

RFF REPORT

Attaining Sustainable Development of Oil and Gas in North America

A Review of the Environmental Regulatory Landscape

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ATTAINING SUSTAINABLE DEVELOPMENT OF OIL AND GAS IN NORTH AMERICA: A REVIEW OF THE ENVIRONMENTAL REGULATORY LANDSCAPE

Alan J. Krupnick and Raymond J. Kopp*

Introduction

North America has long been a significant player in global energy markets, more so recently given the revolutionary use of hydraulic fracturing technology to unlock oil and gas resources. With dramatic growth in oil and gas production in the United States (US) and Canada—combined with energy sector reforms in Mexico—many now consider the region to be a potential energy powerhouse.

The three countries have much to gain from these developments. The exploitation of these resources and the potential for enhanced cross-border energy trade is likely to make the continent's energy-intensive economic sectors more competitive, improve energy security, dampen short-term energy price volatility, and stimulate continent-wide economic growth.

Some have noted, however, that maximizing the economic potential of the continent's vast natural resources—while ensuring that development is environmentally sustainable and mindful of climate consequences—will require better cross-border coordination, particularly in the policy realm.

Identifying areas for policy reform and harmonization first requires an understanding of existing regulatory landscapes. To that end, leading experts from Resources for the Future (RFF) in the United States, the International Institute for Sustainable Development (IISD) in Canada, and the Mario Molina Center in Mexico have come together to develop this review of critical regulations related to the potential tri-national coordination of oil and gas markets. This process led to the development of over 60 individual policy analyses that are reflected in this document.

This review focuses on national and subnational environmental regulations that are important for governing the sustainable development of oil and gas. It provides a snapshot of the policies and regulations in each country related to oil and gas extraction, oil and gas transport and oil refining, and certain issues that impact demand.

*Accompanying this report are three corresponding policy review reports, one each for Canada, Mexico, and the United States. Researchers from Canada's International Institute for Sustainable Development (IISD) authored the Canadian policy review, researchers from Mexico's Centro Mario Molina authored the Mexican policy review, and researchers from RFF authored the US policy review.

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The review concludes by highlighting several policy differences and opportunities for harmonization. For example:

- Individual country policies that affect siting and construction of new energy infrastructure should be a prime target for consideration, especially related to the process of environmental impact assessments.
- Policies regarding light- and heavy-duty new vehicle fuel economy and greenhouse gas emissions have largely been homogenized in the United States and Canada, and for light-duty vehicles in Mexico. Differences exist in the promotion of alternative fuel vehicles.
- Canada and the United States have different standards for railroad safety. Harmonization is important because of the high level of oil shipment by rail between the two countries and the risk of accidents.
- North America does have an immediate opportunity to begin the process of developing a continent-wide climate policy via the current international negotiations under the United Nations Framework Convention on Climate Change.
- There is an opportunity to harmonize the electric power sector regulations as the United States moves forward under the Clean Air Act and Mexico begins to restructure its electricity sector.

To supplement this summary report, the expert group developed a more extensive report for each country to provide additional detail on their distinct policies, including information on context; current policy and industry best practices; and commentary on policy coverage (or gaps), effectiveness, suitability, or options for reform.

While there are also various economic regulations that strongly influence demand for oil and gas, in this review, the experts have focused primarily on those policies with specific environmental impacts—including regulations related to hydraulic fracturing operations, carbon and conventional air pollutant emissions, managing risk, and others. This scope was somewhat extended in the case of Mexico, however, where the recent institutional and economic reforms in the energy sector are inextricably linked to environmental policy development. Similarly, the experts examined only a select number of policies related to the electricity sector and transborder electricity markets, which is an important area for future research.

Finally, due to the limited scope of this research, this review does not cover energy development issues in the Arctic (an area of increasing importance in the United States and Canada) and only briefly mentions indigenous peoples' disputes related to land claims, mineral rights, and general protests about community benefits and impacts. These remain a significant part of the oil and gas production debate, however, and their exclusion should only be seen considered as a reflection of the limited scope of this exercise.

Oil and Gas Extraction

Mexico

Revisions to the Mexican Constitution in December 2012 provided the starting point for the nation's ambitious energy reforms, opening oil and gas activities to greater participation from the private sector. Over the next several years, new policies and regulations will emerge to guide fossil

fuel extraction in Mexico. The federal government is the regulatory authority for these activities (unlike the United States and Canada, where the states and provinces play a larger role). The Mexican government is already reaching out to various US stakeholder groups for insights for a Mexican regulatory strategy, indicating an interest in coordination and potential harmonization.

The 2012 reforms established the National Agency for Industrial Security and Environmental Protection (*Agencia Nacional de Seguridad Industrial y Protección del Medio Ambiente*, or ANSIPMA) to manage and oversee hydrocarbon activities. The Mexican Congress is now defining the roles and responsibilities of the new agency. ANSIPMA will absorb many responsibilities previously held by the Energy Ministry (SENER) and Environment Ministry (SEMARNAT), including ensuring industrial safety, operations in natural protected areas, standard setting, and monitoring and enforcement of environmental regulations.

Mexico relies heavily on an environmental impact assessment (EIA) procedure to grant construction and operation permits for large-scale projects including hydrocarbons. The EIA review and authorization is perceived to be slow by the private sector due to bureaucratic bottlenecks and a lack of personnel with technical expertise. On the other hand, many civil society organizations view the process as too short to be properly informative.

As part of the energy reform, President Enrique Peña Nieto has proposed that the EIA procedure for oil and gas activities be housed under ANSIPMA. This realignment would lead to more financial resources and technically trained staff devoted to these EIAs, ideally resulting in a more rapid processing of the EIAs and greater confidence in the outcome of the process.

