

RFF REPORT

# Attaining Sustainable Development of Oil and Gas in North America

## Appendix: Canada Policy Briefs

Philip Gass, Douglas Russell, and  
Maxine Cunningham

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# ATTAINING SUSTAINABLE DEVELOPMENT OF OIL AND GAS IN NORTH AMERICA

## APPENDIX: CANADA POLICY BRIEFS

Philip Gass, Douglas Russell, and Maxine Cunningham<sup>1</sup>

### Introduction

The following set of policy descriptions was put together by researchers at the International Institute for Sustainable Development as part of an international review of environmental policies governing oil and gas development in Canada, Mexico, and the United States. The policy briefs presented here cover Canada, with the [United States](#) and [Mexico](#) covered in companion appendices. The broader set is reflected in a summary report covering all three countries: [\*Attaining Sustainable Development of Oil and Gas in North America: A Review of the Environmental Regulatory Landscape\*](#).

This document includes brief descriptions of policies governing the oil and gas production process, from extraction (well-site permitting onward) to end use in the transportation and electricity sectors. Each description provides context, the current state of regulation and best practice, and commentary options for reform and, in some cases, harmonization.

Monetary values are expressed in Canadian dollars.

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<sup>1</sup> Philip Gass is a project manager at the International Institute for Sustainable Development (IISD), Douglas Russell is an associate at IISD, and Maxine Cunningham is a project officer at IISD. Questions or comments can be addressed to Mr. Gass at [pgass@iisd.ca](mailto:pgass@iisd.ca).

# Environmental Assessments

## **Context**

In 1992, the Government of Canada enacted the Canadian Environmental Assessment Act (CEAA), which was intended to achieve sustainable development by identifying, evaluating, and mitigating adverse environmental effects that may be caused by projects under federal jurisdiction. Over the years, CEAA was publicly reviewed and periodically amended by Parliament to ensure that the federal environmental assessment process was effective, efficient, and equitable. The Government of Canada repealed this legislation in 2012 and replaced it with the new CEAA 2012, which came into force on July 6, 2012. The amendments were intended to update and modernize the regulatory system in terms of predictability, timeliness, and coordination. On October 24, 2013, the federal Minister of Environment also finalized the amendments to the Regulations Designating Physical Activities. These regulations set out the physical activities that are considered “designated projects” under CEAA 2012.

## **Current Policy**

- CEAA 2012 now takes a “project list” approach: an environmental assessment is required only for particular projects included in the list of “designated projects.” However, for most of those projects an assessment is not automatic and will be undertaken only where the federal government exercises its discretion to conduct an assessment. This is in contrast to the former Canadian Environmental Assessment Act, which used a “trigger” approach: an assessment was automatically required where a federal authority intended to participate in the project.
- Key issues identified by third parties in CEAA 2012 include the following:
  - fewer assessments may be conducted;
  - fewer factors are required to be considered;
  - timelines are shorter;
  - environmental effect is defined more narrowly;
  - stakeholders intervention is more limited in environmental assessment hearings;
  - heavy oil and oil sands processing facilities as well as pipelines, other than offshore pipelines, have been removed from the designated projects list.
- In addition, responsibility for environmental assessments (EAs) has been consolidated to three agencies (Canadian Environmental Assessment Agency, Canadian Nuclear Safety Commission, National Energy Board) instead of 40; there is now a single environmental report.

## **Commentary**

Government’s approach to achieving more predictable and timely project reviews and reducing duplication can be achieved, but there is concern that the new approach may lead to less rigour in assessing the environmental impact of projects.

## Water Testing: Fracking

### **Context**

- Fracking has raised a host of environmental concerns, most notably around potential water contamination. Many rural residents fear fracking fluid could leach into their drinking water. Up to 90 tonnes of water are required for some gas wells in northeastern British Columbia.

### **Current Policy and Best Practices**

#### **Provincial**

- *New Brunswick.* Commitment to baseline water testing: water will be tested before fracking begins to provide a before-and-after comparison. Commitment to groundwater: if groundwater comes to the surface, drilling must be discontinued, the hole plugged, and government notified. Conditions apply to oil and gas on both private and provincially owned land from exploration through to abandonment.
- *Alberta.* The Alberta Energy Regulator (AER) protects freshwater aquifers (groundwater) with strict regulations that are designed to ensure that gas cannot migrate up a well bore to contaminate groundwater sources. Alberta Environment and Water is currently undertaking a comprehensive review with the Energy Resources Conservation Board (ERCB) on regulations, new technology, and water usage in regard to hydraulic fracking. A large component of this review will focus on assessing what additional data collection and reporting may be required, including baseline testing and information on fracture fluids.

#### **Industry**

- Companies are working aggressively to reduce water use. Where practical, strategies include use of brackish or salt water for some or all of the supply necessary for fracking operations, recycling of portion of frack fluid that is produced after the fracking operation, and fluid alternatives.
- In September 2013, the Canadian Association of Petroleum Producers (CAPP) introduced guiding principles for hydraulic fracturing and followed up in January 2014 with new operating practices. These practices obligate CAPP members to ensure sound wellbore construction, seek alternatives to fresh water, recycle where feasible, report water use voluntarily, disclose fracturing fluid, and pursue technical advancement and collaboration.

# Water: Policy and Regulation for Oil and Gas Development

## **Context**

- There are increasing public concerns about the use of fresh water for oil field injection. These concerns apply to both surface water and groundwater and indicate the need for the government to take steps to reduce the oil and gas industry's use of fresh water. Projections indicate that water use for oil recovery could increase significantly in the future as demand for thermal oil sands recovery grows.

## **Current Policy and Best Practices**

### **Provincial**

- Provinces regulate water and drilling permits, and development therefore varies across the country.
- Alberta Environment and Water (AEW) allocates water licences under the Water Act, which act regulates the diversion of water from surface and groundwater sources, with the exemption of diversions of saline groundwater. Alberta's Energy Resources Conservation Board (AERCB) regulates saline groundwater diversions, while AEW has jurisdiction over nonsaline groundwater diversions and the Alberta Energy Regulator (AER) requires the industry to track the actual volumes of water used.
- In 2006, Alberta replaced the Groundwater Allocation Policy for Oilfield Injection Purposes (1990) with the Water Conservation and Allocation Guideline for Oilfield Injection. The ultimate goal of the policy is to reduce or eliminate allocation of nonsaline (fresh) water for oilfield injection, while respecting the rights of the current licence holders. In 2011, the policy was reviewed; recommendations included reduction or elimination of nonsaline water use, improved productivity of water use, conservation and protection of nonsaline aquifers and aquatic ecosystems, improved partnerships, and research initiatives.

### **Commentary**

- An enhanced regulatory management regime could encourage industry to avoid the use or disturbance of freshwater resources as much as possible and to optimize efficient use where usable water continues to be required.
- According to a report produced by the Pembina Institute, recommendations could include the following:
  - Record the amount of water withdrawn under licences and approvals
  - Reduce the use of fresh water by the oil and gas industry
  - Introduce a charge for the industrial use of water
  - Revise regulations relating to the management of fresh water in coal bed methane extraction
  - Track and report complaints about water

- Review grandfathered industrial water licences and approvals [1]

## Disclosure: Fracking Fluid

### **Context**

- The impacts of shale gas development on the hydrological cycle are the most uncertain and controversial and the subject of the vast majority of peer-reviewed studies [2]. Fracturing fluids contain several chemical additives that, depending on the operator and reservoir, are mixed in different recipes.
- In response to public concern about the risks that these chemical additives pose to human health and the environment, an increasing number of jurisdictions require disclosure. Fracking fluids are not currently required to be reported federally to the National Pollutant Release Inventory (NPRI) because facilities used exclusively for oil and gas exploration or the drilling of oil or gas wells are exempt from NPRI reporting requirements.
- In addition, facilities that conduct well drilling and completion activities (including hydraulic fracturing) do not generally meet the NPRI employee threshold. However, disclosure requirements vary provincially.

