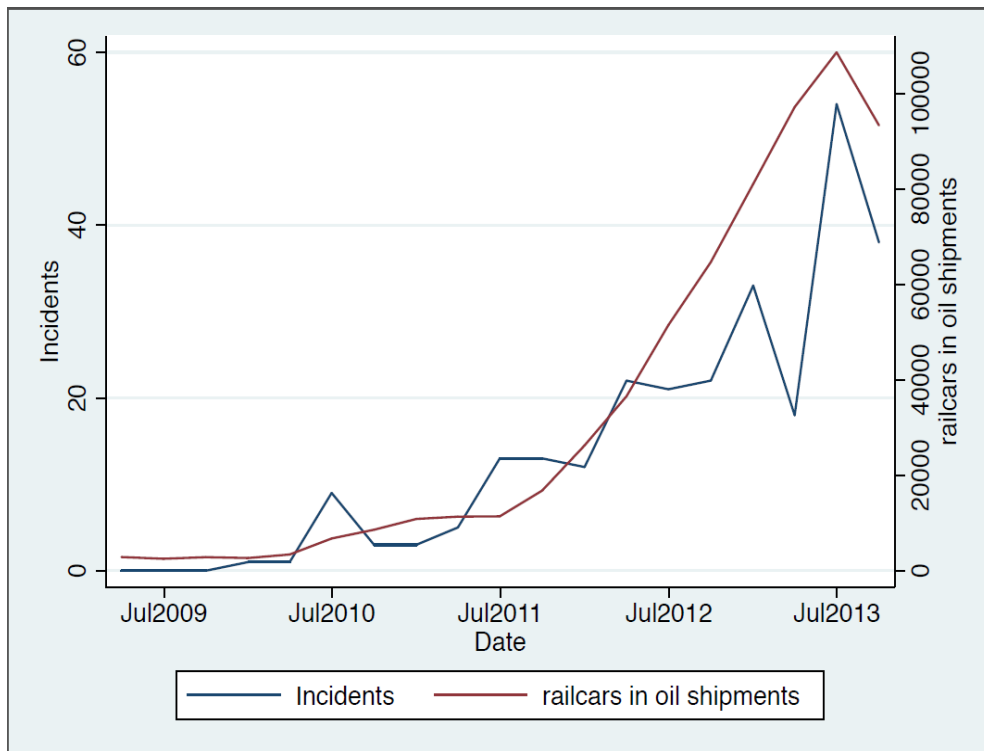
Saskatchewan requires reporting for natural gas releases exceeding 30,000 cubic meters (m³).¹⁶ This lack of harmonization makes comparing the effectiveness of regulations across jurisdictions difficult, if not impossible.

2.1.3. Offshore Safety and Infrastructure

With regard to offshore oil and gas, Canada’s Atlantic region is most relevant, as there has been a moratorium on offshore oil and gas exploration in place in the Pacific region since 1972, and no active drilling is occurring in the Arctic. This moratorium is based on entrenched government policy; no statutory impediments exist. Offshore boards,

which manage offshore resources, oversee implementation of health and safety requirements. Operators must have authorization from the boards before conducting any activities and must submit safety-related policies and procedures for review (CNSOPB, n.d.). Once operations begin, the board manages compliance monitoring and enforcement. Related to this, any spills must be reported to the boards (CAPP, n.d.).

FIGURE 4. NUMBER OF RAILROAD INCIDENTS COMPARED TO NUMBER OF RAILCARS USED IN OIL SHIPMENTS, 2009–2013



Source: Calculations by Charles Mason, professor of Petroleum and Natural Gas Economics, University of Wyoming, and H.A. "Dave" True Jr., visiting fellow, Resources for the Future.

¹⁶ Directive PNG014: Incident Reporting Requirements. <http://publications.gov.sk.ca/documents/310/85293-Directive%20PNG014-Incident%20Reporting%20Requirements%20December%20Final%202016.pdf>.

2.2. United States

A number of factors have combined to make the siting and safety of oil and gas infrastructure highly salient in the United States, both for the public and for regulators. The 2010 Deepwater Horizon spill prompted an overhaul in how the United States addresses offshore drilling safety, while the “keep it in the ground” protest movement has made pipelines specific targets. And as unconventional oil and gas development has grown in the United States, domestic rail transport has been increasingly used as a method of transport. This increase in rail transportation is primarily due to exploration and production activity outpacing the development of pipeline infrastructure in the regions where shale development has flourished. Increased use of rail has resulted in a greater number of railroad incidents (Figure 4), which in turn has drawn more attention to safety in the sector.

2.2.1. Rail and Pipeline Infrastructure

In particular, the Federal Rail Administration has passed new regulations to improve rail integrity. As Canada has strengthened rules for railcar safety, this creates challenges for railcar owners in the United States, which may be using older cars that are being phased out, forcing upgrades even though they have not yet been federally mandated in the United States. In May 2015, the United States and Canada jointly announced rules to make transport of flammable liquids safer (DOT 2015), with a specific focus on harmonization.¹⁷ The resulting rules are nearly identical, as discussed earlier.

While public attention to rail safety has waxed and waned, pipeline safety has become a much more substantial issue in the United States than it has in Canada or Mexico, as the United States has 2.5 million miles of oil and gas pipelines, compared with 10,000 miles in Mexico and 50,000 miles in Canada (Groeger 2012; Pemex, n.d.; NRCan 2014). Whether railroad transport is actually safer than pipelines depends on how safety is measured: although the risk of a rail spill is about six times higher than that of a pipeline spill, pipelines tend to spill more when they do leak or rupture, and between 2004 and 2012, pipelines spilled three times more oil than rail did (Tencer 2013; IEA 2014). According to an IEA study (2014), the age of the US network (where more than half of the pipelines are over 50 years old) and the inspection rate (only 7 percent of pipelines are subject to frequent and rigorous inspections) are outstanding safety issues that need to be considered. Monitoring and upgrading to improved safety standards are increasingly important as the current pipeline network ages.

2.2.2. Pipeline Infrastructure and Environmental Impact Statements

The Federal Energy Regulatory Commission (FERC) determines “rate-setting methods for interstate pipeline companies, sets rules for business practices, and has the sole responsibility for authorizing the siting, construction, and operations of interstate pipelines, natural gas storage fields, and liquefied natural gas (LNG) facilities” (EIA, n.d.). The US Environmental Protection Agency (EPA) works with FERC on environmental aspects of pipelines. FERC also

¹⁷ 49 CFR Parts 173 and 179, Fed. Reg. 81(157). (August 15, 2016). <https://www.federalregister.gov/documents/2016/08/15/2016-19406/hazardous-materials-fast-act-requirements-for-flammable-liquids-and-rail-tank-cars>.

takes the lead on environmental reviews under the National Environmental Policy Act (NEPA),¹⁸ Endangered Species Act,¹⁹ National Historic Preservation Act,²⁰ and Magnuson-Stevens Fishery Conservation and Management Act.²¹ An important distinction is that FERC regulates natural gas pipelines, whereas oil pipelines are regulated on a state-by-state basis. The state-by-state approach on oil has led to a patchwork of policies and processes for oil transport. Other agencies are also involved, such as the Army Corps of Engineers for water crossings, the focal point in the Dakota Access protests and environmental review process. Importantly, the US Department of State also has jurisdiction over international pipelines.

President Trump has begun to act on his promise of increased and faster pipeline approvals. On January 24, 2017, he signed three separate memoranda regarding approvals for the Dakota Access pipeline, the Keystone XL pipeline, and pipeline construction in general, requiring pipelines to use American-made materials (White House 2016d, 2016e, 2016f).

One item likely to be addressed by the Trump administration is the NEPA's environmental impact statement (EIS) process, which has come under criticism for its complexity, length, and use following the Keystone XL review in the United States. Congress has also expressed interest in streamlining the permitting process, including the EIS reviews. At a recent oil and gas industry conference, Senator Dan Sullivan (R-Alaska) discussed the possibility of a Rebuild America Now Act that would aim to “modernize how the US approaches permits

for pipelines and other projects” (Klump and Lee 2017). House Republicans are also discussing legislation to expedite the permitting processes for oil and gas pipelines. One bill would give FERC more authority to set deadlines for other agencies, both federal and state, involved in the natural gas pipeline permitting process. Another bill would “place FERC in charge of permitting cross-border oil pipelines, eliminating an existing presidential review process overseen by the US State Department. The bill would set a ... deadline for FERC to approve an oil pipeline border crossing after environmental reviews are complete, unless it found the border-crossing was not in the ‘public interest.’ This review would replace a more rigorous ‘national interest’ test that now applies” (Argus Media 2017).

2.2.3. Offshore Safety and Infrastructure

Offshore drilling is another area that was subject to new safety rules under the Obama administration. The BSEE was created in 2011 in the wake of the Deepwater Horizon explosion and spill with the mandate to enforce safety and environmental regulations. BSEE has enacted reforms to issues such as well design, workplace safety, and corporate accountability. BSEE (n.d.) highlights the following items as among its most significant achievements:

- enhanced well design and casing standards;
- increased number of and training for safety inspectors;
- promotion of a culture of safety and continuous improvement;

¹⁸ National Environmental Policy Act of 1969. <https://www.epw.senate.gov/nepa69.pdf>.

¹⁹ Endangered Species Act of 1973. <https://www.epw.senate.gov/esa73.pdf>.

²⁰ National Historic Preservation Act. <http://www.achp.gov/nhpa.pdf>.

²¹ Magnuson-Stevens Fishery Conservation and Management Act. <http://www.achp.gov/nhpa.pdf>.

- enhanced blowout preventer performance, testing, and maintenance;
- ensuring that operators have access to subsea containment capability;
- enhanced understanding to support the review and approval of emerging technologies; and
- more stringent regulations for exploratory drilling activities in the Arctic.

Coordination between Mexico and the United States regarding offshore safety has occurred in the Gulf of Mexico following the US-Mexico Transboundary Hydrocarbons Agreement (DOS 2013). This agreement, designed to promote responsible stewardship in the Gulf of Mexico, provides for joint inspection teams to ensure compliance with safety laws and regulations, as well as joint review of and approval for agreement governing exploration and development of transboundary reservoirs.

On the final point, the recent Arctic Drilling Rule regulations,²² for exploratory drilling on the US Arctic Outer Continental Shelf, require companies to ensure internal controls and planning for oil spill prevention, containment, and responses (DOI 2016b). This regulation builds on the final well control and blowout prevention rules issued by the DOI in early 2016, which established a number of measures to ensure that the latest technologies and practices are incorporated, as well as enhances in inspection, monitoring and maintenance of equipment and practices.²³ The rules include design requirements and operational procedures for control equipment (DOI 2016a). In addition to these changes,

BOEM also increased the liability cap for oil spill damages to US\$134 million (BOEM 2014).

Other long-standing Acts play an important role in safety and environmental protection for energy transportation. The Pipeline Safety Improvement Act requires natural gas pipeline operators to implement an integrity management program that includes risk analysis, inspections, and baseline integrity assessments.²⁴

2.3. Mexico

2.3.1. New Infrastructure Framework

Before its recent energy reforms, the mid- and downstream sectors were operated entirely by Pemex, but with the energy reform, private companies are now able to participate (IEA 2017). After the energy reform, the National Center for Natural Gas Control (CENAGAS) was created, and in 2015, it obtained ownership of Pemex's natural gas infrastructure (Oil and Gas Magazine Staff 2014). Its mandate is to ensure the guaranteed "continuity and security of the country's natural-gas supply, as well as the integration of that supply into Mexico's national pipeline network" (Days 2014). The services provided by CENAGAS include reception of processed natural gas, pipeline transportation, measurement and analysis of the quantity and quality of the gas products, and delivery at designated departure areas.

To acquire these services for gas, as well as for other hydrocarbons, operators are required to obtain a transport permit from CRE for open access to storage, transportation, and distribution of oil and gas

²² Final Rule, 30 CFR, Parts 250, 254, and 550, Fed. Reg. 81(136). (July 15, 2016) https://www.bsee.gov/sites/bsee_prod.opengov.ibmcloud.com/files/federal-register-notice//2016-15699.pdf.

²³ Well Control Rule. <https://www.bsee.gov/guidance-and-regulations/regulations/well-control-rule>.

²⁴ Pipeline Safety Improvement Act of 2002. https://www.npms.phmsa.dot.gov/Documents/Pipeline_Safety_Improvement_Act_2002.pdf.

products and some petrochemicals. During 2017, 90 percent of Pemex's oil storage and transportation capacity "will be subject to open season tenders approved by CRE," and by 2020, Pemex's transportation activities will be market-based and regulated as the rest of the permit holders are (IEA 2017, 91–92). For natural gas transmission pipelines, CRE will mitigate Pemex's market power and avoid barriers to entry in order to regulate the market. Permit holders that provide natural gas transportation and storage services are required to grant open access to the infrastructure and services by carrying out an open season to allocate capacity (IEA 2017).

2.3.2. New Safety and Transportation Regulations

Safety and environmental regulations for these midstream activities fall under ASEA's jurisdiction. Railroad safety is governed by the Ministry of Communications and Transportation (La Secretaría de Comunicaciones y Transportes). The ministry recently published the rule PROY-NOM-021-SCT2/2015; however, it makes no specific mention of hydrocarbon transportation safety.²⁵ ASEA released in 2016 a draft of its rule PROY-NOM-018-ASEA-2016, which serves as the technical specifications on environmental protection for activities involving the construction, maintenance, and operation of transportation systems for hydrocarbons.²⁶ This rule is specific to transportation infrastructure located in agricultural (crops and livestock) and wastelands. The rule provides requirements mostly specific to biodiversity protection, including proper waste management during

construction and maintenance, as well as the decommissioning of the entire infrastructure system or a portion thereof and restoration of the land to original conditions. The rule does not outline specifications for the construction of the pipeline itself, as it focuses only on the surrounding environmental impacts.

2.3.3. Additional Policy Instruments

The energy reforms also created two new policy instruments to address the social impacts of energy projects: the social impact assessment and the consultation with indigenous peoples (which is based on the ILO's Indigenous and Tribal People's Convention, C169). With more than 70 projects have been held up for social issues and the close connection between environmental impacts and social impacts, these innovations can be seen as something the other countries should consider.