The Integrated Environmental License (*Licencia Ambiental Única*, or LAU) gathers the various environmental permits into a single process. It also helps to compare the pollution inventories across countries: the *Toxic Release Inventory* (TRI) in the United States, the *National Pollutant Release Inventory* (NPRI) in Canada, and the *Pollutant Release and Transfer Registry* (RETC) in Mexico. The LAU applies to air emissions from stationary sources under federal jurisdiction, which includes oil and gas activities, among others. The LAU is issued once and is permanent, but it must be updated if the facility changes its process or production rates.

The LAU requires an annual reporting (*Cedula de Operación Anual*, or COA) of production levels, inputs for production, criteria pollutants and their precursors, wastewater discharges, and generation and management of hazardous waste. Many COA reports are incomplete and exclude the estimation of fugitive emissions and other unregulated emissions. Also, some of the requirements of a LAU are not applicable or well-suited for some facilities.

United States

A June 2013 RFF report² summarizes the state of regulations for extraction in the United States:

“Outside of federal lands and offshore production, oil and gas production has historically been regulated primarily by state governments. This pattern has remained consistent throughout the shale gas and tight oil boom. States regulate the location and spacing of well sites, the methods of drilling, casing (lining), fracking, and plugging wells, the disposal of most oil and gas wastes and site restoration, and many other activities. State common and public

² Richardson, Nathan, Madeline Gottlieb, Alan J. Krupnick, and Hannah Wiseman. 2013. *The State of State Shale Gas Regulation*. Washington, DC: Resources for the Future.

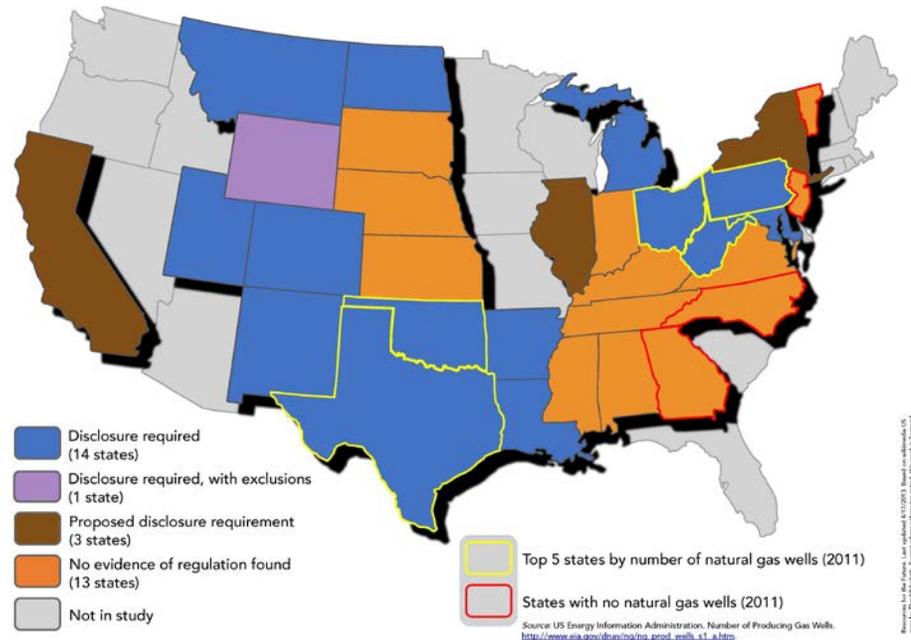
law governs the interpretation of lease provisions and disputes between surface and mineral owners and mineral lessees about payments and surface damage.

However, federal authority over some parts of shale gas development is significant, particularly regarding the protection of air and surface water quality and endangered species. The federal government also plays a direct role in that it issues regulations in its capacity as a landowner—many states with oil and gas deposits include large areas of federally owned land. In some cases, local governments have an important role, placing limits on the weight of equipment on roads; requiring operators to repair road damage; taxing oil and gas operations; and additionally constraining well pad locations, drilling and fracking techniques, and waste disposal methods.”

Research has documented state and federal regulations in this area and found the following:

- State regulations for extraction activities are heterogeneous in terms of aspects of the activities that are regulated or not, how each aspect is regulated (through permitting or through regulation), and how stringently they are regulated. For example, see Figure 1 below, which illustrates the range of fracking fluid disclosure requirements in place in various US states (as of mid-2013). It is unclear why so much heterogeneity exists.
- Most states use command-and-control approaches rather than performance standards. The latter would be more flexible and less costly, but requires greater oversight.
- Enforcement data and regulatory cost information are hard to come by. Therefore, it is difficult to identify states that stand out from an economic efficiency perspective.
- The federal government has a suite of laws applicable to oil and gas development; some of these contain exemptions for the oil and gas sector (for example, produced water is excluded as a hazardous waste subject to Resource Conservation and Recovery Act requirements).
- At the same time, the US Environmental Protection Agency (EPA) has begun to address methane and other volatile organic compound emissions from the well and other parts of the supply chain. More regulatory activity can be expected. EPA is also conducting a study on drinking water pollution and shale gas development.
- Local and state governments have been debating the allocation of state powers to regulate or limit shale gas and tight oil development. Some states have tried to prevent regulation by localities. A good example is Act 13 in Pennsylvania: the part of the act that supersedes local regulation was thrown out by the Pennsylvania Supreme Court.