### **Current Policy and Best Practices**

#### **Provincial**

- British Columbia and Alberta require operators to post on a public website ([fracfocus.ca](http://fracfocus.ca)) the chemical additives used in their fracturing fluids on a per well basis, along with their maximum concentration, within 30 days of completing a fracturing job [3],[4],[5].
  - Exceptions are permitted in both these provinces for ingredients considered trade secrets (i.e., confidential business information). For a component to be considered a trade secret, a claim of exemption must be filed with the Hazardous Materials Information Review Commission (HMIRC), and the Hazardous Materials Information Review Act (HMIRA) registry number must be provided. (The responsibilities of HMIRC were transferred to Health Canada on April 1, 2013.)
  - Certain government officials and medical professionals are able to access information on trade secrets, using the HMIRA number, under specific circumstances (Minister of Justice 2013). In Alberta, if a trade secret is considered nonhazardous, then only the chemical family name needs to be listed (in addition to the maximum concentration).
- New Brunswick also requires public disclosure.
- Saskatchewan, Manitoba, Ontario, and Prince Edward Island do not have any regulations pertaining to fracking, including disclosure of chemicals.

## **Industry**

- The Canadian Association of Petroleum Producers (CAPP) released a set of guidelines for fracking, which include public disclosure of all toxic chemicals by its member companies. It also supports use of FracFocus and supports provinces' decisions to make public disclosure the law.

## **Commentary**

- To assess any potential impacts and to design monitoring strategies, researchers and policymakers need the exact chemical composition of the hydraulic fracturing additives, as well as toxicity assessments and persistence and mobility tests in surface and subsurface systems [6].
- Federal (or continental) oversight may address differences in fracking disclosure across country. NPRI is the major tool in Canada for tracking use of toxic chemicals and could apply to all hydraulic fracturing operations for consistency. The ratio of chemicals could also be disclosed.
- FracFocus is a voluntary, industry website developed in response to calls for disclosure. The voluntary approach allows companies to choose whether and when to report. According to data compiled by Bloomberg, energy companies failed to list information for more than two of every five fracked wells in eight US states in 2011 [7]. The gaps reveal some shortcomings in the voluntary approach to transparency.
- The US version of FracFocus is searchable by state, something that may be considered for the Canadian website (province-based search) to increase transparency.

## **Rail Car Standards: Hazardous Materials**

### **Context**

- Canada has a large and well-developed railway network, with about 44,000 km of tracks across the country [8]. Rail safety is highly regulated in Canada; Transport Canada (TC) has regulatory oversight over the sector via various legislations and acts. TC has stringent rules dictating track inspection, track maintenance, equipment inspection and maintenance that are rigorously applied and enforced. All incidents are reported to and investigated by the Transportation Safety Board of Canada.
- Recently, the volume of transportation by rail has greatly increased while the budget for rail safety has been cut by 19 percent. There has been a shortage of inspectors; in 2009 there was 1 inspector per 14 tank cars, now there is one per 4,000 tank cars [9]. Trains have also increased in size; some trains are 3 km long and weigh over 18,000 tonnes.
- In 2012 the Railway Safety Act was amended to include a series of changes recommended by an independent review panel in 2008. Most of the requirements were voluntary. Since then, regulatory action was pushed by Transportation Safety Board of Canada in 2013

following several rail accidents in the United States and Canada, including an accident in Lac-Mégantic, Quebec, resulting in more than 40 deaths.

### **Current Policy Status**

- The Railway Safety Act imposes new regulations:
  - 5,000 DOT-111 tank cars are to be removed within 30 days
  - 65,000 DOT-111 cars must be removed or retrofitted within three years
  - Emergency Response Assistance Plans are now required for all flammable liquids, not just gasoline and diesel
  - Speed limits are reduced
  - Industry, not government, holds financial obligations
- Industry has been manufacturing DOT-111s to an improved standard, known as the CPC 1232 design, since Oct 2011 in anticipation of the changes.
- Canada will make the change to DOT -111 tankers ahead of the United States which has initiated a rule-making process but has not yet specified a timeframe.

### **Commentary**

- Regulations could be structured to reflect expected increases in demand.

## Reporting: Greenhouse Gases

### **Context**

- In 2004, the Government of Canada announced the introduction of the Greenhouse Gas Emissions Reporting Program (GHGRP), a legislated, publicly accessible inventory of data on greenhouse gases (GHGs).
- Canadian GHG reporting operates on a two-tier system: businesses must file both a federal GHG report and a provincial GHG emission report. In some provinces the relevant air regulations differ between the federal and provincial levels, although a single-window reporting system has been implemented.

### **Current Policy**

#### **Federal**

- GHGRP 2004 applies to large GHG emitters (in excess of 50,000 tonnes of carbon dioxide equivalent, CO<sub>2</sub>e, per year).
- GHGs subject to mandatory reporting include CO<sub>2</sub>, methane, nitrous oxide, sulphur hexafluoride, hydrofluorocarbons, perfluorocarbons.
- Information is collected under authority of the Statistics Act, CEPA, and Climate Change Emissions Management Act.
- Facilities report their emissions through the Single Window Information Management (SWIM) system. The reporting system is administered by Environment Canada.

## Provincial

- *British Columbia.* British Columbia's reporting regulations came into effect on November 25, 2009. Under the authority of the Greenhouse Gas Reduction (Cap and Trade) Act, the regulations set out the requirements. Operations emitting 10,000 tonnes or more of CO<sub>2</sub>e per year are subject to reporting requirements. Those operations with emissions of 25,000 tonnes or greater are required to have emissions reports verified by a third party.
- *Alberta.* Alberta's Specified Gas Reporting Regulations came into effect on July 1, 2007, and will expire September 2014 (with expected renewal or amendment before that date). The regulation lays out the reporting requirements for large emitters of the province and is nearly identical to GHGRP. Alberta requires industrial facilities that emit more than 50,000 tonnes of CO<sub>2</sub>e to submit annual reports on GHGs. For 2011, 164 facilities located in Alberta reported GHG emissions amounting to 123.3 megatonnes in CO<sub>2</sub>e.
- *Ontario.* Ontario's GHG reporting regulations came into effect on December 1, 2009. Under the Ontario Environmental Protection Act, all facilities that emit 25,000 tonnes of CO<sub>2</sub>e or more per year are required to report and verify (by an accredited third party) their emissions data annually for 26 sources outlined in the regulation. Reports are submitted using Environment Canada's single-window system.