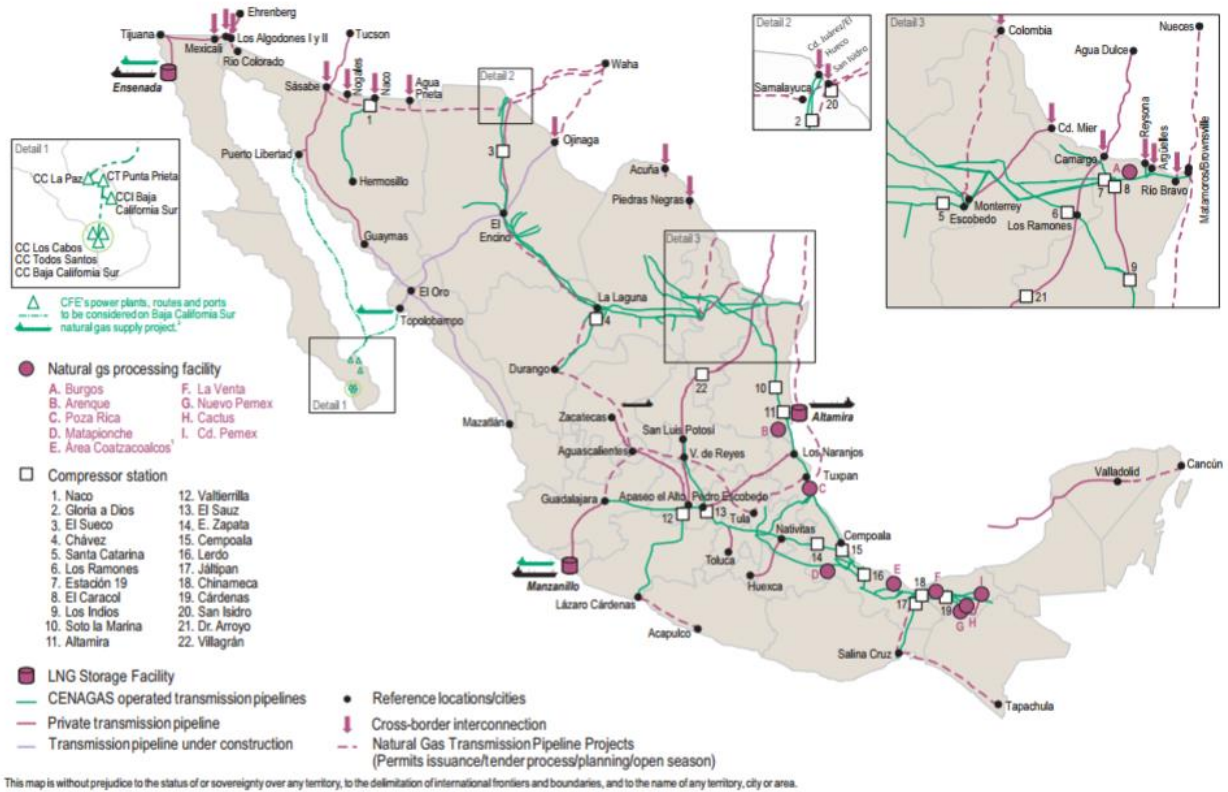
2.3.4. Infrastructure Expansion Plans

With the energy reform, the government hopes to expand its pipeline infrastructure, which has not kept up with the increase in demand for gas, leading to exceedances of maximum capacity and interruptions of gas imports and supply a number of times in the past several years (IEA 2017). Figure 5 maps existing natural gas infrastructure and pipelines under construction (light purple) and future projects (pink dashed line). Expanding this infrastructure will be important for ensuring energy supply across the country, but this need must be balanced with safety in terms of infrastructure and efficiency and stability in terms of the transition away from Pemex ownership.

²⁵ PROY-NOM-021-SCT2/2015. (December 15, 2016). http://www.dof.gob.mx/nota_detalle.php?codigo=5465556&fecha=15/12/2016.

²⁶ PROY-NOM-018-ASEA-2016. (September 15, 2016). http://dof.gob.mx/nota_to_doc.php?codnota=5452732.

FIGURE 5. NATURAL GAS INFRASTRUCTURE AND PROJECTS, 2016



Source: IEA (2017).

2.4. Harmonization Opportunities for Transportation, Infrastructure, and Safety

In Brief

- Review the EIS process with the goal of increasing certainty for operators and improving public trust in the process.
- Determine and share best practices for ensuring pipeline safety and leak detection.
- Continue harmonization efforts in the Gulf of Mexico by increasing cooperation on safety regulations as well.

President Trump’s commitment to become energy independent from “the OPEC [Organization of Petroleum Exporting Countries] cartel and any nations hostile to our interests” (White House 2017a) can also be

seen as an opportunity for greater North American cooperation on energy of all types, which entails a buildout of transportation and infrastructure and provides incentives to cooperate on environmental protection and safety. These opportunities are particularly relevant in light of a number of changes taking place in North American energy production and consumption. Given the shale boom, the United States will become a net energy exporter by possibly 2026, although Canada will likely continue to be a major oil supplier for the United States, which imports oil on net. Mexico became a net importer of hydrocarbons in the second half of 2015, becoming particularly dependent on the United States for natural gas and diesel (Lajous 2017). Although Mexico’s energy reform seeks to close this deficit in the long run, the country will remain dependent on imports for the foreseeable future.

These changes have already spurred cooperation and harmonization in a number of areas highlighted above, and North American governments have a clear role to play in continuing these efforts. Though North America is predicted to become energy independent from other regions before 2025 (EIA 2017a), the countries can benefit from reaching this goal sooner or preventing any backsliding in the process. Harmonizing policies on infrastructure and safety will enable this process, reducing transaction costs and improving safety outcomes as well. Progress in these areas, however, could be hindered by a border tax should such a policy come to fruition.

The countries could see large benefits from harmonizing a number of areas that have existing momentum. Railcar standards have moved toward harmonization between the United States and Canada, and safety regulations in the Gulf of Mexico could likewise stem from current US-Mexico cooperation in that area. Furthermore, as Canada has shown, harmonizing reporting requirements for incidents and other data regarding trade and transportation is an important area for further work.²⁷ Discussions in RFF's workshop, however, indicate that harmonization of oil data is unlikely in the near future due to the vastly different definitions used by North American governments. Finally, EISs and permitting approval processes are at issue in all three countries—there are opportunities to improve the process to provide industry with certainty while also increasing or at least not diminishing public trust.

Understanding best practices and lessons learned from the three countries would be a

first step. Reviewing these processes could improve environmental and public safety outcomes and address indigenous/First Nations and other social concerns, while also standardizing the process, all helping provide certainty for industry. Given President Trump's public statements regarding the current approval process for infrastructure projects, climate, and other environmental issues, some areas, particularly climate, are not likely to become a priority in this process in the near future. Even so, regulatory certainty for industry could be a goal among the three countries, with further harmonization in regard to climate and other impacts a goal in the longer run.

Overall, oil and gas infrastructure and safety are likely to remain salient to the public and, of the larger issue areas discussed in this document, are also the most propitious for harmonization efforts in both the short and long term. Furthermore, harmonization on this front would have long-lasting benefits as the North American countries come to increasingly rely on each other for energy trade.

3. Climate Regulations

Over the past few years, Canada, Mexico, and the United States have cooperated on climate regulations in a number of ways, most notably through the commitments made in June 2016 as part of the North American Climate, Clean Energy, and Environment Partnership Action Plan. Among the most relevant parts of the action plan to the oil and gas sector are the trilateral commitment to reduce methane emissions from the sector by 40–45 percent by 2025; interest in continued technology and data sharing; collaboration on

²⁷ Such work has begun with early steps in a trilateral effort to improve data sharing and publication, projections, and references for terminology and concepts at <http://www.nacei.org/en/>.

implementation of the World Bank’s Zero Routine Flaring by 2030 Initiative; and phasing out “inefficient” fossil fuel subsidies (Obama White House 2016).

Canada, Mexico, and the United States also submitted Intended Nationally Determined Contributions (INDCs) to the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC), though President Trump has recently announced he will withdraw the US from the agreement. Because pulling out of the agreement cannot occur before three years after implementation, and a country cannot exit until a year after its withdrawal is announced, the final decision to exit will be left until just before the next US presidential election in 2020 (Farber 2017). The United States’ INDC, therefore, technically remains in effect at least until that point, though President Trump presumably will not make efforts to comply. Nonetheless, the three countries’ submissions already have some notable overlaps and similarities:

- All three countries proposed absolute emission reductions, with Canada and the United States starting immediately and Mexico projecting peak emissions in 2026 and declining thereafter.
- Both Canada and the United States committed to major emissions reductions. The US target is 26–28 percent by 2025, while Canada commits to 30 percent by 2030, both below 2005 levels.
- Both Canada and the United States reference planned reductions in emissions of methane from the oil and

gas sector, while Mexico covers methane in its plans more generally.

- Canada and the United States both address energy conservation and efficiency.

Despite issues resulting from the US absence of climate leadership following the 2016 election, earlier momentum through these aforementioned initiatives, discussed in the context of each country below, have provided the basis for a perhaps longer-term form of cooperation among the North American countries as well as subnational efforts.

3.1. Canada

3.1.1. Carbon Dioxide

Before 2016, the prevailing carbon dioxide emissions mitigation approach rested at the provincial level, driven by early actors that had an economic or moral interest in being the first-in-country. The federal government had launched policy initiatives focused on carbon pricing (most notably, the Turning the Corner plan in 2008)²⁸ but failed to implement them, eventually favoring a sector-by-sector regulatory approach.

In 2016, Canada’s new federal government announced a carbon pricing plan that will be applicable in all provinces and territories and mandated a price floor for carbon that will start at Can\$10 per ton in 2018, and climb to Can\$50 per ton in 2022 (Government of Canada 2016b). Provinces will be given the flexibility to implement their own pricing systems (similar to what would have been state implementation under the Clean Power Plan in the United States) that will deliver outcomes consistent with the

²⁸ Turning the Corner: Taking Action to Fight Climate Change. (March 2008). http://publications.gc.ca/collections/collection_2009/ec/En88-2-2008E.pdf.

direct pricing plan proposed by the federal government. Provinces that do not opt for developing their own approach will be subject to pricing being imposed by the federal government in 2018. Provinces that already have a carbon pricing approach in place will be expected to adapt their plans to match or exceed the stringency of the plan proposed by the federal government. Respective provincial and territorial governments will determine how they use the revenues associated with the carbon tax. The goal of implementing this pan-Canadian approach is to assist the federal government in meeting the national GHG reduction target of 30 percent below 2005 emission levels by 2030.

3.1.2. Methane

As mentioned, the federal government in Canada has also committed to reducing methane emissions in the oil and gas sector by 40–45 percent below 2012 levels by 2025. Canada published its proposed methane regulations for the oil and gas sector in May 2017.²⁹ The proposed rule estimates that from 2018 to 2035, the cumulative emission reduction from the proposed regulations are estimated at 282 Mt CO₂e, with net benefits of the proposed regulations estimated at \$11.7 billion. In parallel, Canada published proposed regulations to limit the emissions of volatile organic compounds (VOCs) from the petroleum sector, which could also reduce methane emissions.³⁰

The proposed approach will set requirements for facilities above a certain level of production or processing capacity. Facilities will be required to implement leak detection and repair (LDAR) programs, conserve or flare gas in well completion,

repair compressors, set requirements for pneumatic controllers and pumps, and limit venting. Alberta is in the process of developing its own regulations. Canada is also a signatory of the World Bank Zero Routine Flaring by 2030 Initiative. This initiative is an existing area of harmonization with Mexico and the United States (as well as California at the state level), which have also endorsed the initiative.

3.1.2. Alberta's Climate Regulations

As Alberta is the province responsible for the greatest percentage of Canada's oil and gas production, it is worth highlighting its regulations in particular. Alberta has a similar methane reduction target of 45 percent, with the oil and gas industry representing 70 percent of provincial methane emissions. The province uses a combination of approaches to reducing methane, including offset protocols; new design standards; improving measurement and reporting, including leak detection; and regulated standards, to take effect in 2020 (Government of Alberta, n.d.c).

Alberta has an emissions limit for the oil sands sector (100 megatons per year) and requires facilities to meet the level of emissions intensity of best performers in their sector or pay a price on carbon over and above such a benchmark. Alberta also has an economy-wide price on carbon, which came into effect on January 1, 2017, of Can\$20 per ton of emissions, to increase to Can\$30 per ton one year later (Government of Alberta, n.d.c). This roughly translates to a 2018 cost of Can 8.03 cents per liter of diesel fuel, Can\$1.517 per gigajoule of natural gas, and Can 6.73 cents per liter of gasoline (Government of Alberta 2016b).

²⁹ Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector), Canada Gazette 151(21), Part I, 2017. <http://www.gazette.gc.ca/rp-pr/p1/2017/2017-05-27/pdf/g1-15121.pdf>.

³⁰ Regulations Respecting Reduction in the Release of Volatile Organic Compounds (Petroleum Sector), Canada Gazette 151(21), Part I, 2157. <http://www.gazette.gc.ca/rp-pr/p1/2017/2017-05-27/pdf/g1-15121.pdf>.

3.2. United States

3.2.1. Carbon Dioxide

After the well-publicized failure to pass national cap-and-trade legislation in the United States in 2009, there has been no substantive effort to develop an economy-wide GHG reduction policy. The result is a patchwork system where the federal government has sought to address carbon emissions through existing legislation such as the Clean Air Act, executive orders, and other regulatory processes, while the states have pursued their own initiatives.

At the federal level, the development of the Clean Power Plan³¹ sought to reduce electricity sector emissions under the authority of Clean Air Act section 111(d), though the rule is currently stayed by the Supreme Court, and the Trump administration has requested that EPA review the rule and that courts not issue a decision on the rule (White House 2017b; Gilmer 2017). The Clean Power Plan, now facing a very uncertain fate, would have set carbon dioxide emission performance rates for fossil fuel-fired steam generating units (including oil- and natural gas-fired electricity generation) (EPA 2016b). The Supreme Court ruled in 2007 that EPA had the authority to regulate GHG emissions under the Clean Air Act, given that they endanger public health and welfare, so simply rescinding the rule without replacing it could be difficult and would certainly lead to legal battles (Gilmer 2017). Furthermore, finalized environmental regulations are federal law and cannot be removed without a rulemaking process.

The Trump administration also rescinded the White House Council on Environmental Quality guidance calling on agencies to

consider climate impacts in environmental assessments with its March 28 executive order (White House 2016b, 2017b). Agencies were advised to quantify projected emissions and consider alternatives to reduce vulnerabilities in affected communities and make them more resilient to a changing climate. In doing so, the council suggested using “existing information and science when assessing proposed actions” (White House 2016b).

In terms of international climate action, the Paris Agreement is expected to remain in force irrespective of developments in the United States. While President Trump has announced he will withdraw from the Paris Agreement, the US will remain in the agreement until at least 2020, though he could still ignore the agreement and the United States’ stated goals, or perhaps withdraw from the UNFCCC in the future.