Figure 1. Fracking Fluid Disclosure Requirements in Various US States



Source: Richardson, Nathan, Madeline Gottlieb, Alan J. Krupnick, and Hannah Wiseman. 2013. *The State of State Shale Gas Regulation*. Washington, DC: Resources for the Future.

Canada

In Canada, the regulation of oil and gas extraction has also been focused at the provincial level. Federal-provincial offshore petroleum development boards have been established as regulatory bodies, while a moratorium on offshore development off of the Pacific Coast has been in place for a number of years. Provinces have been the prominent regulatory bodies for shale gas development, with approaches varying from bans in some jurisdictions to increased shale gas exploration and development in others.

The most important area where the federal government has maintained a role is in the issue of environmental assessments. The Environmental Assessment Act (1992) intended to identify, evaluate, and mitigate adverse environmental effects caused by projects under federal jurisdiction. This act was repealed and replaced in 2012 by new legislation that sought to increase predictability, timeliness, and coordination in assessments. An assessment is now warranted when it is referenced under a defined “designated projects” list and is conducted at the discretion of the federal government. There are mixed views about the changes to environmental assessments, with positive responses about moves to expediency but concerns about rigor with the new approach.

The Northern Canadian territories (Yukon, Nunavut, Northwest Territories) have differing resource rights than provinces, granting the federal government increased influence in these jurisdictions.

Research at IISD identified the following dynamics at work with regard to the issue of extraction:

- Provinces maintain resource rights, and therefore are the primary regulators, but the federal government maintains a pivotal role in environmental assessments, a role that has been evolving in recent years.

- As in the United States, public opposition to hydraulic fracturing—particularly among populations in eastern Canada (where resources are in heavily populated areas) and among aboriginal groups concerned about pollution to water and resources on their traditional lands—is influencing policymaking.
- Issues of disclosure of fracking fluids closely mirror the debate ongoing in the United States. Some have called for more alignment of the Canadian FracFocus website with the American version.
- There is significant public debate, and some strong opposition, to the idea of oil sands extraction because of concerns over impacts to local communities (aboriginal and otherwise), impacts on water resources, the energy intensity of oil sands extraction activities, the significant land use, and surface environmental impacts.
- Reporting and mitigation of greenhouse gas (GHG) emissions has been a prominent issue in Canada. On the reporting side, the federal government has its own threshold for GHG reporting (50,000 tons of carbon dioxide equivalent [CO₂e] per year), while several provinces require reporting at lower thresholds. This has been streamlined through a single window reporting system.
- With regard to mitigation, provinces may have their own GHG mitigation system for oil and gas, as the federal government has not yet regulated the sector. Alberta has the most notable approach: an intensity-based system with targets and flexible compliance mechanisms including trading, offsets, and compliance payments at a set rate, with funds going to low-carbon technology. The federal government has stated its intent to regulate, but has not yet released draft regulations.

Digging Deeper on US Extraction Policies

A number of regulations and industry best practices affect all phases of shale gas extraction activity. Topics prominent in the public debate in the United States include permitting (on federal lands), fugitive methane control, fracking fluid disclosure, casing and cementing leakage, liquids handling (from freshwater withdrawals to ultimate disposal), deepwater drilling, induced seismicity at deep injection well sites, bans and moratoria, and performance bonding to assure that well sites are restored after the wells are depleted. Several of these are explored in more detail below.

Fugitive Methane. There is significant controversy over how much methane is leaking throughout the natural gas value chain. US federal regulators, the state of Colorado, and some operators are working on ways to cut these emissions. According to the Environmental Defense Fund, a high fraction of available emissions reductions opportunities would actually save the industry money. Even if the reductions were costly, it may still be worthwhile for the industry to agree to a tight cap on such emissions to end the debate about whether natural gas is a clean fuel relative to coal.

Fracking Fluid Disclosure. In the United States and Canada, arguments continue to build about balancing industry's need for protecting and valuing proprietary information and the related incentive to innovate, and the public's need for information on the chemicals that the public could be exposed to in the event of an accident or drinking water well pollution. The development of and recent improvements to the FracFocus reporting website in the United States have created a forum for such disclosure. Schlumberger, a fracking service provider already fully discloses the chemicals and their proportion in the fracking fluids, while withholding specific chemical recipes. The decision by oil

company Baker Hughes that it will follow Schlumberger's lead is evidence that the industry is listening, but these efforts cannot, by themselves, take the debate off the table. Public and government engagement is now needed.

Liquids Handling. Liquids handling—from freshwater withdrawals to the ultimate disposal of liquids containing fracking fluids, brine, and other chemicals released from underground (called produced water)—is of high concern from both an environmental and economic perspective. This concern is heightened by increasing droughts in areas coincident with oil and gas plays. Freshwater withdrawal regulations need improvement; not all jurisdictions regulate the quantity, location, and timing of such withdrawals. On-site storage of fracking liquids in pits and ponds is usually regulated, but these regulations are highly heterogeneous and may miss the growing industry movement to reduce the liquids' footprint by using tanks or closed-loop systems, and recycling. The induced seismic events caused by disposal and deep injection wells in Arkansas, Oklahoma, and Ohio are raising concerns about such options, while commercial treatment is very expensive when desalinization is needed. To begin to address these issues, some states are requiring operators to develop water use, treatment, and disposal plans.