## Performance: GHG Emissions from Oil and Gas and Electricity Production and Manufacturing

### Context

- Canada's coal-fired electricity and transport sectors are subject to emissions regulations that seek to reduce the emissions in those sectors. The oil and gas sector—a rapidly growing emissions source that accounts for nearly a quarter of Canada's carbon emissions—has no current GHG emissions mitigation regulation at the federal level, but the sector is regulated in some provinces. The federal government has stated that such regulations, as well as those for other sectors, will be implemented, but indications are that some sectors may be several years from regulation. However, several provinces have adopted measures of their own to reduce their own provincial carbon emissions; British Columbia's carbon tax, Quebec's cap-and-trade system, and Alberta's gas emitters regulation are examples of such provincial approaches.

### Current Policy

#### Provincial

- *British Columbia.* The province introduced its carbon-neutral tax of \$10 per tonne in 2008, making it the first North American jurisdiction to implement such a tax. The tax increased each year until 2012, reaching a final price of \$30 per tonne, a level at which it is projected to stay for the foreseeable future after a review of the tax affirmed it should stay at the current rate. In January 2013, the carbon tax was generating about \$1 billion each year, which was used to lower other provincial taxes (corporate, personal income). According to

a report by Sustainable Prosperity, the policy has been a major success. During the time the tax has been in place, fossil fuel consumption dropped 17.4 percent per capita (and fell 18.8 percent relative to the rest of Canada). British Columbia's rate of economic growth (measured as GDP) kept pace with that of the rest of Canada over that time. The tax shift enabled the province to have Canada's lowest income tax rates as of 2012. And the aggregate effect of the tax shift was positive for taxpayers as a whole, in that cuts to income and other taxes exceeded carbon tax revenues by \$500 million from 2008 to 2012.

- *Alberta.* In 2007, Alberta was the first province to develop legislation regulating reduction of GHGs. The Specified Gas Emitters Regulation (SGER), implemented in 2007, required established facilities that emit more than 100,000 tonnes of GHGs a year to reduce their emissions intensity by 12 percent below a baseline established between 2003 and 2005. Industry had three options for meeting the target: improve performance at the facility, purchase credits from an Alberta-based offset project, or pay into a compliance fund designated for low-carbon technology at the rate of \$15 per tonne of emissions. Regulations targeted approximately 100 facilities that emit more than 100,000 tonnes of GHGs annually. These 100 facilities accounted for approximately 70 percent of industrial GHGs. The emission reductions achieved in 2012 represent approximately 3.05 percent of Alberta's total emissions. Alberta is currently reviewing SGER, which expires in September 2014.
- *Saskatchewan.* This province continues to work toward adopting SGER-style regulations for 2015 under the Management and Reduction of Greenhouse Gases Act.
- *Ontario.* Starting in April 2014, fuel suppliers are required to demonstrate a 2 percent content standard that will then have an average blend of 4 percent post-2016. The content standard is tradable, and according to the Canada's Gazette, 1 Mt of reductions can be expected annually once the program is fully implemented, in 2017. Ontario has also completely phased out coal-fired electricity generation from the provincial grid.
- *Quebec.* Quebec's cap-and-trade system came into full swing in 2013 with a number of regulations. The cap-and-trade regulations released identify covered entities and enable full linking with California on January 1, 2014, as part of the Western Climate Initiative, the first active cross-border carbon market in North America. The first permit auction, in early December, sold 1 million of the 2.97 million tonnes of 2013 vintage units bought at the price of \$10.75. Another 1.7 million 2016 vintage units were purchased. Total auction proceeds were \$29 million. A joint auction with California is planned for June 2014.

### **Commentary**

- *Federal.* Without new regulations, oil sands emissions are projected increase significantly between 2005 and 2020, potentially outstripping reductions that all other sectors in Canada are projected to make.
- *Alberta.* SGER covers only 43 percent of Alberta's emissions; it is expected that Alberta will renew the SGER after September 2014, potentially increasing the stringency of the SGER and raising the price of technology fund compliance payments.

## Development: Unconventional Shale Gas

### **Context**

- Recent technological advances are making shale gas reserves increasingly accessible and their recovery more economically feasible. The resource is already being considered and/or actively developed in British Columbia, Alberta, Quebec, New Brunswick, Nova Scotia, and elsewhere in Canada.
- The assessment of environmental impacts is hampered by a lack of information about many key issues including; environmental and health effects, contamination of drinking water, air pollution, large volumes of wastewater generated from shale gas wells, earthquakes, toxic chemicals, etc.
- As it stands, many provinces are relying on conventional development standards in place of unconventional standards; this has sparked public concern, including protests.

### **Current Policy**

- *Federal.* There is currently no federal legislation on fracking. The federal government recently commissioned a study by the Council of Canadian Academies to assess the state of knowledge about the impacts of shale gas exploration, extraction, and development in Canada. The report was prepared for the Government of Canada in response to a request from the Minister of Environment and released May 1, 2014. It addressed the following question: *What is the state of knowledge of potential impacts from the exploration, extraction, and development of Canada's shale gas resources, and what is the state of knowledge of associated mitigation options?* One of the main conclusions of the report was that the assessment of environmental impacts is hampered by a lack of information regarding many key issues. In other words, the question was difficult to answer objectively because relevant data have not been obtained, relevant data are not publically available, and/or existing data vary in quality, allowing for divergent interpretations.
- *Provincially.* Provinces regulate natural gas production, and development therefore varies across the country.
- *New Brunswick.* New Brunswick's shale industry is in the exploration phase; no shale wells are currently in production. The government of New Brunswick is working to establish regulations for shale development before moving forward. New rules will be implemented as conditions to approvals and certificates of determination issued under the Oil and Natural Gas Act, Clean Environmental Act, Clean Air Act, and Clean Water Act.
- *Alberta.* Approximately 174,000 wells have been hydraulically fractured in Alberta since the technology was introduced more than 50 years ago.
- *Quebec.* In June 2013, a bill submitted to the Quebec National Assembly imposed a moratorium on shale gas drilling and fracturing in the lowlands of the St. Lawrence River. Oil and gas projects were excluded from the moratorium. The government will wait until

two environmental assessments are complete, likely by the end of 2014, to determine next steps. If the law is passed, the moratorium will be in effect for five years.

- Holding one of the revoked licences, Lone Pine Resources, an oil and gas company, is now launching a \$250 million lawsuit against the Canadian government over Quebec's fracking moratorium under the North American Free Trade Agreement.
- *Nova Scotia.* The provincial government implemented a two-year moratorium on fracking in 2012. The government is looking to have an independent review completed by next year, and no applications for fracking will be considered during this review process. The province's chief medical officer of health issued a report in October 2012 warning that the province's infrastructure and legislation were not strong enough to protect public health if the shale gas industry expanded.

### **Commentary**

- At the federal level, natural gas production companies have exemptions from parts of at least seven federal environmental laws written to protect air and drinking water from hazardous and radioactive chemicals released by heavy industries.
- In September 2012, the Council of Canadians delivered to the Ministry of Environment petitions signed by nearly 10,000 people, calling for a moratorium. According to an Environics poll around the time, 62 percent of Canadians support a moratorium until all federal reviews are complete.

## **Offshore Oil and Gas Exploration and Drilling**

### **Background**

- Offshore oil and gas exploration has been taking place in Canada since 1964. In the past this exploration has occurred on both coasts, but a moratorium is in place on the coast of British Columbia. Currently there are six active projects in Canada's Atlantic region across multiple reservoirs producing both oil and gas. Regulations for offshore oil and gas are overseen by federal-provincial offshore petroleum boards covering projects in Newfoundland and Labrador and Nova Scotia.