3.2.2. State-Level Carbon Pricing Schemes

With regard to carbon pricing at the state level, only California has an economy-wide price on carbon. The basis for this system is the Global Warming Solutions Act (AB 32),³² which requires California to reduce its emissions to 1990 levels by 2020. AB 32 requires the state to implement regulations to achieve maximum emissions reductions that are feasible and cost-effective. At the heart of this plan is the development of the cap-and-trade system that linked through the Western Climate Initiative to Quebec and Ontario and covers emitters of over 25,000 tons of GHG emissions annually. Mexico is interested in joining this system as well.

The Regional Greenhouse Gas Initiative, a collective of East Coast states, will also continue to operate an electricity-only cap-

³¹ 40 CFR 60, Fed. Reg. 80(205). (October 23, 2015). <https://www.federalregister.gov/documents/2015/10/23/2015-22842/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating>.

³² Assembly Bill 32, the California Global Warming Solutions Act of 2006. <https://www.arb.ca.gov/cc/ab32/ab32.htm>.

and-trade system in that region, with current allowance prices around US\$5 per ton in 2016 auctions (RGGI, n.d.). This system does not apply to oil and gas, other than electricity use in the sector, and there is no indication that it will expand at this point.

3.2.3. Methane

The United States began addressing oil and gas sector methane emissions in 2012 through VOC performance standards that reduced methane as a co-benefit. In September 2016, the US Department of Energy (DOE) awarded US\$13 million in funding for projects that would look at cost-effective ways to reduce methane emissions, including multiple projects in Texas, Colorado, and Pennsylvania (DOE 2016).

The Obama administration developed a number of rules and guidance documents aimed at reducing methane emissions from the oil and gas sector directly—publishing an EPA regulation for new sources, gathering information to eventually regulate emissions from existing sources, and a BLM rule for oil and gas operations on federal lands. EPA’s 2016 federal methane standards for new oil and gas sources require a 95 percent reduction in methane leaks from new oil and gas wells.³³ The EPA, under Administrator Pruitt, had proposed a two-year delay,³⁴ though a federal appeals court blocked the proposed moratorium (Friedman 2017). The standards were designed to align with state-specific requirements and are expected to reduce 510,000 short tons of methane, equivalent to 11 million metric tons of carbon dioxide (EPA 2016a). Though the rules for new standards

were heavily negotiated with industry, and therefore more likely to remain in place than other climate-related and fossil fuel industry rules, their fate could change, as the March 28 executive order directed EPA to review the rule. EPA has also stopped the rulemaking process for regulating methane from existing oil and gas facilities (Mooney and Dennis 2017).

With the Trump administration, initial steps have been taken to also end the US Bureau of Land Management’s (BLM’s) venting and flaring regulations for federal lands by postponing compliance dates.³⁵ The rule was flagged for review in the March 28 executive order and could be removed through a lengthier regulatory process or through court decisions, though repeal under the Congressional Review Act did not come up for a vote in the Senate.

3.2.4. State-Level Methane Regulations

At the same time, a number of state actions are advancing methane regulations. Colorado, Pennsylvania, California, Utah, Wyoming and, most recently, Ohio have implemented statewide methane regulations (Nelson 2017). Some of these states are Republican-led, indicating bipartisan interest at state and local levels to reduce emissions. Cooperation with state and local governments could strengthen harmonization on methane despite federal inaction.

Following are some highlights of state-level actions related to methane regulation:

- Colorado was the first state to limit methane emissions from oil and gas

³³ Final Rule, 40 CFR, Part 60, Fed. Reg. 81(107) (June 3, 2016). <https://www.gpo.gov/fdsys/pkg/FR-2016-06-03/pdf/2016-11971.pdf>.

³⁴ 40 CFR 60, Fed. Reg. 82(115). (June 16, 2017). <https://www.gpo.gov/fdsys/pkg/FR-2017-06-16/pdf/2017-12698.pdf>.

³⁵ 43 CFR 3170, Fed. Reg. 82(114). (June 15, 2017). <https://www.gpo.gov/fdsys/pkg/FR-2017-06-15/pdf/2017-12325.pdf>.

wells (Ogburn 2014). The rules of the Air Quality Control Commission (AQCC) require oil and gas companies to find and fix methane leaks and capture 95 percent of volatile organic compounds and methane, similar to the federal rule that followed. This was the first state-led initiative on methane.³⁶

- California has released proposed rules on methane emissions for the oil and gas sector that cover both upstream (producing, gathering and boosting, processing) and downstream (storage and transmission compressor stations) emissions sources.
- Ohio has also taken steps, regulating VOCs and methane through the permitting process for compressor stations and requiring quarterly checks for leaks (Williams 2017).
- Pennsylvania introduced rules in 2016 to limit emissions from natural gas development operations, first targeting new sources but then also existing sources (Williams 2016). The rules released by the Department of Environmental Protection follow the federal regulations under the Air Pollution Control Act and EPA's Oil and Natural Gas Sector: Emission Standards for New and Modified Sources. Under the permitting process, the department also has requirements for reducing methane emissions. Actions were also taken to establish best practices for methane monitoring and prevention of fugitive emissions from pipelines (PA DEP 2016).

On the other hand, some states oppose these regulations. Texas is one of several

states that have launched a lawsuit challenging the EPA approach to limiting methane emissions from oil and gas wells and storage tanks (Snow 2016). These states consider the EPA efforts an overreach of the agency's mandate and claim that the cost of the changes is harmful to industry. Montana and Wyoming issued a lawsuit against Obama administration rules intended to limit gas flaring at drilling sites, stating that BLM does not have authority over air quality issues (AP 2016).

3.3. Mexico

At the national level, the 2012 Ley General de Cambio Climático (LGCC) governs Mexico's efforts to address GHG emissions reductions and its mitigation and adaptation to climate change actions.³⁷ And under its INDC for the UNFCCC, Mexico's current emissions reduction target is 22 percent below business-as-usual levels, coupled with a 51 percent reduction of its black carbon, by 2030 (SEMARNAT, n.d.)

3.3.1. Carbon Dioxide

Under the LGCC, in 2013, Mexico opened up a voluntary market for emissions trading. In addition, in 2014, Mexico implemented a carbon tax on the sale and import of fossil fuels; however, natural gas pays no tax on its emissions. More specifically, the tax covers the additional emissions generated by the use of fossil fuels above what natural gas would produce (World Bank, n.d.). The tax is capped at 3 percent of the sales price of fuel. Companies paying the tax have the flexibility to pay via credits from clean development mechanism (CDM) projects implemented in

³⁶ AQCC Regulation Number 7. 5 CCR 1001-9. https://www.colorado.gov/pacific/sites/default/files/5-CCR-1001-9_1.pdf.

³⁷ Ley General de Cambio Climático. (June 6, 2012). http://www.inecc.gob.mx/descargas/2012_lgcc.pdf.

Mexico (World Bank, n.d.).³⁸ Specifically for the oil and gas sector, the LGCC outlines viable mechanisms that use best practices to minimize fugitive emissions in extraction, transportation, processing, and consumption activities and calls for both mitigation and adaptation actions that promote the sustainable use of these resources (Cámara de Diputados del H. Congreso de la Unión 2015). In 2016, the government of Mexico first announced its intention to implement a cap-and-trade system in the country via a joint declaration with Ontario, Quebec, and California on carbon market collaboration during the Climate Summit of the Americas. Following the announcement, a pilot scheme was announced to commence in November 2016, running a 12-month trial and consisting of up to 60 volunteer companies. Following the trial period, Mexico is expected to launch its national carbon market in 2018 (Schachar 2016).

Two agencies are active in the climate change portfolio for Mexico. The first is on the technical side, National Institute for Ecology and Climate Change, which is the national agency responsible for evaluating the outcomes of these actions toward achieving Mexico's climate change targets and

commitments. Reporting on its GHG emissions is the responsibility of SEMARNAT under the Reglamento de la Ley General de Cambio Climático en Materia del Registro Nacional de Emisiones (or regulation under the LGCC regarding the national emissions registry).³⁹ The responsible body for collecting and registering the GHG emissions is Mexico's GHG registry and reporting system, Registro Nacional de Emisiones (ICF International 2015). SEMARNAT is the overall responsible ministry for coordinating with other government agencies on climate change actions in Mexico.

3.3.1. Methane

Mexico, a quarter of whose emissions are released by the oil and gas sector, was the fifth-largest methane emitter in the world in 2015 (Larsen, Delgado, and Marsters 2015; Zavala-Araiza 2016). Enforcement of methane emissions regulations falls under ASEA. The agency's recently published guidelines for upstream oil and gas activities,⁴⁰ as well as the guidelines for unconventional development,⁴¹ prohibit venting of natural gas except in emergency situations. The flaring of natural gas is allowed in only three situations: when unforeseeable circumstances cause a safety

³⁸ Currently, there are limited number of CDM projects. The Ministry of Finance is looking at other mechanisms for the sector to use as a way to credit companies' emissions.

³⁹ Reglamento de la Ley General de Cambio Climático en Materia del Registro Nacional de Emisiones. (Octubre 28, 2014). http://dof.gob.mx/nota_detalle.php?codigo=5365828&fecha=28/10/2014.

⁴⁰ "Disposiciones administrativas de carácter general que establecen los Lineamientos en materia de Seguridad Industrial, Seguridad Operativa y Protección al Medio Ambiente para realizar las actividades de Reconocimiento y Exploración Superficial, Exploración y Extracción de Hidrocarburos" (December 9, 2016). http://www.dof.gob.mx/nota_detalle.php?codigo=5464908&fecha=09/12/2016.

⁴¹ "DISPOSICIONES administrativas de carácter general que establecen los Lineamientos en materia de seguridad industrial, seguridad operativa y protección al medio ambiente para realizar las actividades de Exploración y Extracción de Hidrocarburos en Yacimientos No Convencionales en tierra" (March 16, 2017). http://www.dof.gob.mx/nota_detalle.php?codigo=5476643&fecha=16/03/2017.

risk, during planned production tests, or for associated natural gas that is not technically or economically feasible to recover. Operators must report the volume flared and vented, emergency situations that may have led to venting or flaring, the content of hydrogen sulfide in the natural gas, and weather conditions during venting and flaring. The hydraulic fracturing guidelines furthermore require operators to detect methane leaks, suggesting several options for doing so, including pressure changes, acoustic or laser detection, and infrared technology, in order to repair leaks.

3.4. Harmonization Opportunities for Climate Regulations

In Brief

- Mexico, collaborating with US states where possible.
- Share approaches for regulating methane with the goal of implementing cost-effective regulations to reduce emissions.
- Share data and technology regarding methane emissions and reductions.
- Consider long-term opportunities for federal harmonization on climate policies.

Progress on continental-scale GHG emissions policies will be slow in the absence of US climate leadership. That said, there is no indication that the governments of Canada and Mexico will back away from the Paris Agreement or carbon policies, such as the existing carbon pricing system in Mexico, the announced federal carbon price backstop in Canada, subnational carbon taxes and caps in Canadian provinces and some US states, and tighter fuel economy standards in all three countries.

Although opportunities for increased harmonization on climate policy at the federal level are unlikely, there may be opportunities

for subnational governments to collaborate. In particular, province- and state-level governments with methane regulations could work together to ensure a consistent approach across the sector at the subnational level. With methane in particular, sharing approaches for cost-effective regulation as well as data would aid subnational jurisdictions. Furthermore, US states, particularly California, may be able to keep certain national climate policies, particularly vehicle emissions policies, from backsliding, as the state represents a large enough market for automakers. There is also an opportunity to have province- and state-level governments commit to the World Bank zero routine flaring initiative and accelerate the elimination of black carbon.

While federal harmonization on climate policies is improbable at best in the short-term, North American governments should not lose sight of the longer-term opportunities and benefits of climate policy cooperation. In the meantime, subnational efforts in the United States and both federal and subnational undertakings in both Mexico and Canada will continue North American efforts to reduce greenhouse gas emissions.

4. Royalties and Fiscal Regimes

Fiscal policies governing the oil and gas sector vary significantly among jurisdictions. In Canada, the federal and provincial governments are primary owners of resource deposits, whereas in the United States, natural resource rights are primarily privately held. In Mexico, the government both owns the mineral rights and operates oil and gas production with private sector participation.

There are two overarching types of fiscal regimes for taxation and royalties or severance taxes: sharing of revenues and set levies on the value of goods. Approach, stability, and rate of fiscal regimes can have a significant impact on the forecast internal rate of return of projects and investment attractiveness.

Multinational companies, in particular, pay special attention to fiscal policies when assessing the jurisdictions in which to invest capital. Analogous to the private sector, governments are cognizant of their (the public's) return on granting permits for resource extraction.

Fiscal regimes cannot always be directly compared, given their inherent differences; nevertheless, this section provides an overview of fiscal regimes in the jurisdictions reviewed in this study.

Although regulatory burden on the oil and gas sector could in theory be reduced by harmonizing fiscal regimes, given the differences noted above, not only would harmonization be difficult, but it also may not result in optimum fiscal outcomes. In our October workshop, participants further stated that they did not believe harmonization was needed or would necessarily improve outcomes. The three countries have, however, committed to phasing out “inefficient” fossil fuel subsidies by 2025, discussed further below.

Because of the nature of fiscal policies affecting oil and gas development, we look at two broader issues within this policy area: resource ownership and tenure; and royalty and fiscal structures, including property taxes and corporate income taxes, among others. And though harmonization may not be needed (or desirable) in this area, two case studies highlight best practices for the countries to consider for improved fiscal oil and gas policies in the future: Alberta's successful royalty simplification efforts and the US-Mexico Transboundary Hydrocarbon Reservoirs Agreement.

4.1. Resource Ownership and Tenure

Land tenure governing the oil and gas sector varies significantly among jurisdictions, as noted above. In the United States and Canada, the owner of the mineral rights has

the power to sever the surface and subsurface (mineral) estates. Surface and mineral properties are recognized as real property, and the mineral property owner has a right of surface access.

Retention of oil and gas rights on both US state and federal lands is based on well productivity—whether the well is actually producing after a given period of time. This contrasts with Canada, where the requirement is only that the well has the *potential* to produce. Although this is likely a relatively minor difference when viewed in full context, it is an example of a practice that may have implications for trade or leveling the playing field. Movement across borders could occur, distorting the market, because of inefficiencies or market failures introduced by such a policy.

Another example may relate to cross-border pooling. Newfoundland and Labrador settled a boundary dispute with France a number of years ago that would affect offshore resource development. Similarly, increasing investment prospects in Mexico's offshore have increased the importance of cross-border pooling between the United States and Mexico.