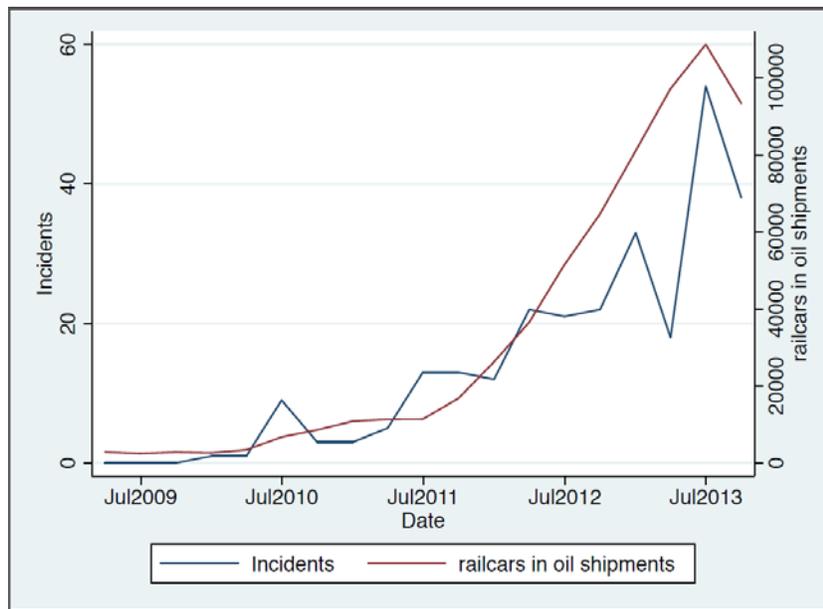
Casing and Cementing. Public concerns about groundwater pollution dominate all other fracking-related issues. An essential part of the drilling process is protecting groundwater by isolating the well bore (using casing and cementing) from a freshwater aquifer. There is still too little routine reporting of data to document the risk of casing and cementing failures and subsequent contamination, owing partly to the use of non-disclosure agreements with landowners who find their wells polluted. Pennsylvania has taken a leadership role in this area through its presumptive liability rule, which holds operators responsible for any contamination that occurs within 12 months of the beginning of operations within a 2,500 foot radius of an unconventional well site. One of the defenses against the presumption is a pre-drilling baseline groundwater testing survey. The result reportedly has been a big increase in such testing.

Oil and Gas Transport

United States and Canada

Pipelines and, more recently, railroads are used to move oil and gas from the fields to processing and refinery plants and, for gas, to local distribution networks and customers. The boom in shale gas and tight oil has strained these networks in several ways. A primary example is the lack of pipeline capacity in the Bakken shale region, requiring a rapid ramp-up in railroad use and associated increase in railroad accidents (see Figure 2). Some of these accidents have been serious, as have some recent leaks from pipelines, resulting in new regulatory proposals to make transport safer. Indeed, the Federal Rail Administration in the United States recently passed a new regulation to improve rail integrity.

Figure 2. Number of Railroad Incidents Compared to Number of Railcars Used in Oil Shipments, 2009–2013



Source: Charles Mason, H.A. "Dave" True, Jr. Professor of Petroleum and Natural Gas Economics, University of Wyoming and Visiting Fellow, Resources for the Future

In Canada, the tragic accident in Lac-Mégantic, Quebec, which resulted in more than 40 deaths, has led to renewed and increased focus on improvements in rail car standards and the transportation of hazardous materials. There had already been amendments to the Canadian Rail Safety Act under consideration when the Lac-Mégantic accident occurred, drawing increased attention to the strengthening of standards and regulations under the act.

Another consequence of the US shale gas boom has been the production of natural gas liquids exceeding the capacity of takeaway pipelines and processing plants. Most industry analysts expect these problems to be handled by market forces (as opposed to policy interventions), albeit over some extended period of time.

Railroads are still about three times safer than pipelines in terms of amounts of oil spilled per ton-mile. Pipelines can be made safer or located in less vulnerable areas, or excavators can take more care to reduce this prevalent cause of leaks. Alternatively, railroad shipments can be routed to better-maintained tracks and other systems, safer cars can be used, and personnel training can be improved. The XL pipeline debate over siting highlights any number of issues with this part of the process.

Canada's recent Rail Safety Act amendments require that the railroad tank cars mostly likely to leak in case of an accident be immediately removed from Canadian rails, with the next most vulnerable cars phased out within a three-year period. This is a wakeup call to the US regulatory system, which issued advisories and reporting requirements instead. The fact that the oil and gas operators own or lease the cars and have no control of routing may create problems for providing appropriate incentives for minimizing risk and determining liability for accidents.

Oil Refining

Mexico

As noted above, LAUs (environmental operating permits) are required of all oil refineries under federal jurisdiction. LAUs also require annual reporting on criteria pollutants and their precursors, wastewater discharges, generation and management of hazardous waste, toxic pollutants, ozone-depleting substances, and greenhouse gases.

United States

US refineries are regulated for air emissions under the nation's Clean Air Act and, to a lesser extent, waste water releases under the Clean Water Act. Regulation of air emissions includes the suite of "criteria" pollutants (sulfur dioxide, carbon monoxide, oxides of nitrogen, particulates, and lead). In addition, refineries must control volatile organic compounds and hazardous air pollutants (HAPs). Regulation of HAPs is especially important for refineries because EPA is required to update the stringency of the regulations at periodic intervals on the basis of new control technology (defined as Maximum Achievable Control Technology). Thus, regulation of HAPs is a never-ending process and will continue to impact refinery operation.

In the future, refineries will become subject to CO₂ regulation under the Clean Air Act, following the regulations currently being promulgated for new and existing power plants. There is concern about how such standards might reduce the incentives to build new plants. Only one new refinery has been built since 1998, although several have undergone major modifications. The mismatch between the mix of crude oil now being produced (with more light oil from the Bakken) and the existing refineries' capabilities (which are designed mostly for heavy crude) is expected to spur further refinery growth.