### **Current Policy Status**

- *British Columbia.* The moratorium on oil and gas exploration on the British Columbia coast has been in effect, in one form or another, since 1972. It is a policy moratorium; there is no statutory impediment to exploration. The moratorium is maintained through government policy.
- *Newfoundland and Labrador.* In-production developments are Hibernia, Terra Nova, and White Rose. Average monthly oil production has been between 6 MMbbls and 8 MMbbls over the past 12 months.

- *Nova Scotia*. This province has two in-production developments: Sable (average monthly gas production between 100,000 and 150,000 E3m3 (thousands of cubic meters) over the past 12 months), and Deep Panuke (average monthly gas production between 200,000 and 250,000 E3m3 for 2014).
- To obtain a license to convert an identified reserve into production, an operator must submit a development plan to the regulatory board, covering such issues as safety and local benefits, and attest that best practices are followed. An additional safety and environmental protection plan are also required. Nearly all of this information (save that which is proprietary) is made available for public review. Additional authorizations and approvals are required for production, petroleum transportation, and production reporting [10]. Regulatory requirements regarding spills specify that “Operators are required by law to develop spill response plans as part of their approval and permitting process. These plans include detailed descriptions on how companies prevent spills and how they would respond to a variety of spill scenarios in exploration, development and production phases. Offshore operators must also have equipment and trained personnel prepared to respond to an incident. Operators are required to report all spills to the Offshore Petroleum Boards in Newfoundland and Labrador and Nova Scotia, including spills of drilling fluids, hydrocarbons and diesel” [11].
- Four principal acts cover offshore oil and gas:
  - Canada Petroleum Resources Act, which governs leasing of federal reserves to companies, and also covers issues such as environmental protection.
  - Canada Oil and Gas Operations Act, which covers exploration, production, processing, and transportation of oil and gas.
  - Canada-Newfoundland Atlantic Accord Implementation Act and the Canada–Nova Scotia Offshore Petroleum Resources Accord Implementation Act, which establish the regulatory board and outline issues between provinces and federal government regarding resource management and revenues.

### **Commentary**

- The Canadian Association of Petroleum Producers (CAPP) highlights technology and actions that industry uses to prevent spills, including the following [12]:
  - Specialized equipment, such as blow-out preventers, which are heavy-duty valves attached to the wellhead to control well pressure and prevent a blowout
  - Heavy-duty piping, subsurface safety valves, fire and gas detection systems and deluge systems for putting out fires
  - Spill containment devices and drainage systems
  - Rigorous risk assessments to ensure design and equipment integrity
  - Extensive quality assurance and quality control programs to ensure equipment is fit for its intended purpose
  - Emergency shut-down equipment located throughout facilities
  - Third-party review and assessment of facilities to ensure highest standards
  - Extensive training and competency assessment of personnel

- Operational techniques that incorporate the industry's best practices
- Comprehensive health, safety and environmental management systems
- Regular tracking of icebergs and accurate prediction of harsh weather
- Though not statutory, the moratorium for the British Columbia coast has become entrenched, while expansion is occurring in the Atlantic region in recent years.
- The Pembina Institute has conducted a comparison of Arctic offshore oil and gas drilling regulatory regimes in the United States and Canada (among other countries): <http://www.pembina.org/reports/comparing-offshore-regulations-executive-summary-final.pdf>.
- In Canada, Arctic drilling in deep water is being considered, but as of yet there are no developments. There has been community opposition to drilling in Arctic waters, and the federal government is considering which sites may open to drilling and which may remain closed. The National Energy Board and Aboriginal regulators are involved [13]. Actual drilling is potentially years away, but the BP Gulf oil spill has made local residents wary.

## Wastewater

### **Background**

- Effluent from wastewater systems represents one of the largest sources of pollution, by volume, in Canadian waters [14]. Harms to aquatic ecosystems and to Canadians from substances found in wastewater effluent have been documented domestically and internationally for more than 20 years.
- Mining industries discharged most (73 percent) of their wastewater to surface fresh water and discharged another 11 percent to tailing ponds and 9 percent to groundwater. Metal mines accounted for the largest proportion of wastewater discharged to tailing ponds. Of the total water discharged by mining operations, 60 percent was not treated before discharge, 31 percent underwent primary or mechanical treatment, and 9 percent underwent tertiary or advanced treatments [15]. One drop of oil can render up to 25 litres of water unfit for drinking [16].

### **Current Policy Status**

#### **Federal**

- Environment Canada published its first-ever set of wastewater regulations on July 18, 2012, as a means of cleaning up, or at least reducing, the 150 billion litres of untreated or undertreated wastewater or sewage that is dumped into waterways each year. The regulations fall under the Fisheries Act and are enforceable by law. Environment Canada requires a minimum treatment standard for wastewater before it is released into waterways. That minimum standard is called secondary treatment, a process that screens and filters water with both machines and biological processes and removes 95 percent of pollutants. In addition, there are requirements for monitoring, recordkeeping, reporting,

and toxicity testing. Currently, there are approximately 850–1,000 Canadian wastewater treatment plants in need of upgrades to meet the federal wastewater regulations. These upgrades will cost an estimated \$6 billion. All Canadian wastewater systems will eventually have to comply with the regulation by 2040. High-risk systems would require completion by 2020.

### **Provincially**

- Waste management acts authorize the provincial environment ministers to make guidelines and regulations pertaining to every person and commercial, industrial, or public organization that produces, stores, transports, handles, treats, destroys, discharges, or disposes of wastes and special wastes. They generally supersede municipal by-laws and permits, and wastes discharged or disposed of must have a permit, approval, order, or waste management plan, or be in compliance with the regulations. The acts deal with licensing of disposal facilities as well as the transportation of wastes.
- *British Columbia.* The provincial Oil and Gas Commission regulates aspects of the water used in oil and gas activities from both surface and subsurface sources. The disposal of produced water is heavily regulated through legislation. There is no surface discharge of produced water from oil and gas activities allowed in British Columbia.
- *Ontario.* The Municipal Industrial Strategy for Abatement (MISA) program was the provincial response to address levels of persistent toxic substances in industrial direct discharges entering Ontario's waterways. The MISA regulations are nine sector-specific regulations that set limits on toxic pollutants in wastewater discharged directly into a body of water by a designated industrial facility. Each parameter addressed under MISA is regulated with both a daily limit and a monthly average limit, and the effluent must not be toxic to fish.
- *Alberta.* The Water Act provides the legislative mandate for water management and regulation for all water uses in the province. The Environmental Protection and Enhancement Act establishes a legislative framework for protection of water quality in aquatic ecosystems. All wastewater discharges and management of pollution incidents are addressed in this legislation and the regulations. Environmental impact assessments of major industrial projects are also established by this act.

### **Commentary**

- In Canada, the management of wastewater is subject to shared jurisdiction, which has led to differing regulatory regimes and varying levels of treatment across the country. Treatment levels range from very good in many areas to poor or no treatment in others. Through various consultation processes, interested parties have consistently indicated the need for all levels of government to develop a harmonized approach to managing the wastewater sector in Canada. Although Environment Canada published its first-ever set of wastewater

regulations on July 18, 2012, many environmental groups urged Environment Canada to consider tougher measures and that 28 years to comply to the new regulations is too long.