4.1.1. The US-Mexico Transboundary Hydrocarbon Reservoirs Agreement

If the host rock is sufficiently permeable, hydrocarbons can flow across political jurisdictions. In such a setting, extraction on one side of the border can adversely impact extraction on the other side. In the Gulf of Mexico, this is likely to occur. A moratorium area existed—1.4 miles on each side of a 135-mile-long section of the maritime border—until the US-Mexico Transboundary Hydrocarbons Reservoirs Agreement became effective in 2014.

The agreement recognizes the possibility that a reservoir may exist across the continental shelf boundary in the Gulf of Mexico and establishes a framework for

developing such resources cooperatively. The agreement encourages arrangements such as unitization agreements, under which the firms extracting from the pool—collectively referred to as the *unit*—all agree to have one party take charge of decisions regarding extraction by firms in the unit. In this way, the common pool delivers an aggregate level of revenues. These revenues are then distributed among the participating firms—for example, in proportion to their share of landholdings—which eliminates any motivation to extract rapidly (so as to pull resources away from a nearby firm). Unitization agreements on cross-border resource deposits could be an important arena for harmonization of standards.

If a unitization agreement cannot be reached, however, the agreement allows for unilateral production with a limit up to the amount of hydrocarbons that exist on that side of the boundary.

4.2. Royalty and Fiscal Structures

Finding the economically appropriate level of development of hydrocarbon resources is an issue of comparing benefits with costs. Leasing arrangements have an important role in this calculation. At one level, leasing arrangements are simply a means of transferring potential wealth from landowners to resource developers, with compensation provided by the latter to the former. But at a deeper level, they can create efficient incentives to explore for, and extract, hydrocarbon deposits.

Exploration is a form of investment: a firm expends resources before extracting any resource in the hope that the efforts will lead to a profitable venture. From society's perspective, the level of effort undertaken by the leaseholder can depart from socially optimal levels in the presence of two externalities. In some instances, particularly with conventional oil and gas projects, knowledge that a particular hydrocarbons project has been successfully developed raises the value of

nearby plots; this spillover benefit is essentially a public good, and its presence creates an incentive for firms to wait and see how nearby projects pan out. On the other hand, in those instances where exploratory results are less transparent, agents can use the information gleaned from their efforts to speculate on related assets. One important example of such speculation relates to land; here the concern is that developers will underpay for additional prospects, relative to the true value. In such instances, excessively large levels of exploration are likely to result. These levels will likely deliver smaller (and possibly negative) net social benefits.

When the “landowner” is society, as when the deposits are located on state or federal land, lease arrangements offer the opportunity to ensure that the public receives fair compensation for the deposits it implicitly owns. In addition, the leasing process presents the opportunity to assess the potential developer's expertise and financial resources, ensuring that the developer can competently proceed with resource development and will be less likely to disappear from the scene in the event that trouble arises (for example, if an oil spill occurs).

In addition to benefits associated with economic activity of resource development and leasing, governments collect fees for covering future liabilities and collect taxes against profits and royalties for the amount of resource extracted. Governments may have royalty, severance, and other tax schedules that are sensitive to individual circumstances, such as for low resource prices, small business, dry holes, or declining production volumes. Local governments in some states have the ability to levy property taxes on oil and gas

operations.⁴² Governments also provide various subsidies and tax expenditures. All in all, determining the effective tax rates for any one jurisdiction, let alone a comparison among countries and subnational governments, is exceedingly difficult and beyond the scope of this report. Notably, although there clearly are significant differences across governmental boundaries, industry attendees at our workshop did not consider such differences particularly important for harmonization purposes or particularly influential in their investment decisions. Table 2 on the following page gives some idea of gross differences.

Alberta applies royalty rates to net, not gross, revenues and further adjusts rates for the prices of oil and gas. In the United States, for oil and gas activity on federal lands, the government typically applies a royalty rate of 12.5 percent (DOI, n.d.) and 18.75 percent for offshore activities. Montana has a state-level corporate tax of 6.75 percent.⁴³ For Mexico, the royalty rate is set at a minimum of 7.5 percent on oil prices under US\$48 per barrel, with $\frac{1}{8}$ percent increase in the royalty rate for every US\$1 increase in the price of oil (Bentein 2015). In 2016, the Ministry of Finance announced that an additional royalty was added to the offshore exploration and production of oil and gas contracts taking place in the Gulf of Mexico, with the minimum rate set between 1.9 and 3.1 percent (Forbes Staff 2016).

Because Mexico's leasing process is so new, it is worthwhile to note that the tender process is conducted by the CNH, and the

technical and economic terms are established by SENER and the Ministry of Finance (ITAM 2016). The first auction was Round Zero, which took place in August 2014, and only Pemex was asked to participate. From this first auction, Pemex was granted 83 percent of Mexico's probable reserves and 21 percent of Mexico's prospective reserves. Though private companies were not able to take part in this auction, Round Zero opened the doors for private companies to get involved in exploration and production in the country by leaving room to participate in both probable and prospective reserves. Moreover, following Round Zero, Pemex moved to change some of its existing service contracts to profit-sharing contracts with private companies (Seelke et al. 2015). These are called "farm-out agreements," with one objective being to help foster knowledge-sharing and technology transfers between Pemex and private companies to help improve Pemex's performance (SENER 2016).

Since this time, there have been five more bidding events (labeled rounds 1.1-1.4 and 2.1), the last of these in mid-June and round 1.4 being the first to auction deepwater tracts. Indeed, some degree of harmonization in leasing arrangements has already occurred between CNH/SENER and BOEM, where the latter put larger, regionwide Gulf of Mexico blocks for lease in acknowledgment of Mexico's similar practice.⁴⁴

⁴² Some US states, however, such as Texas, define property to include the discounted present value of the physical oil and gas. In these cases, the property tax can be more significant, perhaps equating to a 1–3 percent royalty.

⁴³ Montana Corporate Income Tax. https://revenue.mt.gov/home/businesses/corporation_license.

⁴⁴ See <https://www.eenews.net/energywire/2017/03/13/stories/1060051341>.

TABLE 2. COMPARISON OF OIL AND GAS FISCAL LEVIES

Federal	Canada			United States						Mexico
Tax rate	10–15%			15–35%						30%
Royalty/ severance	1–30%			12.5–18.75%						7.5– 20%
State/ province	AB	NS	NL	CA	CO	MO	WY	PA	TX	
Tax rate	12%	16%	15%	8.84%	4.60%	6.75%	n/a	9.99%	1%	
Royalty	0–40%	2–35%	1–50%	12.5– 16.67%	16.67%	16.67%	16.67%	12.5– 18%	20– 5%	
Severance	n/a	n/a	n/a	\$0.14/bbl	2–5%	9%	11.5%*	negligible	4.6– 7.5%	

Source: Barry Rodgers, Rodgers Oil and Gas Consulting, Edmonton, Alberta, Canada.

*Includes property tax at 6.5%. US royalty rates are for federal and state lands.

4.2.1. Alberta’s Royalty Modernization

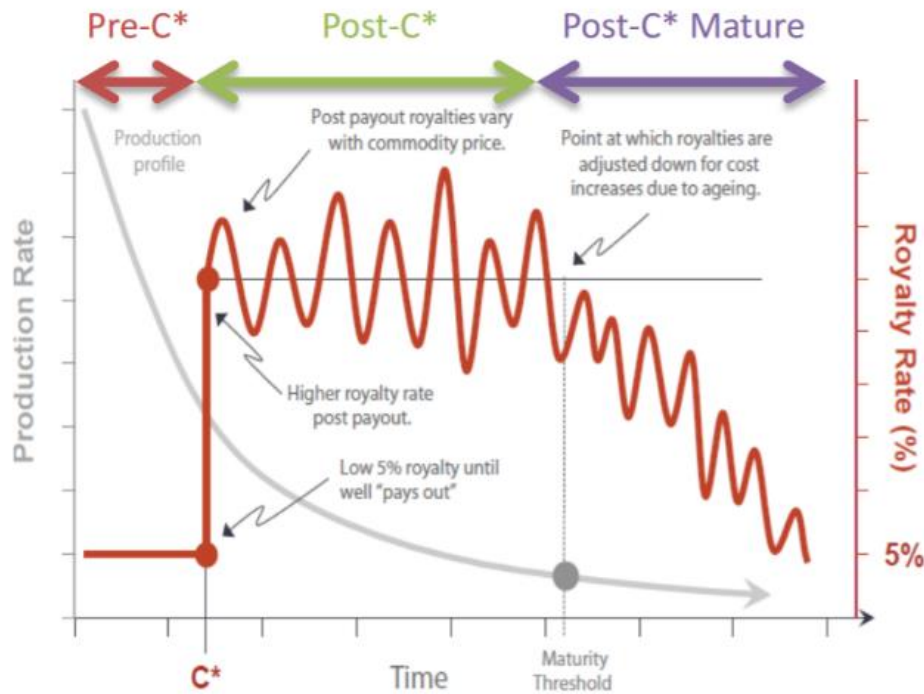
Alberta stands out in regard to simplifying its royalty scheme, increasing transparency, efficiency, and, the government of Alberta argues, “the value Albertans receive for [their] resources over time” (n.d.b). The old royalty scheme was “rigid” and did not adjust for changes in costs or productivity of wells. Additionally, it distinguished between oil and gas wells, which a review panel found to be “no longer meaningful,” and it did not provide Albertans with an optimal return. Finally, the review panel found the previous scheme to be nontransparent (Government of Alberta 2016a). The new royalty framework levies a single royalty for crude oil, natural, and liquids (excluding oil sands) that is comparable with a revenue-minus-cost system that is likewise able to account for different levels of costs for operators as well as different oil and gas prices. As Figure 6 shows, this royalty is a flat 5 percent rate until costs are recovered, then the company pays a higher fee that depends on the resource and prices. As the well ages and production rates decline, the royalty rates will likewise

decrease once a well reaches the “maturity threshold,” shown in Figure 6 (Government of Alberta, n.d.a).

This royalty modernization effort began in 2015, when the government of Alberta created an advisory panel to review the royalty framework. This effort was undertaken in the context of increasing competition from the United States, low oil and gas prices, increasing development costs in the province compared with other jurisdictions, and expectations of better environmental regulation. The panel engaged in extensive outreach, including both industry members and others. The goals of this effort were to encourage investment, provide Albertans with optimal returns, motivate diversification (e.g., innovation, value-added processing), and promote more responsible resource development (Government of Alberta 2016a).

The modernization effort has largely been seen as successful. For example, the new framework was scheduled to take effect for wells drilled beginning January 1, 2017, but companies were asking to opt in earlier (Wood 2016).

FIGURE 6. ROYALTY STRUCTURES OVER THE LIFE CYCLE OF A WELL



Source: Government of Alberta (n.d.a)

4.3. Harmonization Opportunities for Royalties and Fiscal Policies

In Brief

- Simplify existing fiscal structures and policies to ensure fair returns to taxpayers while adjusting for potential changes in operator costs or productivity.
- Consider the use of agreements promoting unitization and pooling to develop resources near borders.
- Define what constitutes a fossil fuel subsidy, work toward parallel schedules for phasing out these subsidies, and compel Canada to follow United States and Mexico's lead and initiate the peer review of its fossil fuel subsidies.

Although larger harmonization efforts for fiscal policy may not necessarily be desirable for improving economic or environmental outcomes, there is some low-hanging

harmonization "fruit." For example, maintaining existing fiscal rules and their effects but reducing their complexity can provide the private sector with more certainty and the public with more clarity. Certain practices or rules should be reviewed for simplification, such as the rolling start rules around the determination of Canadian depreciation, the US federal tax deduction in determining state tax, and rules around the treatment of intangible drilling costs in the United States. Following the example of Alberta—simplifying the royalty process in a manner that accounts for changes in oil prices and also adequately compensates the public—other jurisdictions could seek to simplify their royalty processes and also review current policies to ensure a fair return to the taxpayers. An opportunity may also exist for harmonization on leasing and royalty rates in the Gulf of Mexico, where comparable resource deposits and overlapping pools are

(or will be) pursued by entities in both the United States and Mexico.

And given the three countries' commitment to phasing out "inefficient" fossil fuel subsidies by 2025 (Prime Minister's Office 2016a), there is an opportunity in the short term for the three countries to cooperate by first defining what constitutes a subsidy to the oil and gas sector and then harmonizing this definition. In further cooperation, meeting this goal on parallel schedules would minimize inefficiencies in the North American market. In its election platform, the current Canadian government appears to have signaled its desire to "phase out subsidies for the fossil fuel industry over the medium-term" and specifically notes, as a starting point, the Canadian Exploration Expenses being allowed for "deduction only in cases of unsuccessful exploration" (Liberal Party of Canada 2015).

In Budget 2017, the government announced two changes, including adjusting exploration expenses for successful oil and gas exploration and modifying development expenses through flow-through shares (Department of Finance Canada 2017). Although momentum for such efforts in the short term have slowed in the United States, there are still opportunities for further work—first, defining subsidies, and second, for Canada to follow Mexico and the United States in opening its subsidies for peer review.

5. Decommissioning

At the end of their productive lives, oil and gas wells are supposed to be decommissioned—a process referred to as abandonment—and the land reclaimed. Rules regarding this process vary significantly among countries and jurisdictions within countries but follow a common underlying principle. Proper decommissioning and reclamation seek to prevent contamination of ground and surface water; prevent leaks, including methane leaks; and allow for use of

the land surface after the reclamation. The rules, however, do not always meet intended policy objectives. For instance, the integrity of decommissioning may be jeopardized by poor-quality material or workmanship or by environmental factors that occur after the process is completed.

Ongoing monitoring is the best way to ensure proper well decommissioning. However, monitoring is often expensive and may draw only a one-time conclusion. For example, a well may not show any methane leaks at a given point in time but may experience "methane burping" that results from a buildup and release of methane at another point in time. To capture this, either ongoing monitoring or testing of cement integrity would be required.

Additionally, there is the issue of governments taking on increasing liability for abandoned wells that are not decommissioned. Although most jurisdictions require a bond, insurance, or resources set against liability, operators continue to abandon projects prior to decommissioning—leaving "orphaned" wells. The number of orphaned wells across North America is in the hundreds of thousands, with the backlog of wells to be reclaimed under state-funded programs (Ho et al. 2016). With a decline in the price of oil, it is foreseeable that this liability could grow. Governments do not have the funding set aside to cover all liability borne by oil and gas operations.