Canada

Canada's future in refining is less tied to light oil than it is to the oil sands: upgraded capacity related to the oil sands has increased while traditional refining operations have been in a slight decline.

Similar to those in the United States, refineries in Canada have been subject to regulations for air pollutants and toxins, as well as liquid effluents, for decades. In 2002, the Canadian Council of Ministers of the Environment launched the National Framework for Petroleum Refinery Emission Reductions as a multi-stakeholder process with three goals: protection of human health and the environment; quantifiable emission reductions; and convergence with comparable US refineries in terms of environmental performance (current and anticipated) for emissions levels related to air pollutants and air toxics³. Efforts have also been underway to reduce water use. For example, in a 'first of its kind' approach, a refinery in Edmonton, Alberta is using treated wastewater from the city for its energy purposes as opposed to clean water from the Saskatchewan River.

There has been talk about federal regulation of GHG emissions for the refining sector, but it would appear that these regulations would come after the already-delayed regulations on extraction. Alberta does cover these facilities under its Specified Gas Emitter Regulation (SGER), which entails a 12

³ Chamberland, C. (2007). Improving Air Quality in a Competitive Context: National Framework for Petroleum Refinery Emissions Reductions. *Workshop #2 of the National Policy Consultation Series on Children's Health and the Environment*. February 27-28, 2007.

percent emissions intensity improvement target as of January 2007. There is also the potential that the intensity target, or the compliance flexibility prices, may be increased under an expected amendment to the SGER, but this is yet to be seen. Quebec will cover refineries under its cap-and-trade system beginning in 2015, although there will be assistance for these facilities in the form of partial free credit allocation to address competitiveness concerns with refineries in neighboring, uncovered jurisdictions. It is expected this free allocation would decline over time. In British Columbia (BC), refinery gas is covered under the BC carbon tax at a rate of 5.28 cents per cubic meter.

Demand

Quantities of oil and gas traded on North American energy markets and their prevailing prices are affected by regulations on oil and gas extraction, transport, and refining—but also by policies impacting oil and gas demand. In the United States, the most significant demand-related regulations concern electricity generation, light duty vehicles, heavy duty trucks, renewable transport fuels, and the ability to satisfy export demand for LNG. Canada faces similar issues to these, with the added issue of dealing with export concerns related to the oil sands.

Electricity Sector

Mexico

For several decades, the Mexican constitution established that electric power generation, transformation, transmission, and distribution were exclusive activities for state-owned firms. In 2013, unprecedented reforms to the constitution opened up these activities to the private sector. Planning and operation of the sector will now be under the control of an independent, decentralized public institution: the Centro Nacional de Control de Energía (CENACE), which will also control and operate the wholesale electricity market.

All types of power generation (with the exception of nuclear) will be open to public and private firms. The Energy Regulatory Commission (CRE) will be responsible for regulating and granting power generation permits to these firms and CENACE will work to ensure competitive conditions for private and public generators.

Transmission and distribution remain within the federal government (Comisión Federal de Electricidad; CFE). CFE establishes the transmission and distribution fees and guarantees open access to networks for all generators. According to the level of electricity consumption, end users will be classified as either qualified users or basic supply users. Basic supply users will receive electricity from CFE through regulated fees. Qualified users, on the other hand, can buy energy directly from the wholesale electricity market or from independent suppliers where they are free to negotiate prices and terms between the parties.

Alongside Mexico's reforms of the oil and gas industry have also come reforms designed to boost renewables by opening up the electricity market to private companies. The government's goal is to generate 35 percent of its energy from renewable sources (including hydro) by 2024, up from four percent in 2012. This increase in generation is anticipated to come mainly through solar and wind projects, and be driven in part by renewables mandates as seen in many US states. Businesses are expected to self-generate electricity using distributed renewables generation, as well. Note, however, that some of Mexico's electricity sector reforms could well reduce the price of electricity, lowering incentives for installing higher-priced renewables.

United States and Canada

For the past several decades, the US electricity generation sector has been subject to waves of environmental regulation—primarily focused on conventional air pollutants and water use. These regulations continue to impact the sector’s fuel mix and thereby its demand for gas, but they will be overshadowed by the forthcoming regulations under the Clean Air Act’s sections 111(b) and 111(d), limiting emissions of carbon dioxide from new and existing power plants, respectively.

Canada also has federal regulations regarding GHG emissions from new and existing power plants. These regulations (effective July 1, 2015) will limit emissions from coal in new plants to a standard roughly equivalent to emissions from natural gas combined cycle. Provinces in Canada have the opportunity to adopt equivalency approaches to the federal regulation, where they feel that they can meet the same outcomes through alternative means.

In both the United States and Canada, regulations for new power plants likely favor the construction of new gas plants, as coal plants will require carbon capture and storage technology to be deployed. Given the uncertain commercial performance record of carbon capture technology and the equally uncertain regulatory setting for long-term storage, it is expected that these new regulations will further disadvantage coal and lead to greater gas demand.

All indications suggest the regulations for existing power plants in the United States will further incentivize utilities to favor gas over coal, leading to additional coal plant retirements and thereby enhancing the demand for gas (as well as solar and wind).

Currently, 29 states in the United States also have renewable energy portfolio standards (RPS). Although not directly regulating CO₂ emissions, these RPS policies will continue to force the deployment of zero-carbon generation within the sector. To the extent these regulations bind on utility capacity investment choices, they can displace new gas generation; however, to the extent the renewables are intermittent and require rapid cycling backup they can increase the demand for gas generation.