## Pipeline Safety

### **Background**

- The National Energy Board took action in March 2012 to promote safety, security and environmental protection by requiring certain regulated companies that own or operate pipelines to annually report on new performance measures. Company reporting was reviewed in 2013 to assess whether the measures were providing the intended results and the guidance was enabling consistent reporting.
- The National Energy Board Onshore Pipeline Regulations are made under the National Energy Board Act, whose purpose is to promote safety and security, environmental protection, and efficient energy infrastructure and markets in the Canadian public interest within the mandate set by Parliament in the regulation of pipelines, energy development, and trade. Companies are responsible for meeting the requirements to manage safety, security, and environmental protection throughout the entire life-cycle of their facilities, from design through construction, operation, and abandonment. On April 10, 2013, the 1999 regulations were amended and renamed the National Energy Board Onshore Pipeline Regulations. The regulations clarify requirements for federally regulated pipelines regarding management systems for the purpose of protecting the public, workers, and the environment.

### **Current Policy**

- The Onshore Pipeline Regulations make it clear that management systems (a systematic approach designed to effectively manage and reduce risk) must apply to company programs for safety, pipeline integrity, security, environmental protection, and emergency management. Also, the regulations require that management systems be in place throughout each phase of the life-cycle of the pipeline, from design, materials, construction, operation, and all the way through to abandonment.
  - According to the National Energy Board, management systems are the primary means for a company to reduce risk and continually improve its operations. Management systems provide a consistent framework for the design, development, and implementation of organizational management programs, as well as for the cyclical planning, implementation, review, and adjustment of operational activities; such systems are essential for a company to address risks, manage its resources appropriately, and achieve desired outcomes.
- The regulations include provisions that focus on a company's senior leadership for accountability of its management systems, the company's safety culture, and the achievement of outcomes related to safety of the public and environmental protection.

Furthermore, companies must have an internal reporting policy that will encourage employees to bring forward, without fear of reprisals, the hazards and risks that they may encounter during their work activities.

## Pollution Prevention

### **Context**

- The Canadian Environmental Protection Act (CEPA), the National Pollutant Release Inventory (NPRI) under CEPA, the Fisheries Act, and the Canadian Shipping Act are some of the main federal regulations that focus on pollution prevention.
- CEPA has been in force since 1988. A revised version of the act came into force in 1999. A substantial portion of the act deals with the identification, control and/or prevention of toxic substances in the environment. CEPA also fulfills Canada's international and national commitments for regulating air pollution and ocean dumping.
- NPRI provides Canadians with facility-specific information regarding the release (to air, water, and land), disposal, and recycling of more than 300 substances that meet the criteria under Section 64 of CEPA 1999. NPRI is covered under Sections 46 to 53. Section 46 addresses the creation of inventories of data; Section 48 states that the minister shall establish a national inventory of releases of pollutants; Section 50 states that the minister shall publish this inventory; and Sections 47, 49, and 51–53 contain guidelines for the collection and publication of inventory data. NPRI does not capture data on all pollutant emissions in Canada. Reporting requirements are intended to create a balance between the level of effort required from reporting facilities and the overall quality of information on NPRI.
- The Fisheries Act is the principal federal statute that manages Canadian fisheries resources, protecting fish and the habitat they need to reproduce, grow, and survive. In 2012 the Fisheries Act was changed by provisions enacted in two successive omnibus budget bills—Bill C-38 and Bill C-45.
- The pollution provisions of the Canadian Shipping Act (CSA) apply to Canada's oil handling facilities. On July 1, 2001, CSA replaced an older act, and it came into force on July 1, 2007.

### **Current Policy Status**

- *NPRI*. Close to 4,000 oil and gas extraction facilities report to NPRI, representing more than 40 percent of all facilities reporting to NPRI. All producing Canadian oil sands operations and off-shore oil and gas extraction facilities reported, as did most natural gas-processing plants. Current NPRI reporting requirements do not require reporting of fugitive or venting emissions or fracking. Oil and gas exploration are also exempt (Environment Canada 2014).
  - Environment Canada is undertaking a review of NPRI's reporting requirements for oil and gas facilities in order to achieve appropriate rates of reporting and coverage for pollutants of concern, as well as simplified data reporting/data collection processes for industry and Environment Canada.

- This review also responds to an environmental petition, Shale Gas Fracking and In Situ Oil Sands Chemicals and the National Pollutant Release Inventory: Public Disclosure Needed (petition 317), which was submitted to the Auditor General of Canada on June 22, 2011. Environment Canada responded to the petition on October 25, 2011, indicating that it would be undergoing a review of NPRI reporting from the oil and gas sector and would consider NPRI reporting for shale gas and in situ oil sands extraction as part of that review [17].
- *Fisheries Act*. A new subsection enables lawful harm to fish habitat and expands governments' ability to authorize harm to fish habitat.
- *Shipping Act*. To date, there have been no convictions for pollution offences for ship-source oil pollution, following the act's amendment in 2005 [18].

### **Commentary**

- *CEPA*. Environment Canada could adopt an on-line enforcement disclosure approach, similar to the US EPA's Enforcement and Compliance History Online (ECHO), linked to CEPA.
- *NPRI*. Facilities reporting to NPRI could be required to use the same method every year; to make comparisons and trend analyses more reliable, and requirements could be increased to include fugitive, venting, and fracking gases.
- *Fisheries Act*. The act could be amended to include fish habitat and the Department of Fisheries and Oceans could have stronger powers to enforce compliance.

## **Renewable Energy Initiatives**

### **Context**

- "Renewable Energy provides some 1900 petajoules of Canada's primary energy supply, or about 16.5 percent" [19]. Conventional hydropower provides about two-thirds of Canada's renewable energy and about 60 percent of Canada's electricity.

### **Current Policies**

#### **Federal**

- The accelerated Capital Cost Allowance (CCA) in the income tax regulations allow investors to accelerate write-off of certain equipment used to produce energy more efficiently or from alternative renewable resources. In 2005, a 50 percent accelerated CCA was introduced for eligible equipment that generated heat for use in industrial processes, generated electricity by a renewable energy source, or made efficient use of fossil fuels. Budget 2005, 2007, 2008, 2010, and 2011 extended eligibility to a broader range of applications.
- The Government of Canada is also committed to expanding the production and use of renewable alternatives to gasoline and diesel, such as ethanol and biodiesel. The ecoENERGY Program, introduced in 2007, provides up to \$1.5 billion over nine years to encourage investment in the biofuels industry.

- The Aboriginal and Northern Community Plan provides \$30.7 million for Aboriginal and northern communities to increase their energy efficiency and their use of renewable electricity.