Another issue may occur when wells are temporarily abandoned rather than decommissioned. Muehlenbachs (2017) found that wells throughout Canada are typically left in temporary status for many years, as opposed to being capped and reclaimed. Presumably the same thing happens in other jurisdictions, with the consequences that environmental risks are larger than they otherwise would be. In Firestone, Colorado, the recent explosion of a residence and two

deaths from a gas leak was attributed to a temporarily abandoned well.⁴⁵

While there is little momentum for harmonization on funding and rules around liability, a better understanding of scope of the problem at hand would help inform government policies across jurisdictions and can support all jurisdictions in strengthening their rules in ways that meet their local circumstances. That said, there is significant room for governments to harmonize on underlying principles for oil and gas project decommissioning.

5.1. Canada

In Canada, well abandonment is primarily regulated at the provincial level. For example, Alberta's Directive 020, released in March 2016, sets fairly prescriptive requirements for well abandonment, with the intent to complete an open-hole well to protect nonsaline groundwater.⁴⁶ To this end, the province provides the Groundwater Protection Query Tool.⁴⁷ The province sets minimum length requirements of 30–60 meters for zones covered. For oil sand zones, thermal cement is required for the entire length of the plug. For oil sands mining, reclamation requirements will result in more upland than wetland creation and could result in liability related to tailings ponds for about 10 years beyond mine life.

For orphaned wells, Alberta collects a levy from industry based on liability determination, which, in principle, is funded by the industry. Alberta recently increased the liability management ratio to twice the value of producing wells over the cost of abandonment and reclamation when acquiring new wells.

The province's Mine Financial Security Program applies an asset-to-liability approach, giving a value to the asset. If a project has assets three times the value of the liability, no additional financial contribution to the program is required.

For offshore wells, Canada's two Atlantic offshore boards require that well completion isolates the hydrocarbon and prevents pollution from escaping the well. It also requires that the seafloor be cleared of all equipment. These requirements are the same for both boards.

5.2. United States

A 2016 RFF report provides a detailed review of regulatory approaches to abandoning and decommissioning wells in the United States (Ho et al. 2016). The study reports that the United States has 3 million inactive wells but notes a lack of data on the breakdown by categories. Furthermore, about 12 percent of inactive wells in 13 major oil and gas producing states have not been decommissioned (Ho et al. 2016).

BLM oversees abandonment rules for oil and gas operations on federal public lands, while at the subnational level, regulations and requirements vary from state to state. According to the RFF review of state-level regulations, 18 of 22 states examined contain prescriptive requirements for different plugs (Ho et al. 2016), but the authors also find inadequate financial assurances to cover liabilities and recommend bonds that take into account all costs. They also find that individual states and BLM (in charge of federal lands) have very different approaches for regulating these wells, particularly in terms

⁴⁵ See <https://www.wsj.com/articles/colorado-explosion-in-april-blamed-on-leak-near-anadarko-well-1493766071>

⁴⁶ Directive 020. (March 15, 2016). <https://www.aer.ca/documents/directives/Directive020.pdf>.

⁴⁷ See <https://dds.aer.ca/BGP/UI/BGP-Main.aspx>.

of stringency and comprehensiveness of these policies.

The RFF report recommends that “bonding amounts should vary according to the major factors influencing costs, such as well depth.” The authors “report that many states already do this, to varying extents. We therefore recommend that other states consider this approach to bonding” (Ho et al. 2016, 16). Harmonization could therefore be explored across US states as well as across the three countries. Additionally, some best practices can be gleaned by comparing states’ regulations. For example, with states that have policies that are less protective of the environment, “shortening the time a well can be temporarily abandoned and raising the bar for proving a well should stay in that condition would help reduce the likelihood that inactive wells will create environmental externalities” (Ho et al. 2016, 16). Such practices can inform future decommissioning policies in states with weaker regulations as well as Canada and Mexico.

Another area in which such policy could be explored is in the decommissioning of offshore infrastructure. In February, BOEM rescinded its earlier requirements for ensuring that taxpayers do not foot the bill for cleaning up after bankrupt offshore oil and gas companies, but the agency still plans to go ahead with a program to address the issue, as the liabilities in the outer continental shelf alone could be as high as US\$40 billion, though industry states that the actual amount is much lower (Gronewold 2017).

5.3. Mexico

As discussed earlier, Pemex was a state-run enterprise and the sole oil and gas developer before the energy reform, so the costs related to abandonment would have fallen to the government in any case. Now that private companies are able to conduct production and exploration activities, however, the Mexican government should take note of the best practices of its northern neighbors to avoid challenges that both Canada and the United States have faced in minimizing the costs of reclaiming and plugging orphaned wells.

The recently published guidelines for upstream oil and gas operations mandate that wells should be abandoned within one year after the well has been declared dry, unsuccessful, saturated with water, or not commercially productive and requires operators to use two barriers, including one mechanical barrier, to plug the well, for both temporarily or permanently abandoned wells.⁴⁸ The regulation states that well plugs should protect aquifers and that authorized third parties will ensure compliance.

Two policies dictate and regulate the steps necessary to plug wells in more specific areas. NOM-115-SEMARNAT-2003 regulates wells that fall under agricultural, farming, or unused areas (though not protected areas), and it stipulates that any well at the end of its production should be plugged according to the technical requirements of the regulation.⁴⁹

⁴⁸ “Disposiciones administrativas de carácter general que establecen los Lineamientos en materia de Seguridad Industrial, Seguridad Operativa y Protección al Medio Ambiente para realizar las actividades de Reconocimiento y Exploración Superficial, Exploración y Extracción de Hidrocarburos.” (December 9, 2016). http://www.dof.gob.mx/nota_detalle.php?codigo=5464908&fecha=09/12/2016.

⁴⁹ NOM-115-SEMARNAT-2003. (August 27, 2004). <http://www.profepa.gob.mx/innovaportal/file/1326/1/nom-115-semarnat-2003.pdf>.

In addition, all equipment used during operations is to be removed from the area and the site restored its original conditions. NOM-149-SEMARNAT-2006 focuses on abandoned wells in marine areas.⁵⁰ This regulation notes that all wells need to be plugged when operations have ended and must be temporarily suspended following the rules of petroleum work construction (Reglamento de Trabajos Petroleros).

5.4. Harmonization Opportunities for Decommissioning

In Brief

- Share policies that minimize the potential for environmental damage due to temporarily abandoned wells or improperly constructed wells and plugs.
- Share best practices for decreasing liability related to the costs of decommissioning orphaned wells using cost-effective methods.
- Cooperate on policies that minimize environmental impacts and decrease liability of offshore infrastructure, particularly in the Gulf of Mexico.

In regard to decommissioning regulations, one area stands out for its utility, given the current state of policy in this area: the sharing of best practices. Each jurisdiction could still set its own rules, but through collaboration, best practices could be transferred from one jurisdiction to another. Lessons learned from Alberta's new Directive 020, for example, could be shared across jurisdictions. Variation in the stringency and comprehensiveness of requirements in different US states could likewise inform other jurisdictions of best practices.

There are a number of low-cost policies jurisdictions could adopt to improve environmental outcomes and reduce financial risk. Most important, jurisdictions should require bonding amounts that reflect the actual cost of plugging wells. Other best practices, such as the potential for idling and applying or reapplying for temporary abandonment status, could minimize the environmental harm caused by temporarily inactive wells. Canadian provinces and US states can learn from these best practices. And Mexico, as it transitions from having the government be solely responsible for managing these wells to involving private enterprises, can implement regulations to avoid many of the issues Canada and the United States have had as a result of inadequate regulation. Furthermore, as the United States seeks to address its own decommissioning issues offshore, Mexico and the United States could cooperate in the Gulf of Mexico to harmonize policies to decrease liability.

6. Water Regulations

There are two primary considerations at the intersection of water and oil and gas production: the amount of water used (which varies considerably across the sector) and how wastewater is handled. According a 2014 study, Canada used nearly 845 million cubic meters (m³), the United States used 3,684 m³, and Mexico used 667 m³ of water in fossil fuel energy production in 2008 (Spang et al. 2014) (note that 2008 was a period when fracking was ramping up). The wastewater (including processed water and fracking fluid), depending on the mixture and what it comes in contact with, will have varying toxicity. Produced water could contain heavy metals, hydrocarbons, and salts, which, if not properly

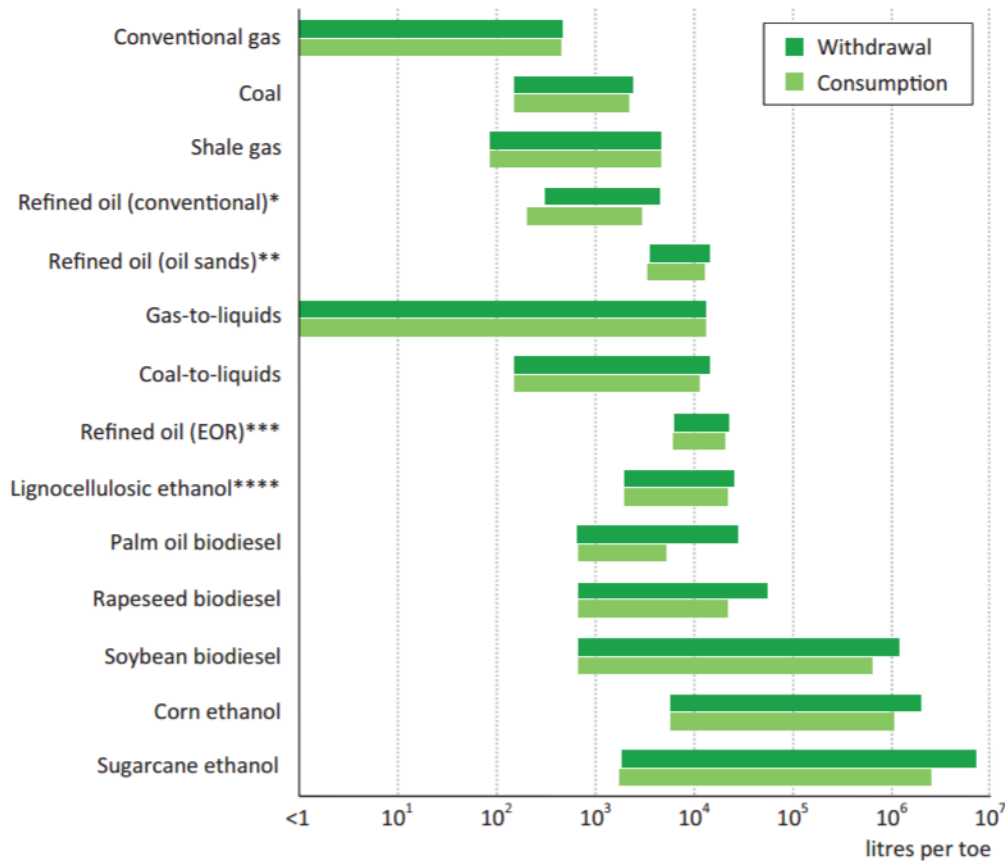
⁵⁰ NOM-149-SEMARNAT-2006. (January 31, 2007). <http://www.profepa.gob.mx/innovaportal/file/1338/1/nom-149-semarnat-2006.pdf>.

handled, could have environmental impacts. Figure 7 illustrates the amounts of water used by consumption and withdrawal of different sources.

Specific oil and gas rules are lacking for water use and disposal of waste. The three jurisdictions could explore opportunities in this area from a number of different perspectives. For regulating produced water discharges from offshore platforms, for

example, there are two primary approaches: EPA’s holistic approach used in the Gulf of Mexico, which focuses on what comes out of the pipe using toxicity testing, and Norway’s precautionary approach used in the North Sea, which assesses and emphasizes control of all the chemicals used in the well and during treatment. Most countries choose one of these two approaches. Mexico’s new regulation is

FIGURE 7. FOSSIL FUEL PRODUCTION WATER CONSUMPTION



Source: IEA (2012).

Note: Ranges shown are for “source-to-carrier” primary energy production, which includes withdrawals and consumption for extraction, processing and transport. Water use for biofuels production varies considerably because of differences in irrigation needs among regions and crops; the minimum for each crop represents nonirrigated crops whose only water requirements are for processing into fuels. EOR = enhanced oil recovery; toe = tonne of oil equivalent. For numeric ranges, see <http://www.worldenergyoutlook.org>.

* The minimum is for primary recovery; the maximum is for secondary recovery.

** The minimum is for in situ production; the maximum is for surface mining.

*** Includes CO₂ injection, steam injection, alkaline injection, and in situ combustion.

**** Excludes water use for crop residues allocated to food production.

being drafted by ASEA, but previously, the country regulated water discharges from offshore platforms under a number of rules and regulations, including NOM-149-SEMARNAT-2006 under the Ley General para la Prevención y Gestión Integral de los Residuos (LGPGIR).⁵¹ ⁵² Overall, all three countries would benefit from increased efficiency and data sharing in this regard, particularly in water-scarce regions.

6.1. Canada

Provincial governments have the responsibility of regulating water use and disposal. That said, under the Fisheries Act, the federal government can regulate activities that may result in harm to fish and prohibit the deposit of deleterious substances unless authorized by a regulation. Furthermore, the federal government can enforce rules to control discharges of toxic substances and to protect species at risk and migratory birds. Provinces, as they regulate most aspects of oil and gas activity, are also in charge of regulating induced seismicity related to these operations. Much of the induced seismicity related to oil and gas operations in Canada is associated with hydraulic fracturing operations rather than wastewater disposal, however. Jurisdictions such as Alberta have implemented “stoplight” regulations, which provide more stringent compliance requirements for operators, dependent on the magnitude of the earthquake, such as reporting seismic events above M2.0 and invoking response plans but ceasing operations if an

earthquake above an M4.0 occurs (Alberta Energy Regulator, n.d.b).

Environment and Climate Change Canada is responsible for the Petroleum Refinery Liquid Effluent Regulations, which were introduced in 1973.⁵³ Similar guidelines exist in the United States to regulate the discharge of effluents from refineries, but they have not been updated since 1985.

NEB and the Canada-Newfoundland and Canada-Nova Scotia offshore petroleum boards provide guidelines on the management of waste from offshore petroleum activity.⁵⁴ The guidelines provide guidance on both best practices and approaches to meeting regulatory requirements set under each of the board’s governing acts.

When it comes to flowing bodies of water, intake during low-flow periods could have adverse effects on fish ecology. Alberta’s Lower Athabasca Region Surface Water Quantity Management Framework for the Lower Athabasca River sets indicators and triggers to manage water withdrawal in oil sands areas. Two companies’ operations have grandfathered water licenses that would allow for withdrawals that are likely to be above freeze protection limits. Oil sands operations require unique water-use technologies. That said, cross-border collaboration can help advance scientific knowledge on the determination of minimum low-flow triggers, which remains a contentious issue, and their impacts on fish habitats. Alberta could also lead by establishing better practices to both

⁵¹ NOM-149-SEMARNAT-2006. (January 31, 2007). <http://www.profepa.gob.mx/innovaportal/file/1338/1/nom-149-semarnat-2006.pdf>.