Canada has its own approaches for increasing and incentivizing renewable energy deployment, including through provisions in the tax code. Provinces have also developed their own approaches through RPS, feed-in-tariffs and efforts to expand clean energy exports.

Transportation Sector

United States

Changes in the US population and culture and previous fuel economy regulations are leading to a predicted leveling off of passenger vehicle driving and reductions in net oil demand, even as trucking ton-miles are on the upswing. Thus, the rationale for improving fuel economy has shifted away from energy security and toward CO₂ emissions reductions. Over the past few years, the federal government launched aggressive, combined Corporate Average Fuel Economy (CAFE) and GHG emissions regulations for light-duty vehicles and also the first heavy-duty truck standards. The CAFE standards are up for a “midterm” review before they become tighter. The federal government is preparing for the next round of truck standards, which will likely be more costly.

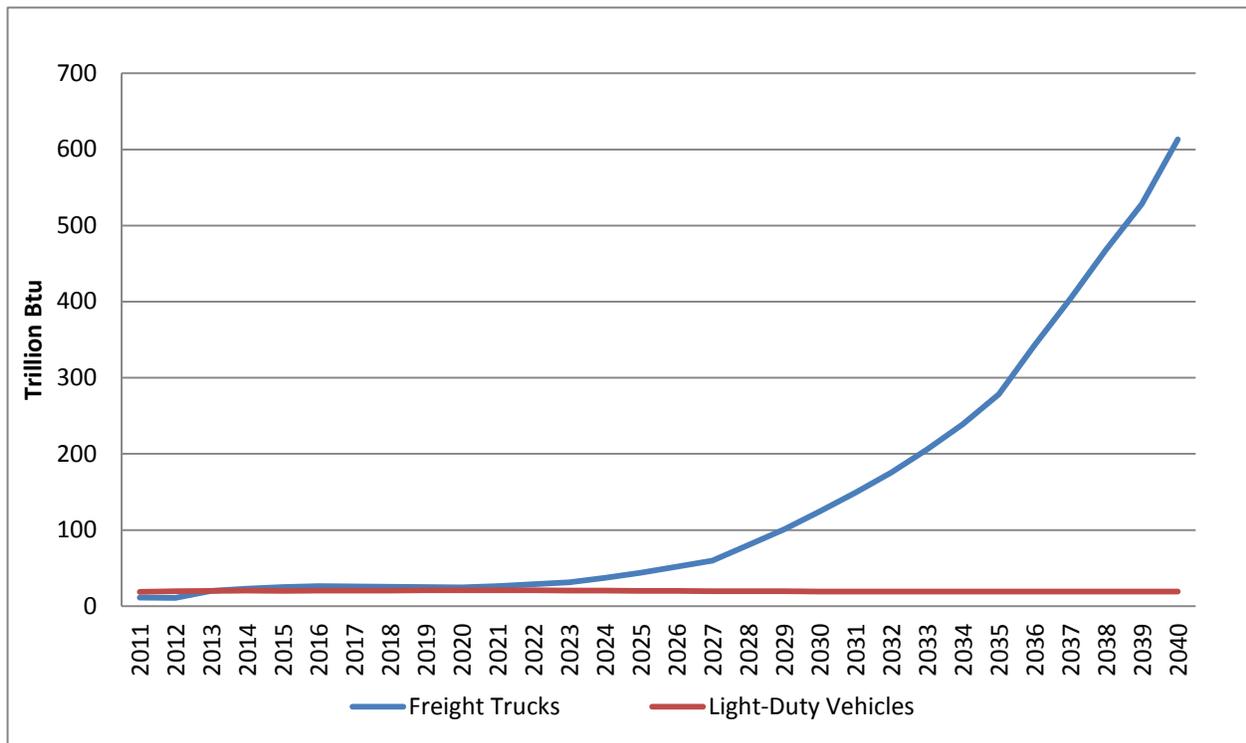
Many observers expect a battle over both major federal regulatory efforts, with the vehicle and engine manufacturing sectors saying the standards will be too expensive and EPA (and the National Highway Traffic Safety Administration) defending them on grounds of air quality, CO₂ emissions reductions, and energy security benefits, as well as fuel cost savings. RFF researchers have noted

numerous questions⁴ to be answered about consumer and manufacturer responses to the regulations and how the costs and benefits should be estimated before these issues can be decided.

Complementing these regulations are other policies by the federal government and the states to increase use of alternative fuel vehicles (tax credits, grants, etc.), change the fuel mix (renewable fuel standards, credits for the sale of alternative fuels, etc.), and improve fuel quality to reduce pollution per unit of fuel used. The US biofuels goals set in 2005 envisioned that a substantial part of fuel demand would be met by cellulosic biofuel. Production of this fuel has consistently fallen short of the year by year targets. Very recently, EPA set a cellulosic biofuel blending mandate equal to the year's production to avoid levying fines on refineries for fuel that was not actually available for mixing with gasoline and diesel.

Industry has embraced LNG as the fuel of choice for trash trucks, and LNG is increasingly making inroads into the heavy-duty trucking fleet, increasing demand for natural gas as a transportation fuel. LNG corridors are helping to supply natural gas to long-haul trucks; still, the US Energy Information Administration predicts relatively minor penetration of natural gas into the truck market until 2027–2030 and almost no penetration into the light-duty market (Figure 3).

Figure 3. Compressed/Liquefied Natural Gas Use in the Transportation Sector



Source: Energy Information Administration Annual Energy Outlook 2014 Early Release Data, accessed on May 31, 2014, at <http://www.eia.gov/forecasts/aeo/er/index.cfm>.