## Provincial

- *Ontario.* The Ontario Power Authority launched the Renewable Energy Standard Offer Programme (RESOP) in 2006 to make it easier for small, renewable energy generating facilities to participate in the electricity supply system by providing a stable pricing regime under a 20-year contract. Projects can use solar, wind, hydro, or biomass and can range from 1MW to 10MW. When launched in 2006, the program aimed to generate 1000 MW over 10 years. In little over a year, 1300 MW of contracted projects were achieved. As of January 2009, RESOP had signed 604 contracts totalling 1,517.5 MW.
- *Ontario.* The Feed-in Tariff (FIT) program, the most comprehensive program of its kind in North America, came into effect in October 2009. It allows generators of all sizes, from homeowners to large developers, to participate, providing a fixed tariff for the electricity grid. The program's prices that are intended to cover total project costs, provide a reasonable rate of return over a 20-year contract, and provide a straightforward way to obtain a contract for renewable electricity energy generation. FIT is open to various renewable energy technologies: biogas, biomass, landfill gas, solar photovoltaic, wind, and water power. It requires specific incentives for Aboriginal projects as well as for community-based projects. FIT payments can range from 10.3 cents/kWh to 80.2 Cents/kWh. The FIT program has created thousands of direct and indirect clean energy jobs, contracted 4,600 MW, attracted more than \$27 billion in private investment, increased the amount of clean energy in Ontario's supply mix, and supported Ontario's plan to replace coal-fired generation.
- *Ontario.* A renewable portfolio standard (RPS) requires that 5 percent (1350 MW) of the province's power come from renewable sources by 2007 and 10 percent (2700 MW) by 2010.
- *British Columbia.* The province introduced a voluntary RPS targeting 10 percent of new generation from renewable sources.
- *Prince Edward Island.* PEI has legislated an RPS, through the Renewable Energy Act, which requires public utilities to obtain 15 percent of their electricity generation from renewable energy sources starting on January 1, 2011.
- *Nova Scotia.* On February 1, 2007, Nova Scotia legislated an RPS, through regulation under the Electricity Act, which required standard service providers to obtain an additional 5 percent of their electricity generation from renewable energy sources by 2011 and 10 percent by 2013.
- *Manitoba.* MB Hydro is attempting to expand the reach of clean energy by seeking to get large-scale hydro exports recognized as renewable under RPS approaches in other jurisdictions (mainly the United States). Manitoba's domestic electricity generation is already more than 95 percent renewable.

## **Commentary**

- According to Ontario's Feed-in Tariff Program Two Year Review Report [20], Ontario should take the following actions:
  - Improve the regulatory approvals process by better aligning approvals with the size and characteristics of a project, reduce duplication, improve service standards, and streamline the process. According to the report, this could improve timelines for project approvals by up to 25 percent.
  - Prioritize projects through a new system that is designed to award points based on the participation of local or Aboriginal communities.
  - Prioritize projects with municipal support by awarding points during the application review process.
  - Reduce FIT prices by more than 20 percent for solar and approximately 15 percent for wind. Prices for hydro, biogas, biomass, and landfill gas should be maintained at the current levels. Prices should be adjusted annually to reflect current costs.
- RPS development in Canada is relatively new; valuable lessons can be learned from jurisdictions with well-established and time-tested RPS, such as those in the United States.

## Refining Operations

### **Commentary**

- As of 2013, Canada had 21 refineries and upgraders with a total capacity of roughly 515,000 cubic meters per calendar day. The total capacity has remained relatively steady, fluctuating between 490,000 and 531,000 since 2008, following a period of expansion in the 1990s and early 2000s. This section covers air emissions issues and water and effluent issues related to refining.

### **Current Policy**

- *Federal.* Canada has currently not proposed GHG emissions control regulations for new or existing refineries or upgraders. There has been ongoing consultation with industry on potential for regulations for refineries, but as of yet this sector remains uncovered. In general the federal government has indicated that provincial approaches to regulating or pricing carbon will be allowed to be maintained when the federal government does propose regulations for sectors, provided that they meet an equivalency threshold with proposed federal approaches.
- *Air emissions and toxics.* The Canadian Council of Ministers of the Environment (CCME) launched the National Framework for Petroleum Refinery Emission Reductions (NFPRER) as a multi-stakeholder process in 2002 with three goals: Protection of Human Health and Environment; Real, quantifiable emission reductions; and Convergence with comparable US refineries [23]. Canada sought to match US performance but with the potential for greater flexibility in achievement.

- *Effluents from refineries.* The Petroleum Refinery Liquid Effluent Regulations, under the Fisheries Act [24], cover oil and grease, phenols, sulfide, ammonia nitrogen, total suspended matter, and any substance capable of altering the pH of liquid effluent or once-through cooling water.
- *Alberta.* The province covers its refineries and upgraders under its Specified Gas Emitters Regulation, which applies to all facilities that emit in excess of 100,000 tonnes of CO<sub>2</sub>e per year. Under this system, covered entities are required to meet a reduction standard of 12 percent in emissions intensity as of January 2007. Compliance options include the following [21]:
  - Improvements to operations
  - Purchasing Alberta-based offset credits
  - Trading credits with entities that exceed their target
  - Making payments into an Alberta Climate Change and Emissions Management fund at a cost of \$15 per tonne, with funds designated for developing low-emissions technology, such as carbon capture and storage
- *Alberta.* The province's Water Council had requested various sectors to develop voluntary water conservation efficiency productivity (CEP) plans to improve their water performance under the Alberta's Water for Life strategy (<http://www.waterforlife.alberta.ca/>). The oil and gas sector was one of those that developed a plan, completed in 2012, that covers refining and seeks to improve water efficiency [25].
- *Quebec.* The province currently has two petroleum refineries, which are subject to its cap-and-trade system beginning in 2015 but receive assistance in the form of partial free allowances to protect their competitiveness with entities in uncovered jurisdictions [22]. Per provincial regulation, the portion of free allowances declines over time.
- *British Columbia.* The carbon tax rate on refinery gas is 5.28 ¢/m<sup>3</sup>.

### **Commentary**

- *GHGs.* Industry has stated opposition to stronger GHG rules, or at the least favours a clear price on carbon and a level playing field with other jurisdictions [26]. Industry supports the NFPRER.
- *Water.* There is some discussion of water use for refineries. The Canadian Association of Petroleum Producers highlights a Suncor refinery in the city of Edmonton as leader in water conservation for its decision not to use water from the Saskatchewan River for its operations, but instead using wastewater from the City of Edmonton's Gold Bar Wastewater Treatment Facility. Suncor filters the water in a "first of its kind" operation and uses this recycled water to meet its needs [27].

## Performance: GHG Emissions Limitations in the Transport Sector

### **Context**

- Given the influence of the American market, Canada has typically fairly quickly aligned its fuel efficiency standards for the light- and heavy-duty fleet with the prevailing US corporate average fuel economy (CAFE) standards. Canada has also adopted biofuel mixing standards at various levels across federal and provincial jurisdictions. Incentives for the manufacture and purchase of highly efficient vehicles have also been prevalent in the past decade.