⁵² Ley General para la Prevención y Gestión de los Residuos. (May 22, 2006). <http://www.aguascalientes.gob.mx/PROESPA/pdf/LEY%20GENERAL%20PARA%20LA%20PREVENCI%C3%93N%20Y%20GESTI%C3%93N%20INTEGRAL%20DE%20LOS%20RESIDUOS.pdf>.

⁵³ Petroleum Refinery Liquid Effluent Regulations (C.R.C., c. 828). <http://laws-lois.justice.gc.ca/eng/regulations/C.R.C.%2C%20c.%20828/page-1.html>.

⁵⁴ Offshore Waste Treatment Guidelines. (December 15, 2010). <http://www.cnlopb.ca/pdfs/guidelines/owtg1012e.pdf>.

monitor and minimize tailings seepage into the watershed. To this end, Canada could establish tracing technologies that could inform future regulations.

6.2. United States

There are no nationwide standards for water use and disposal of wastewater, and even within states, notable differences exist. The differences in regulations within and between jurisdictions create opportunities for regional harmonization. For example, the Susquehanna River Basin Commission, created by the US Congress and the states of New York, Pennsylvania, and Maryland, oversees water consumption along the Susquehanna River and its tributaries. Approvals are subject to low-flow conditions (SRBC 2012). Similar bodies with equivalent regulatory responsibilities do not exist in other river basins.

The majority of Marcellus shale wastewater is recycled to make new frac fluids, with most of this activity done on site (Veil 2015). In other areas of the country, such as Texas and Oklahoma, the majority of fracking-related waste water (almost entirely “produced” water that is accompanied by small amounts of frac fluid) is injected into disposal wells, as the fluids are too briny for economic reuse. These wells have been linked to increases in seismic rates in the region, but several jurisdictions in the United States, and in some Canadian provinces discussed above, have also implemented stoplight regulations. Ohio stands out for its ability to monitor seismic (and microseismic) data in real time so that the risk of felt seismicity can be

minimized with the least inconvenience for operators (ODNR, n.d.).

Also, few, if any, states require recycling or the elimination of tailings ponds, though Texas in 2013 introduced a new law to encourage the recycling of wastewater, relieving “waste producers and recyclers of tort liability for damages that occur once the waste is transferred to a recycler or third party for subsequent use” (Watson 2014, 352). Generally, there is a lack of policies that induce companies to recycle wastewater in the United States (Small 2015), but depending on local circumstances, economic incentives can be adequate.

Wastewater regulation is another area where collaboration could result in improved rules around recycling, and Alberta’s Tailings Management Framework could inform regulatory development at the state level.⁵⁵ The provincial regulator could host a workshop to inform interested states on its approach to tailings management. Although unique to oil sands operation, the principle beneath the framework could initiate cross-border discussion on non-oil sands tailings in the sector.

The federal government regulates the discharge of pollutants through the Clean Water Act.⁵⁶ Some state-level governments (e.g., California, Colorado, Ohio, Pennsylvania) require predrill water quality testing, while others (e.g., Texas) have no such requirement (Bozquez et al. 2015). It is not clear whether EPA could provide liability protection or whether such an approach would violate state-level requirements. There are likely more opportunities to harmonize water

⁵⁵ Lower Athabasca Region: Tailings Management Framework for Mineable Athabasca Oil Sands (TMF). (March 13, 2015). <https://www.aer.ca/about-aer/spotlight-on/alberta-tailings-management-framework>.

⁵⁶ Federal Water Pollution Control Act (Clean Water Act). <http://www.epw.senate.gov/water.pdf>.

testing requirements and disposal rules than for water consumption.

6.3. Mexico

Mexico's National Water Commission (Comisión Nacional del Agua, or CONAGUA) oversees the use of federal waters for industrial purposes. Under its Ley de Aguas Nacionales, CONAGUA also regulates contamination and disposal of water.⁵⁷ Before drilling, companies are required to report the predrilling environmental state of the bodies of water. This requirement is fulfilled when companies are undertaking their environmental impact assessments as mandated by the Ley General del Equilibrio Ecológico y Protección al Ambiente, which requires that no development or production activity affect any integral function of the ecosystems in the area and establishes that companies need to follow all provisions of the regulation for the construction, reinstatement, and closing of water extraction wells.⁵⁸

ASEA's upstream oil and gas guidelines⁵⁹ regulate hydraulic fracturing fluids and produced water, as well as aspects of well

construction or other upstream activities that might affect water quality. Flowback water, for example, must be temporarily stored in metal tanks rather than pits until it can be recycled, sent to a treatment facility, or injected for disposal. The unconventional oil and gas development guidelines⁶⁰ likewise encourage the recycling of water, particularly as the country's unconventional resources are largely located in water-scarce areas. ASEA's guidelines notably require that companies publish the additives as well as their amounts in the hydraulic fracturing fluid used. The agency went a step further than most jurisdictions with unconventional development and requires that operators characterize dangerous compounds in flowback fluid within 10 days. Overall, these regulations seek to avoid spill and contamination of subsurface bodies of water as well as other types of incidents, providing high flexibility for operators.

A number of other regulations likewise apply. According to NOM-138-SEMARNAT/SS-2003, maximum allowable amounts are outlined for hydrocarbons polluting land as well as cleanup measures.⁶¹

⁵⁷ Ley de Aguas Nacionales.

http://www.diputados.gob.mx/LeyesBiblio/pdf/16_240316.pdf.

⁵⁸ Ley General del Equilibrio Ecológico y Protección al Ambiente.

<http://biblioteca.semarnat.gob.mx/janium/Documentos/Ciga/agenda/DOFsr/148.pdf>.

⁵⁹ "Disposiciones administrativas de carácter general que establecen los Lineamientos en materia de Seguridad

Industrial, Seguridad Operativa y protección al medio ambiente para realizar las actividades de Reconocimiento y

Exploración Superficial, Exploración y Extracción de Hidrocarburos." (December 9, 2017).

http://www.gob.mx/cms/uploads/attachment/file/170840/DACG_Reconocimiento_y_Exploracion_Superficial_Exploracion_y_Extraccion_de_Hidrocarburos.pdf.

⁶⁰ "Disposiciones administrativas de carácter general que establecen los lineamientos en material de seguridad industrial, seguridad operativa y protección al medio ambiente para realizar las actividades de exploración y extracción de hidrocarburos en yacimientos no convencionales en tierra." (March 17, 2017). <http://www.gob.mx/asea/articulos/publica-asea-lineamientos-de-exploracion-y-extraccion-de-hidrocarburos-en-yacimientos-no-convencionales>.

⁶¹ NOM-138-SEMARNAT/SS-2003. (March 30, 2005).

<http://tramites.semarnat.gob.mx/Doctos/DGGIMAR/Sirrep/NOM-138-SEMARNAT-SS-03-29-MAR-05.pdf>.

Voluntary standards have also been released that describe methods for sampling water, including NMX-AA-117-SCFI-2001, but there is no mandatory law or regulation for companies to follow.⁶² For contaminated water, NOM-143-SEMARNAT-2003 is the current rule, limiting the amount of hydrocarbons in water for disposal and storage.⁶³ In addition, the regulation outlines stipulations for temporary storage, transportation, determining the makeup of the water, the maximum amounts of certain contaminants for different types of disposal, and the specifications of injection wells. With future expansion of shale extraction and its rate of wastewater generation, however, these regulations are unlikely to be adequate to safeguard the environment and local communities.

6.4. Harmonization Opportunities for Water Regulations

In Brief

- Create incentives to increase the efficiency of water use and mitigate externalities from wastewater disposal.
- Coordinate or standardize reporting requirements for components of hydraulic fracturing fluid.
- Cooperate on the study of induced seismicity from oil and gas operations, and share best practices across jurisdictions.

Differences in water-use regulations across regions can be partly explained by availability and climate. With increased water stress due to climate change, a more consistent and stringent water-use policy could

incentivize best practices and technology deployment among the three countries. In particular, in the short term, there are opportunities for the three jurisdictions to work toward joint research on improving water use in fossil fuel production. As there is variation in the availability of water and needs even within countries, a more regional approach can be used for harmonization.

Increasing efficiency is one way the three countries could each benefit, given existing and future challenges. For wastewater recycling, for example, companies could share information, and governments could establish rules to incentivize more efficient use, such as through wastewater sharing or buying and selling in markets. Such a measure could save water or mitigate some negative externalities of water disposal (such as the potential for spills or induced seismicity, depending on the location and disposal method used). Geologic and economic factors drive disposal decisions, so the government has a clear role to play in assisting with creating proper incentives or, in some areas, technology advancements so that wastewater recycling can increase (Small 2015). One policy recently enacted in Texas (HB-2767),⁶⁴ for example, seeks to encourage the reuse of waste by allowing producers to sell waste to recyclers that will treat it for a “beneficial use” by adjusting liability laws (Watson 2014). Such policies could be expanded to other jurisdictions to promote efficiency and improve economic and environmental outcomes.

Other areas where water policy harmonization can occur offer relatively low-hanging fruit with potentially large benefits.

⁶² NMX-AA-117-SCFI-2001. <http://biblioteca.semarnat.gob.mx/janium/Documentos/Ciga/agenda/PPD02/DO106.pdf>.

⁶³ NOM-143-SEMARNAT-2003. (March 3, 2005). <http://www.profepa.gob.mx/innovaportal/file/1337/1/nom-143-semarnat-2003.pdf>.

⁶⁴ Texas HB No. 2767. <http://www.legis.state.tx.us/tlodocs/83R/billtext/html/HB02767F.HTM>.

Data reporting requirements and sharing among the three countries regarding the components of hydraulic fracturing fluid or produced water, for example, have existing momentum and could provide benefits in terms of data access and public trust. Specifically, improved disclosure of chemicals used in oil and gas operations could allow governments to better assess and develop uniform rules on allowed chemicals in the longer term. In the short term, FracFocus, an online disclosure portal managed by the Ground Water Protection Council and Interstate Oil and Gas Compact Commission,⁶⁵ can be an effective tool for improving data availability and could be expanded to Mexico as well, particularly as the country now has more stringent reporting requirements for hydraulic fracturing fluids than many other jurisdictions in North America. The three countries could work together to establish a standard approach for assessing, setting standards, and sharing best practices for monitoring impact on the environment.

Finally, governments could work together to study the impact of deep-well disposal on seismicity and develop consensus practices that would enable and promote safe deep injection. Exchange of information among regulators and development of cross-jurisdictional practices, such as the stoplight regulations used in a few provinces and states, could prevent or limit major seismic occurrences elsewhere. As the study of seismicity caused by hydraulic fracturing operations in British Columbia and Alberta, as well as wastewater injection induced seismicity in the United States, has increased the knowledge of these mechanisms and the effectiveness of certain policies, other jurisdictions will be better able to prevent or react to instances of induced seismicity.

Overall, improving data, standardizing the approach to reporting, and sharing information provide significant cross-border opportunities that can support future regulatory development. Research and development, as well as improved data analysis and management, can enhance and reduce the cost of monitoring over time. Harmonization of water-use regulations and practices would likewise improve efficiency and environmental outcomes in the three countries.

7. Recommendations and Conclusions

Drawing from both the regulatory review and the ideas generated in the workshop, we conclude by describing a set of recommended priorities for national or subnational action in North America. These recommendations were also informed by a set of prioritization criteria (see Appendix A).

The following key priority recommendations (in no particular order) emerged from this review:

1. *Describe ways the three countries are already collaborating on energy and climate issues, and maintain all nonduplicative interactions.* Workshop participants were all aware of various information-sharing and collaborative forums across the United States, Canada, and Mexico, and subnational governments, but few, if any, participants (including the organizers) were aware of the full suite of conversations already taking place. Capturing this information in one place, and characterizing which collaborations are already happening in which venues, would be a valuable step toward understanding where the gaps are, which harmonization opportunities might need

⁶⁵ For more information: <https://fracfocus.org/>.

more conversation or structure and which, if anything, are already being addressed adequately. It bears saying that continuing these cooperative and collaborative interactions is important for each of the countries' economies and their environments.

2. *Define what constitutes a subsidy to the oil and gas sector, harmonize this definition among the three countries, and continue action to eliminate fossil fuel subsidies.* In June 2016 at the North American Leaders' Summit, the three countries agreed to end "inefficient" fossil fuel subsidies. This work is difficult to move forward without clearer information about the types, costs, and performance of various subsidies, and generating this type of information is a seemingly necessary prerequisite for fulfilling this commitment.
3. *Examine the extent to which infrastructure permitting processes are similar or differ across the three countries, specifically as this relates to environmental impact statements (EISs).* Infrastructure siting processes, including EISs such as those for pipeline approvals, are currently under review or the subject of scrutiny and controversy in the United States and Canada, and Mexico plans to dramatically increase pipelines within its borders and across the US border. These processes should be improved and better aligned to decrease transaction costs and delays, as well as to better address country and cross-border environmental and indigenous/First Nation concerns. These reviews should adopt consistent methods to account for the social cost of carbon.
4. *Improve regulatory alignment and information sharing regarding methane emissions.* The three countries are

currently involved in many of the same international organizations and initiatives focused on reducing methane emissions, including the Climate and Clean Air Coalition, the Zero Routine Flaring by 2030 Initiative, and the Global Methane Initiative. Sharing information on technologies to reduce methane releases and best practices in methane measurement would both improve data collection and also potentially enhance opportunities for cost-effective policymaking. Helpful information would include how to identify methane "superemitters" and calculate baselines with which to set industry reduction targets. Subnational governments have much to add to this information.

In achieving the zero routine flaring commitment, jurisdictions would need to develop policies that also eliminate routine venting. Regulatory certainty and alignment could help industry prepare and make appropriate technology and investment decisions. Governments can work together toward a common vision of reducing and eventually eliminating wasteful practices that vent or flare methane where it could be captured and sold. They could also align regulatory requirements to incentivize the use of best available technologies (e.g., electrification or installation of zero bleed pneumatic controllers) and set standards related to directed inspection and maintenance to inform leak detection and repair requirements. These can create skilled labor opportunities while reducing the sector's environmental footprint. Governments could also work together to address growing legacy issues related to abandoned and decommissioned wells that leak methane and, in doing so,

introduce policies that reduce taxpayer liability when plugging and abandonment costs exceed bonding requirements.