⁴ Alan J. Krupnick, Joshua Linn, Virginia D. McConnell. 2014. [Preparing for the Midterm Review of the Fuel Economy and Greenhouse Gas Emissions Rate Standards for Light-Duty Vehicles: A Summary of Priority Research Questions](#). RFF Issue Brief 14-04. March.

Canada

In Canada, the influence of the US market in terms of light- and heavy-duty vehicles more or less dictates that Canada is a “policy taker” when it comes to fuel efficiency and tailpipe standards. Canadian standards for fuel efficiency and tailpipe emissions generally match the current US CAFE standards. Where Canada has been more unique and flexible is in the promotion of alternative fuel vehicles and biofuels.

Canada has a federal regulation requiring a renewable fuel content of 5 percent in gasoline and 2 percent in diesel. Several provinces have stronger mandates, up to 8.5 percent ethanol (Manitoba) and 4 percent biodiesel (British Columbia). There is interest in increasing biofuel blending in Canadian fuels, but with that comes concerns about performance (gelling) in Canada’s cold weather temperatures. Carbon pricing through various forms of taxation of transport fuels also has some influence on transport choices in Canada.

Mexico

Mexico is also a policy taker in terms of its new light-duty vehicle fuel economy standards, recently adopting the new US standards to 2016. This move came with considerable controversy because the Mexican fleet is already skewed to older, less fuel-efficient vehicles and tighter standards would make the price gap even greater. Notably, Mexico has not yet set fuel economy standards for heavy-duty trucks.

As part of a larger energy reform, Mexico imposed a tax on the carbon content of numerous fossil fuels, including gasoline and diesel fuel, effective January 1, 2014. The tax averages \$3 per ton of CO₂ and is expected to raise \$2 billion on an annual basis. While the major purpose of the tax is revenue, it is also a tool of climate policy.

Exports

Mexico

For years, the state-owned Mexican oil company Petróleos Mexicanos (Pemex) has been capital starved and unable to fully exploit its on- and offshore oil and gas reserves. With the new energy reforms that will now permit direct foreign investment in the Mexican oil and gas sector, many expect the rates of Mexican oil and gas production to increase, perhaps considerably, over the next decade. This will almost certainly result in increased oil and gas exports, but the volumes and timing are uncertain, as are the policy developments that will guide any new export capacity and infrastructure.

United States

The LNG export discussion has heated up considerably in the United States over the past few years. In addition to US Department of Energy’s export license permitting, the primary environmental regulation related to exports deals with infrastructure siting. New and relatively unique pieces of infrastructure (LNG liquefaction terminals) must be sited and constructed; not only do these facilities require siting permits from the Federal Energy Regulatory Commission (FERC), but new greenfield sites require an extensive environmental analysis and are subject to an approval process under the National Environmental Policy Act (NEPA). The FERC and NEPA permitting process can be used by various parties to slow or halt siting of the facilities and thereby inhibit gas exports. Exports of oil are currently banned (except to Canada), but lifting this ban is very much an issue.

Canada

Canadian producers of oil from the oil sands have real concerns about their export market arising from the carbon intensity of the process required to extract the oil. Some argue that the political fight in the United States on the Keystone XL pipeline had a lot to do with its path through ecologically sensitive areas of the United States. However, the greater obstacle comes from climate advocates concerned with the oil sands' greater lifecycle emissions of CO₂. Understanding how these lifecycle emissions are calculated and treated in, for example, the low-carbon fuel standard in California, is important to the demand for Canadian oil.

Sustainable Integration of North American Energy Markets

Among economists there is little doubt that expanded international trade in transparent and competitive markets benefits all countries involved. North America is endowed with significant energy resources and it is now in the enviable position to take advantage of these resources. However, in today's global economy, maximizing economic growth requires a balance with environmental protection. Achieving these goals will compel some form of greater cooperation within North American energy and electricity markets.

The complete integration of North American energy markets is a herculean task and will take time, political will, and considerable private investment. Numerous policies, large and small, will need to be reformed, harmonized, or simply coordinated. Below are a few areas of environmental policy that seem particularly relevant for early action.

Environmental Impact Assessments and Statements

New energy infrastructure is fundamental to the efficient integration of North American energy markets; therefore, individual country policies that affect siting and construction should be a prime target for reform and coordination. Each country conducts ex ante assessments of major proposed siting and infrastructure projects. These tend to be costly and time consuming, and can be used as a lever to stop or delay projects.

The most obvious difference across countries is in the degree of contentiousness about the EIA process. In Canada, the environmental impact statement (EIS) law passed in 1992 was recently repealed and a new law was put in its place, cutting the number of reviewing agencies from 40 to three. The NGO community says that stringency has been reduced in favor of expediency. IISD rates this issue as the second most contentious energy-related concern after carbon and climate policy issues.

In the United States, the EIS process under the National Environmental Policy Act has its detractors, but this particular policy instrument has not risen to enough prominence for major reform. However, the Obama administration's development of the EIS for the XL pipeline has led to a new spate of critiques calling for reform of the law and the process to reduce the time, complexity, and cost of the process and block its use as a weapon to stop development. To that end, in May 2014, the US House of Representatives Energy and Commerce Committee passed H.R. 3301, the North American Energy Infrastructure Act. According to the committee's website, "The bill's new approval process effectively requires approval of all transboundary pipelines and transmission projects with little or no

federal environmental review. Modifications to existing cross-border pipelines or transmission lines would not require any approval or review at all.”⁵ The future of this bill is unknown.