### **Current Policy**

- *Light-duty vehicles.* Canada now has fuel economy and GHG emissions regulations in place for vehicle models through 2025. Through these regulations, cars will be required to achieve an average 5 percent annual reduction in GHG emissions. The required improvement for light trucks is 3.5 percent through 2022 and 5 percent thereafter. Vehicles of the 2025 model year will consume up to 50 percent less fuel than 2008 vehicles [28].
- *Heavy-duty vehicles.* Proposed regulations for heavy-duty vehicles were released in April 2012 (and finalized in 2013) for the 2014 to 2018 model years, aligning with the standards of the United States [29].
- *Renewable fuels.* Starting in 2010, the Government of Canada required an average renewable fuel content standard of 5 percent (ethanol) in gasoline. Further, a 2 percent biodiesel in diesel fuel regulation has also been put in place (Environment Canada 2013).
- Several provinces have differing mandates (E = ethanol, B = biodiesel [30],[31]):
  - British Columbia: E = 5 percent; B = 4 percent;
  - Alberta: E = 5 percent; B = 2 percent;
  - Saskatchewan: E = 7.5 percent; B = 2 percent
  - Manitoba: E = 8.5 percent, B = 2 percent
  - Ontario: E = 7.5 percent; B = 2 percent (plans to increase to B = 4 percent by 2017)
  - PEI: Proposed B = 10 percent not yet mandated
- British Columbia. The provincial carbon tax is currently 6.67 cents per litre of clear gasoline, 7.67 cents per litre of clear diesel and light fuel oil. Methanol is taxed at a rate of 3.27 cents per litre. Natural gas is taxed at a rate of 5.7 cents per cubic metre [32].
- Quebec. The province has a carbon tax of 0.8 cents per litre of gasoline, and 0.9 cents per litre of diesel fuel
- Industry incentives for biofuels are outlined in the ecoENERGY for Biofuels Program (2008–2017). This \$1.5 billion program is designed to boost production of biofuels through incentives to producers of renewable fuels based on production and market conditions. The program is designed to reduce risk associated with fluctuating feedstock and fuel prices.

### **Commentary**

- There have been a number of incentives for low-emitting vehicles, particularly electric or hybrid vehicles in Canada; however many of these have reached their budget limit, or sun-

set as technology becomes more mainstream. Ontario is one of the jurisdictions with a program still in place, with purchase rebates up to \$8,500 for battery electric vehicles. The full list of rates is available here:

<http://www.mto.gov.on.ca/english/dandv/vehicle/electric/ev-vehicle-list.shtml>.

- There is interest in increasing biofuel mandates in Canada; however there is also concern about the efficiency of biofuels in cold climates, since the fuel can gel at Canada's winter temperatures [33].

## Import and Export of Natural Gas and Oil: Low-Carbon Fuel Standards

### **Context**

- A low-carbon fuel standard (LCFS) is a rule enacted to reduce carbon intensity in transportation fuels compared with conventional petroleum fuels, such as gasoline and diesel. The most common low-carbon fuels are alternative fuels and cleaner fossil fuels, such as compressed natural gas (CNG) and liquefied petroleum gas (LPG). The main purpose of a low-carbon fuel standard is to reduce the carbon footprint of transportation.
- California's LCFS was introduced in 2007 with the goal of decreasing carbon dioxide emissions associated with transportation fuels by defining carbon-intensity standards that suppliers must achieve across all fuels they provide to the market. These reductions include not only tailpipe emissions but also all other associated emissions from production, distribution, and use of transport fuels, considering the entire life-cycle ("well to wheels" or "seeds to wheels"), to reduce the carbon footprint of transportation fuels. The LCFS directive calls for a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020. LCFS targets are back-loaded—that is, the mandated carbon reductions start slowly and ramp up quickly starting in 2015 [38]. Canadian producers of oil from the oil sands have expressed concerns about exports to markets with low-carbon fuel standards that take into account the carbon intensity of full life-cycle of fuels, notably inclusion of production emissions. In particular, the Canadian Association of Petroleum Producers (CAPP) has stated its opposition to a broader application in the United States of low-carbon fuel standards based on the California LCFS [34]. Similarly, the Canadian government has intervened in European Union consultations on its LCFS.

### **Current Policy**

- *British Columbia.* The LCFS requires fuel suppliers to reduce the average carbon intensity of transportation fuels by 10 percent by 2020. This requirement uses life-cycle assessment to determine the overall carbon intensity of fuels used for transportation and includes all factors associated with the production and consumption of each fuel. This includes exploration and production of fossil fuels, production of crops for biofuels and the refining, transport, and end use of the fuel [35],[36].

- *Alberta.* The renewable fuels standard (RFS) requires an average of 2 percent renewable diesel in diesel fuel and 5 percent renewable alcohol in gasoline sold in Alberta. Renewable fuels used to meet the RFS must demonstrate at least 25 percent fewer greenhouse gas emissions than the equivalent petroleum fuel [37].

### **Commentary**

- British Columbia's low-carbon fuel standard was enacted in 2008 with the objective of reducing the average carbon intensity of transportation fuels by at least 10 percent by 2020. It differs from California's in that it does not incorporate indirect land-use values into the life-cycle analysis. The California standard accounts for the fact that GHG emissions associated with land-use conversion in oil sands surface mining are higher than for conventional oil production (peat oxidation yields CO<sub>2</sub> and tailing pond impacts that contribute to methane, a significant greenhouse gas). As a result, the Canadian petroleum industry has come out in support of the British Columbia standard and criticized California's approach. News releases from the provincial and state governments indicate that the fuel standards are identical despite the differences in direct and indirect land-use calculations. The current battle is not as much about changing California's standard as it is about making sure that future LCFS in Canada and the United States follow British Columbia's format and not California's [39].
- An irony of LCFS policies is the "fuel shuffling" phenomenon. An argument can be made that implementation of LCFS in one importing market (e.g., the United States) leads to higher global GHG emissions because of increased transportation of crude oil and other fuels to and from more distant markets. For example, Canadian crudes that are assigned a higher "carbon intensity" value could be transported to Asia in exchange for greater volumes of Middle Eastern crudes with lower carbon intensity being shipped to the United States. A similar phenomenon is already occurring with biofuels, as Brazilian ethanol produced from sugarcane is being "shuffled" with corn-based ethanol produced in the United States.

## Sources

- [1] Griffiths, M., Woynillowicz, D. (2003). Oil and Troubled Waters; Reducing the impact of the oil and gas industry on Alberta's water resources. *Pembina*. Retrieved from <http://www.Ualberta.ca/~ersc/water/links/pembina.pdf>.
- [2] [6] Council of Canadian Academies. (2014). *Environmental Impacts of Shale Gas Extraction in Canada*. Ottawa (ON): The Expert Panel on Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction, Council of Canadian Academies.
- [3] British Columbia Oil and Gas Commission. (2012). Fracture Fluid Report Upload Manual. Retrieved from: [http://www.bcogc.ca/sites/default/files/documentation/wells-manuals/fracfluiddisclosuremanualfinal\\_1.pdf](http://www.bcogc.ca/sites/default/files/documentation/wells-manuals/fracfluiddisclosuremanualfinal_1.pdf)
- [4] Alberta Energy Regulator. (2012). ERCB Improves Public Access to Hydraulic Fracturing Fluid Information FracFocus.ca coming soon to Alberta. Retrieved from: <http://www.aer.ca/about-aer/media-centre/news-releases/news-release-2012-12-19-nr2012-14>
- [5] Alberta Energy Regulator. (2012). Directive 059: Well Drilling and Completion Data Filing Requirements. Retrieved from: <http://www.aer.ca/documents/directives/Directive059.pdf>
- [7] Elgin, B., Haas, B., Kuntz, P., Polson, J. (2012). Fracking Hazards Obscured in Failure to Disclose Wells. *Bloomberg*. Sustainability, August 2012, web. 20 May, 2014.
- [8] Office of the Auditor General of Canada. (2013). Oversight of Rail Safety; *Transport Canada*. Retrieved from [http://www.oag-bvg.gc.ca/internet/English/parl\\_oag\\_201311\\_07\\_e\\_38801.html](http://www.oag-bvg.gc.ca/internet/English/parl_oag_201311_07_e_38801.html).
- [9] Brahmi, T. (2014). Canada. House of Commons. Railroad Transportation Adjournment Proceedings. *Tarik Brahmi on Rail Transportation*. Retrieved from <http://openparliament.ca/debates/2014/2/24/tarik-brahmi-1/only/>.
- [10] Natural Resources Canada. (2011). Oil and Gas Activity. Retrieved from: <http://www.nrcan.gc.ca/energy/offshore-oil-gas/5841>
- [11] [12] Canadian Association of Petroleum Producers (CAPP). (n.d.). Spill Prevention and Response in Atlantic Canada. Retrieved from: <http://www.capp.ca/GetDoc.aspx?DocId=105603&DT=NTV>.
- [13] Canadian Press. (2014). *Arctic offshore drilling closer to reality as projects enter regulatory review*. CBC News. Retrieved from: <http://www.cbc.ca/news/canada/arctic-offshore-drilling-closer-to-reality-as-projects-enter-regulatory-review-1.2583487>
- [14] Government of Canada. (2011). Wastewater Systems Effluent Regulations. Retrieved from <http://www.gazette.gc.ca/rp-pr/p1/2010/2010-03-20/html/reg1-eng.html>.
- [15] Statistics Canada. (2013). Section 4: Waste water discharges. Retrieved from <http://www.statcan.gc.ca/pub/16-201-x/2012000/part-partie4-eng.htm>.
- [16] Environment Canada. (2010). Introduction to Water Quality. Retrieved from <http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=2C3144F5-1>.