As of March 2017, the Trump administration has initiated several actions to roll back the federal role in data collection and emissions reductions related to methane. Given that most regulation of methane emissions happens at the state level in the United States, however, cooperation at the regional and subnational levels can still be effective and build on existing efforts, such as the Western Climate Initiative and the Zero Routine Flaring by 2020 Initiative.

5. *Expand FracFocus, already in place in the United States and Canada, to Mexico.* FracFocus has been relatively well received in the United States and Canada by industry and has provided transparency and important access to data to the public. Expanding the tool to be useful for Mexico would be a relatively straightforward and proactive step, particularly given that ASEA mandates that operators disclose and publicize the additives used in hydraulic fracturing in the regulatory framework released in March 2017.
6. *Continue energy technology innovation exchanges such as on carbon capture utilization and storage (CCUS), methane measurements, and water-saving technologies. Leverage the three countries' investments through joint funding for research and development.* Improvements in technology can drive down both company and consumer costs. Joint funding would also go a long way toward decreasing the marginal cost of research and development, benefiting all three countries.
7. *Develop risk-based safety and environmental inspection systems to address the Gulf of Mexico holistically in the spirit of the US-Mexico Transboundary Hydrocarbon Reservoirs Agreement. The Gulf is one ecosystem, and nature does not recognize borders. Expand existing coordination to address more issues, and look for areas where goals and objectives overlap.* ASEA has already made risk-based regulation one of its goals for rulemaking following the energy reform. Continuing collaboration between the United States, through BSEE and BOEM, and ASEA will ensure that these measures can protect the Gulf—and those working in the area—as a whole. The US government has learned many lessons in its years of regulating offshore drilling in various areas, particularly in the Gulf following the Deepwater Horizon incident; knowledge-sharing will be particularly fruitful in this area as Mexico begins to regulate deepwater drilling for the first time after its energy reforms.
8. *Make changes in rules across the three countries in two identified target areas: decommissioning standards and water use and disposal standards.* More stringent decommissioning rules could have local and global environmental benefits. Harmonization could also reduce regulatory burden and increase competitiveness. Technologies are also replicable. Subnational harmonization may also be an option and US state rules vary widely with little obvious justification.

Given concerns about water use and disposal, there could be interest at all levels to develop harmonized industry standards. Technology is replicable, and harmonization could lead to strong local health benefits, reduced costs, and

marked environmental improvements. The governments furthermore have roles to play in incentivizing (and allowing) wastewater sharing among producers to promote more efficient use. Workshops on both of these topics could be productive.

9. *Study past and present concerns regarding harmonization in NAFTA and what they mean for harmonization in this context. Examine areas where NAFTA could be updated.* Many, if not all, workshop attendees expressed discomfort regarding the word harmonization, in part because of past concerns about “harmonizing” (and potentially weakening) policies during the NAFTA negotiations. What became clear during the workshop, however, is that some relevant lessons can be learned from the NAFTA negotiations and implementation. Further, the treatment of energy issues in NAFTA was in many ways reflective of Mexico’s pre-reform status, and given current scrutiny of the agreement in general, there may be opportunities to update its energy provisions to reflect current political and economic realities. Finally, if NAFTA proves to be an unwieldy instrument for furthering energy market and regulatory coordination, or if it is scrapped for political reasons, consideration should be given to what other institutions might be strengthened instead or what might be put in its place, though it appears that the administration currently plans to renegotiate the treaty.
10. *Provide Mexico with certainty regarding natural gas and oil products supply, and further policies that provide the three countries with increased energy and economic security.* Trade with the United States has quickly become an energy security issue for Mexico, as it

has come to rely more heavily on imports of natural gas and oil products (namely, gasoline). Without certainty from the United States regarding this supply, Mexico will seek to diversify its imports and increase production, decreasing this market for US energy in the long run. The United States would benefit by having a market for its energy products, and Mexico would benefit from reliability as well as more cost-effective energy options. North America as a whole would benefit from its increased energy independence from the rest of the world.

11. *Harmonize CO₂ policies where possible, particularly at the subnational level in the short term.* Although opportunities for increased harmonization on climate policy involving the US federal government are unlikely in the short term, there may be opportunities for Canada and Mexico to collaborate and also include some US states. US states continuing—or perhaps expanding or implementing—CO₂ regulations should consider allowing for cross-state and perhaps international collaboration within these policies in the absence of federal action. California, for example, has already linked its cap-and-trade program with Quebec’s. Furthermore, keeping in mind that further federal efforts on the part of the US are a future possibility, allowing or even building in opportunities for future trilateral collaboration would prove beneficial.

Overall, the United States, Mexico, and Canada would each individually benefit from harmonizing policies related to the oil and gas sector, increasing welfare of both the private sector and the public by increasing efficiency, decreasing operating costs, and improving environmental outcomes. Significant efforts have already been undertaken in a number of

policy areas related to the oil and gas sector. Governments as well as private entities have contributed to these efforts. Continuing and expanding on this momentum will provide numerous opportunities for federal and subnational governments to improve economic and environmental outcomes within

each of their jurisdictions. North America as a whole stands to benefit from harmonization in the energy sector, and maintaining some level of trilateral engagement on these issues will be important to continue current work and foster new efforts in the future.

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Appendix A. Suggested Criteria for Evaluating Recommendations

The criteria below are largely taken from a 2016 RFF discussion paper “[Harmonizing the Electricity Sectors across North America: Recommendations and Action Items from Two RFF/US Department of Energy Workshops](#)” (Krupnick, Shawhan, and Hayes 2016), with only minor modifications.

1. Is this effort foundational?

Certain efforts—whether carrying out a study, building a model, or building a new institution—are important, even critical, building blocks for other, longer-term efforts. They may represent opportunities to fill knowledge gaps or may be necessary precursors to completing other longer-term actions. In other words, it is important to consider which activities are foundational to advancing other harmonization efforts.

2. Does this effort have a high value of information?

Economists often consider the value of information as an important evaluation criterion, and the value of information increases with the probability that the information will change decisions. If a particular high-quality research study simply adds to the consensus, it has less value than if it challenges the consensus. Where information is lacking, a study can have particularly high value.

3. To what degree does this effort immediately or ultimately address a market failure?

Economic principles suggest that government should focus on involvements that address or limit a market failure. By market failure, we mean that an unregulated market is unable to deliver quantities of goods and services that are socially optimal as a result of an inherent characteristic, such as environmental or network externalities, or

conditions that prevent adequate competition. Bigger market failures or much movement toward ameliorating those failures would prioritize an action item over other action items. We think of this criterion as having two parts: the impact of the market failure and the extent to which the effort in question could reduce that market failure.

4. What is the value of this effort?

Certain recommendations or action items do not address market failures but call for the organization of institutions and so on. We use this criterion to judge them according to the value we believe they could provide as a forum or engine for change.

5. What is the political feasibility of this effort? To what extent is there momentum behind this effort that should be capitalized on?

Although often thorny to gauge, this criterion is perhaps the most practical on our list. There is value in considering the related issues of political feasibility and momentum when prioritizing next steps; for example, in June 2016, the three countries agreed to joint goals related to methane reductions from the oil and gas sector, which arguably boosts the priority of actions related to methane data collection and monitoring. At the same time, our field of view is toward long-term feasibility.

6. What is the cost of this effort?

The person-hours and other costs of the effort may help determine some “low-hanging fruit” worthy of shorter-term action. For example, a relatively low-cost regulatory review that has a high value of information might be highly prioritized. At the same time, however, projects with higher costs of effort should not automatically be penalized; in these cases, the large scale of effort simply needs to be valued against the other criteria described here.

Appendix B. List of Key Oil and Gas Relevant Legislation, Regulations, and Resources

Some of these regulations, acts, and resources overlap multiple issues. We included legislation, regulation, and resources directly relevant to the discussion in this report; this list is therefore not comprehensive. For convenience, we have hyperlinked these resources, but note that links may expire.

Transportation and Infrastructure

Canada

- [Estimating upstream GHG emissions](#)
- [Canada Rail Safety Act](#)
- [Canada Pipeline Safety Act](#)
- Transport Canada Competency Guidelines for Responders to Incidents of Flammable Liquids in Transport, High-Hazard Flammable Trains
- [Transport of Dangerous Goods Act](#)

United States

- [Natural Gas Act](#)
- [US Department of Transportation Final Rule to Strengthen Safe Transportation of Flammable Liquids by Rail](#)
- [US-Mexico Transboundary Hydrocarbons Agreement](#)
- [Texas Oil and Gas Transport by Rail Regulations](#)
- [Regulatory Review of Liquid and Natural Gas Pipelines in Colorado](#)

See also general state oil and gas laws in Climate and Emissions Regulations section

Mexico

- [Ley General De Cambio Climático](#)
- Lineamientos en materia de Seguridad Industrial, Seguridad Operativa y Protección al Medio Ambiente, para el transporte terrestre por medio de Ductos de Petróleo, Petrolíferos y Petroquímicos

Climate and Emissions Regulations

Canada

- [Pan-Canadian Framework on Climate](#)
- [Government of Alberta Carbon levy and rebates](#)
- [Government of Alberta Methane Reduction Strategy](#)

United States

- [Clean Air Act](#)
- [Clean Power Plan Emission Guidelines for Existing Stationary Sources](#)
- Regional Greenhouse Gas Initiative Program Design
- [Western Climate Initiative Program Design](#)
- [Leader's Statement on a North American Climate, Clean Energy, and Environment Partnership](#)
- Strategy to reduce methane emissions
- United States Environmental Protection Agency Laws and Regulations
- [Colorado Oil and Gas Conversation Commission Hydraulic Fracturing Rules](#)
- North Dakota Hydraulic Fracturing Standards and Regulations
- [Ohio Department of Oil and Gas Oil and Gas Laws](#)
- Pennsylvania Department of Environmental Protection [Methane Reduction](#) and [Climate Change](#) Strategies
- [California Global Warming Solutions Act \(AB 32\) overview](#)
- [Texas Commission on Environmental Quality: Oil and Gas Activities](#)
- [National Conference of State Legislatures Summary of State Methane Policies](#)

Mexico

- [Ley General De Cambio Climático](#)

Royalties and Fiscal Terms

Canada

- [Offshore Petroleum Royalty Act](#) (Nova Scotia)
- [Royalty Regulations](#) (Newfoundland and Labrador)
- [Modernized Royalty Framework](#) (Alberta)

United States

- [Mineral Leasing Act](#)

Mexico

- [Ley de Ingresos sobre Hidrocarburos](#)
- [Decreto por el que se expide la Ley de Hidrocarburos y se reforman diversas disposiciones de la Ley de Inversión Extranjera; Ley Minera, y Ley de Asociaciones Público Privadas](#)
- [Disposiciones Administrativas de carácter general que establecen las reglas para el requerimiento mínimo de seguros a los Regulados que lleven a cabo obras o actividades de exploración y extracción de hidrocarburos, tratamiento y refinación de petróleo y procesamiento de gas natural](#)

Decommissioning and Abandonment

Canada

- [Directive 006: Licensee Liability Rating \(LLR\) Program and Licence Transfer Process](#) (Alberta)
- [Directive 011: Licensee Liability Rating \(LLR\) Program](#) (Alberta)
- [Directive 075: Oilfield Waste Liability \(OWL\) Program](#) (Alberta)

United States

- [Reorganization of Title 30: Bureaus of Safety and Environmental Enforcement and Ocean Energy Management](#) (sections 250.1700-1754)
- [California Statutes and Regulations for Conservation of Oil, Gas, & Geothermal Resources](#) (Sections 1723 and 1745)
- [Colorado Oil and Gas Conservation Commission Rules and Regulations](#) (Section 300)

- [Montana Administrative Rules](#) (Section 36.22.502)
- [Ohio Administrative Code](#) (Section 1501:9-11)
- [Pennsylvania Environmental Protection Performance Standards at Oil and Gas Well Sites](#)
- [Texas Administrative Code](#) (Rule 3.14)

Mexico

- [NOM-115-SEMARNAT-2003](#)
- [NOM-149-SEMARNAT-2006](#)
- [Lineamientos de Exploración y Extracción de Hidrocarburos en Yacimientos No Convencionales](#)
- [Lineamientos en materia de Seguridad Industrial, Seguridad Operativa y protección al medio ambiente para realizar las actividades de Reconocimiento y Exploración Superficial, Exploración y Extracción de Hidrocarburos](#)

Water Regulations

Canada

- [Fisheries Act](#)
- [Species at Risk Act](#)
- [Lower Athabasca Region Surface Water Quantity Management Framework](#)

United States

- [Safe Drinking Water Act](#)

Mexico

- [Ley de Aguas Nacionales](#)
- [NOM-138-SERMANAT/SS-2003](#)
- [Ley General para la Prevención y Gestión Integral de los Residuos](#)

Health and Safety Regulations

Canada

- [Canada Rail Safety Act](#)
- [Canada Pipeline Safety Act](#)
- [National Energy Board Onshore Pipeline Regulations](#)
- [Canada-Nova Scotia Offshore Petroleum Board Health and Safety](#)
- [Canada-Nova Scotia Offshore Petroleum Board Regulations](#)

- [Canada-Newfoundland & Labrador Offshore Petroleum Board Health and Safety](#)
- [Canada-Newfoundland & Labrador Offshore Petroleum Board Regulations](#)

United States

- [Arctic Drilling Rule](#)
- [Well Control Regulations to Ensure Safe and Responsible Offshore Oil and Gas Development](#)
- [National Environmental Policy Act](#)
- [North American Energy Infrastructure Act](#)
- [STREAM \(Supporting Transparent Regulatory and Environmental Actions in Mining\) Act](#)
- [Pipeline Safety Improvement Act](#)
- [Comprehensive Environmental Response, Compensation, and Liability Act](#)
- [Department of Industrial Relations \(California\) Petroleum Safety Orders – Drilling and Production](#)
- [Well Control Rule](#)
- [Pipeline Safety Improvement Act](#)

See also state-specific oil and gas regulations in Climate and Emissions Regulations section

Mexico

- [PROY-NOM-018-ASEA-2016](#)
- [NOM-EM-003-ASEA-2016](#)
- [Criterios interpretativos que establecen las reglas para el requerimiento mínimo de seguros a los regulados que lleven a cabo obras o actividades de exploración y extracción de hidrocarburos, tratamiento y refinación de petróleo y procesamiento de gas natural](#)
- [Lineamientos para Informar la ocurrencia de incidentes y accidentes a la Agencia Nacional de Seguridad Industrial y de Protección al Medio Ambiente del Sector Hidrocarburos.](#)
- [Lineamientos para que los Regulados lleven a cabo las Investigaciones Causa Raíz de Incidentes y Accidentes ocurridos en sus Instalaciones](#)

National Agencies

Canada

- [National Energy Board](#)
- [Natural Resources Canada](#)
- [Canadian Environmental Assessment Agency](#)
- [Environment and Climate Change Canada](#)
- [Transport Canada](#)

United States

- [Federal Energy Regulatory Commission](#)
- [Department of Energy](#)
- [Department of Transportation Pipeline and Hazardous Materials Safety Administration](#)
- [US Department of the Interior Bureau of Land Management](#)
- [Environmental Protection Agency](#)
- [Energy Information Administration](#)
- [Bureau of Ocean Energy Management](#)
- [Bureau of Safety and Environmental Enforcement](#)
- [United States Department of Labor Occupational Safety and Health Administration: Oil and Gas Extraction](#)

Mexico

- [Agencia de Seguridad, Energía, y Ambiente](#)
- [Secretaría de Medio Ambiente y Recursos Naturales](#)
- [Comisión Nacional de Agua](#)
- [Comisión Nacional de Hidrocarburos](#)
- [Comisión Reguladora de Energía](#)
- [Comisión Federal de Competencia Económica](#)

Appendix C. Harmonization Opportunities: A Workshop Report

This section contains information, recommendations, and action items related to a workshop held in October 2016 called Oil & Gas Development in North America: Opportunities for Regulatory Harmonization. This workshop was put together and facilitated by Resources for the Future with funding from DOE in support of DOE's mandate to investigate opportunities for stronger data, policy, operations and planning, and economic ties across energy sectors in the United States, Canada, and Mexico. This workshop is the third in a series of workshops on energy policy and market harmonization across North America. The first two were on electricity markets and policy harmonization and were held in Boise, Idaho, and Albuquerque, New Mexico, in October 2015. Interested readers can find the report from those electricity sector workshops (Krupnick, Shawhan, and Hayes 2016) on RFF's website.⁶⁶

This summary reflects our best attempt to digest and articulate the workshop participants' comments; however, the Workshop Takeaways and Action Items section, which suggests prioritization of particular action items, represents only the authors' views.