In Mexico, President Peña Nieto is tackling the contentious issue of EIAs in the oil and gas sectors by consolidating the process under the new agency, ANSIPMA. This realignment allows Mexico to devote more resources and expertise to this sector, hopefully streamlining the process and increasing public confidence.

Despite the public controversies, a review of these processes across the three countries could be a first step toward understanding any gaps or inconsistencies, both in the substance and implementation of the EIAs. It will be important to understand how the different countries manage this process before potential reforms can be identified.

Extraction

The suite of policies in place to regulate environmental impacts of oil and gas development in the United States and Canada, and the policies expected to come from Mexico, affect the costs of bringing natural gas and oil to market. For natural gas, the price is also affected; much less so for oil. A harmonized set of policies across the three countries would assure that capital and resulting production are allocated to the projects and plays with the highest “social” rate of return—the highest private rate of return minus the expected environmental damage. This damage can be reduced by tighter, but more costly regulation. Finding that right balance is a difficult job for any jurisdiction, and let alone the three North American countries as a group. Yet this is a goal that needs to be kept in mind when new regulations are being planned and evaluated, such as in Mexico’s reforms of the regulatory system for fossil fuels.

Transportation and Fuels Policies

For decades, Canadian and US environmental policies regarding light- and heavy-duty vehicles have been not only harmonized but homogenized, including the latest round of US CAFE standards for light- and heavy-duty vehicles. Mexico also adopted the most recent US light-duty vehicle standards—both in stringency and the use of the vehicle “footprint” as the basis for the standards—but only through 2016. Depending on the outcome of the US midterm review of its CAFE regulations, it will be important for Mexico to be cognizant of the new standards. Unlike Canada and the United States, Mexico has not adopted fuel economy/greenhouse gas standards for heavy-duty trucks, although they are working on them. Notably, because the Mexican fleet is much older than that of Canada and the United States, Mexican demand for oil is unlikely to fall as rapidly, if at all, whether they keep pace with new US vehicle fuel economy standards or not.

The United States and Canada and their states and provinces do have different priorities on alternative-fueled vehicles, however; for example, the availability of cheap hydroelectric power in Manitoba and Quebec has led to emphasis on electric vehicles that exceeds that found in the United States. Where natural gas is prevalent in Canada (such as in British Columbia), the province is pushing natural gas vehicles. Both countries have used subsidies extensively to promote various types of alternative fuel vehicles, and removed the subsidies once reasonable penetration was reached.

⁵United States House of Representatives Committee on Energy and Commerce. “H.R. 3301, ‘The North American Energy Infrastructure Act.’ Accessed on May 31, 2014 at <http://democrats.energycommerce.house.gov/index.php?q=bill/hr-3301-the-north-american-energy-infrastructure-act>.

But the most controversy between the United States and Canada has been around low-carbon fuel standards, in California and Canada generally. In California, what constitutes a low- or zero-carbon fuel standard is different than in Canada, which takes a more expansive view that includes impacts from fuel exports and imports. This broad view would reduce the carbon footprint of oil from the oil sands relative to competing sources and types of fuels. Consideration of what is needed to achieve harmonization in this area is needed.

Fossil Fuel Transport

Trade in oil and gas involves the physical transport of those products, and one would expect increased transport needs as the market becomes integrated. However, transporting oil and gas is a risky business and developing public confidence in the safety of the transport system is crucial to public acceptance of an expanded, cross-border system.

Canada and the United States have different standards for railroad tank cars and the US timeline for safety improvements is unlikely to match that of Canada. Harmonization is important because of the high level of rail traffic in oil between the two countries, Canada's stance to deny entry of the most dangerous tank cars, and the rapidly rising prominence of this issue in both countries.

The XL pipeline debate in the United States and the relative lack of debate in Canada suggests that the two countries (and particularly in Alberta) might not be on the same page with respect to pipeline safety reform. These issues will grow with oil sands production. Ultimately, these issues will be determined by the EIA processes in the two countries.

Climate Policy

While Canada, the United States, and Mexico have stated climate goals and policies in place to limit CO₂ emissions across the major sources (electric power, transport, and commercial, residential and industrial emitters), there is an enormous degree of heterogeneity in their approaches to the problem. Within the United States and Canada there is added policy heterogeneity at the state and provincial levels that makes coordination even more challenging.

North America does have an immediate opportunity to begin the process of developing a continent-wide climate policy via the current international negotiations under the United Nations Framework Convention on Climate Change. Canada, the United States, and Mexico are signatories to this framework treaty and have the responsibility under the treaty to state their actions to reduce GHG emissions after 2020. A first step toward continental coordination on climate policy could be obtained through a set of organized and reinforcing statements submitted by the three countries.

A second round of harmonizing actions could proceed in any of a number of ways. Two of the most obvious would be harmonization and coordination across sectors or geography. Geographic harmonization has already been discussed among US states and Canadian provinces to link cap-and-trade programs. Adding Mexican states to the mix under a cap or an offset mechanism could also take place. At a minimum, the current conversations that exist between US and Mexican cross-border governors could be expanded to consider the integration of GHG emissions policies within their states.

Sectoral harmonization is already taking place with respect to the transport sectors (especially between the United States and Canada with fuel economy standards for light duty vehicles). Now is an opportune time to begin harmonizing the electric power sector regulations, as the United States moves forward under the Clean Air Act and Mexico begins to restructure its electricity sector under the new agency, CENACE.

Both Canada and Mexico have carbon taxes in place, at the federal level in Mexico and the provincial level in Canada. While a federal carbon taxes in the United States have been discussed for years, there has been little political support so far. However, such pricing could take root at the state level, and Canadian provinces and Mexico might encourage the United States to follow their lead.