- [17] Office of the Auditor General of Canada. (2011). *National Pollutant Release Inventory reporting of chemicals used for shale gas and in-situ mining (petition 317)*. Retrieved from [http://www.oag-bvg.gc.ca/internet/English/pet\\_317\\_e\\_35778.html](http://www.oag-bvg.gc.ca/internet/English/pet_317_e_35778.html).
- [18] Purcell, C. "Important Changes to the Canadian Shipping Act." *International Law Office*, September 2014. Web. May 20, 2014.
- [19] Environment Canada. (2010). Renewable Energy. Retrieved from: <http://www.ec.gc.ca/energie-energy/default.asp?lang=En&n=F62D29CC-1>
- [20] Ontario Ministry of Energy. (2013). Feed-In Tariff Program Two Year Review. Retrieved from: <http://www.energy.gov.on.ca/en/fit-and-microfit-program/2-year-fit-review>
- [21] Alberta Environment and Sustainable Resource Development (ESRD). (2014). *Greenhouse Gas Reduction Program* Retrieved from: <http://esrd.alberta.ca/focus/alberta-and-climate-change/regulating-greenhouse-gas-emissions/greenhouse-gas-reduction-program/default.aspx>.
- [22] MDDEP. (n.d.). Regulation Respecting a Cap-and-Trade System for Greenhouse Gas Emission Allowances (C&T) Technical Overview. Retrieved from: <http://www.mddep.gouv.qc.ca/changements/carbone/SPEDE-description-technique-en.pdf>.
- [23] 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.
- [24] Government of Canada. (2014). Petroleum Refinery Liquid Effluent Regulations. Retrieved from: <http://laws-lois.justice.gc.ca/eng/regulations/C.R.C. percent2C c. 828/index.html>.
- [25] Canadian Fuels Association. (2013). *Water – A Precious Resource*. Retrieved from: [http://canadianfuels.ca/assets/upload/pdf/en/Environment/Guidance percent20Material/Water percent20Primer percent20- percent20Jan-2013 percent20FINAL percent20\(Sec percent20V percent20Revised percent20Jan percent202014\).pdf](http://canadianfuels.ca/assets/upload/pdf/en/Environment/Guidance percent20Material/Water percent20Primer percent20- percent20Jan-2013 percent20FINAL percent20(Sec percent20V percent20Revised percent20Jan percent202014).pdf).
- [26] Canadian Fuels Association. (2014). Industry Policy Positions. Retrieved from: <http://canadianfuels.ca/en/industry-policy-positions>.
- [27] Canadian Association of Petroleum Producers (CAPP). (2014). Using Recycled Water Instead of River Water. Retrieved from: <http://www.capp.ca/energySupply/innovationStories/Water/Pages/usingrecycledwaterinsteadofriverwater.aspx>.
- [28] [29] Environment Canada. (2013). Greenhouse Gas Emission Regulations. Retrieved from: <http://www.ec.gc.ca/cc/default.asp?lang=En&n=E97B8AC8-1>.
- [30] Webb, A. (2013). Canadian federal and provincial biofuels mandates. Retrieved from: <http://www.biofuelnet.ca/2013/09/26/canadian-federal-and-provincial-biofuels-mandates/>
- [31] British Columbia Trucking Association. (2014). North American Biodiesel Roundup – What's Mandated Where for Diesel Blends. Retrieved from: <http://www.bctrucking.com/node/11725>

- [32] British Columbia Ministry of Finance. (2013). Tax Rates on Fuels. Retrieved from:  
[http://www.sbr.gov.bc.ca/documents\\_library/bulletins/mft-ct\\_005.pdf](http://www.sbr.gov.bc.ca/documents_library/bulletins/mft-ct_005.pdf).
- [33] LSU AgCenter. (2013). Biodiesel Fuel Management in Cold Weather. Retrieved from:  
[http://www.lsuagcenter.com/en/our\\_offices/departments/W.A. Callegari Environmental Center/News/Biodiesel-Fuel-Management-in-Cold-Weather.htm](http://www.lsuagcenter.com/en/our_offices/departments/W.A._Callegari_Environmental_Center/News/Biodiesel-Fuel-Management-in-Cold-Weather.htm).
- [34] Canadian Association of Petroleum Producers (CAPP). (2009). Comments on Proposed Low Carbon Fuel Standard Regulations. Retrieved from:  
<http://www.capp.ca/getdoc.aspx?DocID=151109>.
- [35] British Columbia Ministry of Energy and Mines. (2013). Renewable & Low Carbon Fuel Requirements Regulation. Retrieved from:  
<http://www.empr.gov.bc.ca/RET/RLCFRR/FAQ/Pages/default.aspx>.
- [36] British Columbia Queen's Printer. (2008). Renewable and Low Carbon Fuel Requirements Regulation. Retrieved from:  
[http://www.bclaws.ca/EPLibraries/bclaws\\_new/document/ID/freeside/394\\_2008](http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/394_2008).
- [37] Alberta Energy. (2014). Renewable Fuels Standard Administration. Retrieved from:  
<http://www.energy.alberta.ca/BioEnergy/2847.asp>.
- [38] Fuelling California. (n.d.) Low Carbon Fuel Standard Issue Brief: A Comprehensive Analysis of Current Research and Outlook for the Future. Retrieved from:  
<http://www.fuelingcalifornia.org/wpcms/wp-content/uploads/LCFS-Issue-Brief-FINAL.pdf>.
- [39] Pacific Institute for Climate Solutions (PICS). (2010). Briefing Note 2010 – 18 BC's Low Carbon Fuel Standard. Retrieved from:  
[http://pics.uvic.ca/sites/default/files/uploads/publications/BC's\\_percent20low\\_percent20carbon\\_percent20fuel\\_percent20standard\\_percent20.pdf](http://pics.uvic.ca/sites/default/files/uploads/publications/BC's_percent20low_percent20carbon_percent20fuel_percent20standard_percent20.pdf)