Introduction

The past decade has been a transformative one for the energy sector in North America, featuring significant changes in the ways that

Canada, the United States, and Mexico undertake and regulate oil and gas production. Against this backdrop, a multi-stakeholder workshop was held to explore opportunities for further oil and gas market and regulatory harmonization across Mexico, Canada, and the United States. The workshop brought together representatives from all three countries and from sectors including industry, federal and provincial/state governments, academia, and nongovernmental organizations. It was carried out under Chatham House rules.

The workshop yielded a large number of ideas that government agencies, research groups, academics, and other stakeholders in all three countries should consider to move toward further harmonization of energy policy and markets affecting the oil and gas systems in North America. The conversation was not designed to reach consensus in any way, and the lists below therefore reflect a set of ideas embraced by different participants to varying degrees. Participants highlighted several areas where cross-border oil and gas cooperation is already quite effective, such as under the Agreement between the United States of America and the United Mexican States concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico (US-Mexico Transboundary Hydrocarbon Reservoirs Agreement).

Takeaways and action items from the workshop are organized into six categories: goals and principles, economic policy,⁶⁷ infrastructure siting and permitting, methane

⁶⁶ See "Harmonizing the Electricity Sectors across North America" (Krupnick, Shawhan, and Hayes 2016). Available at <http://www.rff.org/files/document/file/RFF-DP-16-07.pdf>

⁶⁷ In general, workshop participants did not express significant discontent over economic policy "disharmony," in part because there are already several processes in place to harmonize economic issues. For example, workshop participants expressed little criticism of pipeline tariff policies in the three countries or of severance taxes and other elements of economic regulation that might differ across the three countries. Indeed, there was acceptance of heterogeneity in these factors across countries, states, and provinces.

policy, environmental policies and strategies, and cross-cutting items. We report reflections and action items here as the participants presented them in October 2016, without making any adjustments for their salience under the new Trump administration.

Workshop Takeaways and Action Items

Goals and Principles for North American Energy Harmonization

- Consider whether *harmonization* is the appropriate word to use for conversations on trilateral policy questions, considering that it has negative connotations for a number of people (particularly reflecting on NAFTA and perceptions of top-down regulation). The goal of harmonization is not to apply one regulatory model to all countries and apply only the lowest common denominator of stringency; rather, the goal is to coordinate efforts among the three countries to varying degrees to improve the whole system. By this definition, words such as *alignment*, *coordination*, and *coherence* should be considered as alternatives.
- Move deliberately and quickly in addressing tri-national coordination opportunities as a window of opportunity currently exists with the recent Mexican energy reforms and the shale and other unconventional resources revolution. The North American energy landscape is changing rapidly, providing an opportunity for coordination within and integration of North American energy sectors while industry, regulations, and markets are “plastic” and malleable. Additionally, climate change mitigation considerations will increasingly affect the fossil fuel industry in Mexico and Canada and in some US states, providing unique opportunities for cooperation.
- Focus on development of “outcome-based” regulations that are targeted to address individual policy objectives, such as a CO₂ cap to limit emissions for climate mitigation. All regulatory approaches must be considered to best achieve a certain goal at least cost to stakeholders—and indeed, there may be circumstances under which it makes sense to use a command-and-control mechanism, given that it may actually cost *less* to mandate the use of a technology than to put all the monitoring in place to develop a functional emissions baseline.
- Understand that there is not a need to harmonize on every policy, and appreciate the political, social, and economic heterogeneity among and within the three countries. The goal is to harmonize where it makes the most sense based on economic and policy principles and given legal and political constraints.

Action Items for Economic Policy

- Define what constitutes a subsidy to the oil and gas sector, and harmonize this definition among the three countries, especially given that the three countries agreed to end “inefficient” fossil fuel subsidies during the North American Leaders’ Summit in June 2016.
- Study royalty frameworks—especially what an efficient royalty would look like and how it would vary with underlying conditions—as this is a shared challenge across the three countries. Consider to what extent royalty regimes should be simplified and how royalties are distributed. Other royalty-related issues included the following:
- Consider Alberta’s Modernized Royalty Framework, in which the government

combined several incentives into a single structure that accommodates costlier investments and takes into account fluctuations in oil and gas prices. Reflect on how Alberta engaged stakeholders to foster transparency and whether and how such a process should and can be replicated.

- Examine whether royalty credit programs, such as British Columbia's Clean Infrastructure Royalty Credit Program, which allows companies a royalty deduction of up to 50 percent of the cost of a project to reduce emissions, should be implemented elsewhere to encourage emissions reductions and other environmentally friendly practices.
- Study how to share benefits within communities, especially indigenous or First Nation communities.
- In general, examine what work could be done to optimize royalty rates and other attempts to get a fair return to taxpayers for resource exploitation. Also consider to what extent externalities, including climate externalities, should be taken into account.
- Study full tax rates across countries, a complex issue because of the need to account for subsidies, taxes and exemptions, accelerated depletion in the United States (a subsidy), and royalty payments. Adjusting policies with an eye toward harmonization is possible only after studies can define true tax rates in the three countries.
- Study local content laws and their impacts. For example, companies entering the market in Mexico for the first time may find that complying with the new Mexican local content laws is very costly or difficult. Many countries have local content laws, and some are not prohibitive or burdensome for business, depending on the local capacity and stringency. Review other local content laws, especially those in the United States and Canada, to highlight any practices or international standards for study.
- Review unitization agreements that govern development of oil and gas pools underlying international borders.
- Examine formulas to calculate companies' profits in the three countries, and consider whether (and under what circumstances) these formulas should be harmonized.
- Review and highlight practices for regulating dominant players in the market, and review oil and gas privatization processes that have occurred in other countries, as Mexico attempts to regulate Pemex and open its oil and gas market.
- In the context of Mexican insurance regulation, consider whether there is sufficient financial responsibility to fully fund emergency response, given that, in the near future, regulators plan to use insurance to cover incidents.

Action Items for Infrastructure Siting and Permitting

- Examine the extent to which infrastructure permitting processes are similar or differ across the three countries. (In Mexico, for example, only federal regulators need to be consulted for pipeline permits, whereas in the United States, oil pipelines are subject to state-level permitting.) Examine the potential for (and desirability of) making processes more similar to reduce company transaction costs.
- Address various issues in the United States, Canada, and Mexico with EISs and associated approval and siting processes. Aside from much-needed

information sharing, the following were all discussed in this regard:

- Harmonize permitting review processes and time frames allowed to improve regulatory certainty. The goal should be to streamline processes as much as possible (and for country leadership to stick to set deadlines), but not so much that they compromise decision integrity. Providing regulatory certainty—in terms of expectations regarding any potential issues that might affect approval as well as the time frame for approval—would benefit all stakeholders.
- Explore best practices in how to properly consult indigenous groups to both protect the rights of local populations and avoid, for example, issues like the ones surrounding the Dakota Access related to siting and sacred spaces.
- Adopt the consistent use of a social cost of carbon (SCC) in EISs, preferably in a manner that is harmonized to a certain degree and uses the same SCC figure. (Notably, in June, the United States, Canada, and Mexico agreed at the North American Leaders’ Summit to work toward an aligned SCC calculation methodology.) The United States must also apply the SCC consistently across its agencies, which has been a challenge.
- Provide regulatory certainty with regard to how governments view life-cycle analyses, with consistent metrics and guidelines for estimating impacts in terms of direct and indirect consequences.
- Be cognizant of the issue of counting GHG emissions and exports of fossil fuels, as the

potential exists for double counting CO₂ emissions.

- Harmonize cross-border safety regimes, such as the successful railroad safety initiative following the Lac-Mégantic rail disaster. Similar initiatives for pipelines may improve safety for cross-border pipelines.
- Canada and Mexico should consider implementing BOEM’s approach to programmatic environmental impact studies, which allows for relevant information on ecosystem baselines and provides common ground for the evaluation of EISs and National Environmental Policy Act analyses. (One participant noted that even though Mexico does not yet implement the bureau’s approach, two guidelines have been published on the matter of developing ecosystem baselines for environmental issues, one for land and the other for offshore.)

Action Items for Methane Policy

- Share information and practices on identifying methane “superemitters” and calculating baselines with which to set industry reduction targets.
- Consider using standardized techniques showing methane emissions by facility based on production accounting platforms, a well-established process currently used to measure production and royalty payments in Alberta. Such a platform would enable high-resolution emissions data, which would allow for better-suited, less costly regulations, and reporting via such a system would generally involve minimal additional time and cost. Define what the next steps would be to incorporate methane emissions accounting into production accounting in other jurisdictions.

- Exchange information on technologies and industry practices that are deemed safe—or even mandatory—in one country but not another. One example is the blowdown requirement for hydrostatic testing of pipelines in the United States versus Canadian “dry” testing. Hydrostatic testing is a technique that is intended to improve safety but can have perverse incentives for reducing methane emissions.
- Determine implications for integrating methane and carbon dioxide reduction regimes. Is there a forcing coefficient for methane that would allow these emissions to be considered together or traded in the same emissions markets as CO₂?

Action Items for Environmental Policies and Strategies

- In the long term, continue to consider the Paris Agreement in decisions and plans within and among the three countries as Mexico and Canada (and perhaps the US or US states pending developments over the next few years) develop future INDCs. Study how an integrated North American climate strategy in the long run would affect the ability of each country to meet agreed GHG reduction goals.
- Facilitate investments in GHG reductions across borders by streamlining goals, baselines, and emissions data.
- Develop risk-based safety and environmental inspection systems to address the Gulf of Mexico holistically in the spirit of the US-Mexico Transboundary Hydrocarbon Reservoirs Agreement. The Gulf is one ecosystem, and nature does not recognize borders. Expand existing coordination to address

more issues, and look for areas where goals and objectives overlap.

- Expand FracFocus, already in place in the United States and Canada, to Mexico. Consider how this would dovetail with Mexico’s existing regulations.
- Examine the potential for wastewater sharing across companies, as state regulations often do not encourage (or perhaps discourage) oil and gas companies operating in the same field from sharing water. Texas implemented regulations that incentivize sharing, and other states are trying to follow suit. Study whether this would be possible within states, let alone across states or countries; whether this would reduce water use or disposal; and whether there might be any unintended consequences.

Cross-Cutting Items

- Harmonize regulations not only across North America but also within countries if jurisdictions and agencies have conflicting goals, such as differing eminent domain laws among US states or differing considerations in the permitting approval processes and reviews among US agencies. This is less of an issue in Mexico because of the strong federal government role relative to state governments.
- Review Mexico’s Social Impact Assessment guidelines, which require operators to submit an assessment of the potential social impact of energy development projects and any relevant mitigation measures, as a potential model for other jurisdictions.
- Mount a case study looking at regulatory review and related judicial processes across the three countries. Mexico’s systems are particularly interesting to

- study because ASEA has won 97 percent of lawsuits.
- Continue to discuss and come to a consensus, as much as possible, on product definitions, data collection methods, and mechanisms for comparing data across countries. Data identification, translation, and sharing are necessary—but be mindful of appropriate levels of effort, as lessons learned from early attempts at data sharing show that some challenges may be too persistent to overcome.
 - Compare how business is conducted across North America in the oil and gas sector (in a similar vein as the World Bank’s Doing Business project),⁶⁸ and potentially create a website that could compare environmental regulations across jurisdictions and countries. This could highlight where some countries or jurisdictions need to improve and provide a platform for knowledge sharing. One model might be to expand and update DOE’s RAPID Toolkit, created for sharing information on regulatory processes and other information, to allow cross-border side-by-side comparison of regulations and academic and industry comparisons. Also consider making RAPID public.
 - Consider the circumstances under which independent regulators, such as the Alberta Energy Regulator, are necessary or have produced better outcomes in the three countries.
 - Continue energy technology innovation exchanges such as carbon capture and storage (CCS), methane measurements, and water-saving technologies.
 - Leverage the three countries’ investments through joint funding for research and development.
 - Study whether regulatory risk is increasing in North America and whether harmonization increases or decreases regulatory risk. Some raised the issue of multinationals seeing the United States as a less favorable place to invest and find that regulatory risk is increasing, though it is unclear how harmonization would affect this issue.
 - Study NAFTA’s effects on oil and gas markets in North America, in addition to past and present concerns regarding harmonization in NAFTA and what they mean for harmonization in this context. Examine areas where NAFTA could be updated.
 - Describe ways the three countries are already collaborating. Produce a list of existing bilateral and trilateral forums.
 - Continue existing partnerships and use them as a model for cooperation in other areas. Mexico’s ASEA, for example, has already been meeting with US agencies, such as BSEE and BOEM, and has visited several other countries’ agencies.

⁶⁸ See www.doingbusiness.org.