IHS ENERGY: CRUDE OIL MARKETS

The State of Canadian and US Climate Policy

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STRATEGIC REPORT

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The State of Canadian and US Climate Policy

Key implications

Global efforts to address climate change are increasing. Development of the Canadian oil sands has featured prominently in climate change discussions in Canada and the United States. Efforts are advancing in both countries to curb national greenhouse gas emissions, including from the Canadian oil sands. Similarities in approach to climate policy exist, but economic, demographic, and political differences are giving rise to dissimilarities. This report explores the state of Canadian and US emissions and climate policy.

- **The major sources of greenhouse gas emissions are different in the United States and Canada.** In the United States, power generation was the biggest emitter in 2014, with 30% of total emissions. In Canada, oil and gas activities accounted for 26% of emissions. Industrial emissions, including oil and gas, accounted for 44% of Canada's emissions.

- **Over the past year, climate policy momentum increased in Canada and the United States.** Although steeped in politics, pre- and post-Paris climate summit, a series of targets, promises, and regulations have come forward. Examples include proposed methane regulations for oil and gas, a cap on Canadian oil sands greenhouse gas emissions, Ontario's introduction of a cap and trade system, US renewal of tax credits, proposed heavy-duty vehicle-efficiency standards, and discussions in Canada regarding a national price on carbon.

- **In the United States, policy efforts are primarily focused on specific sectors—the frontline being power generation.** The United States has a more emissions-intensive power sector with a greater reliance on coal-fired power generation. Access to abundant and affordable shale gas and the declining cost of renewables provide the United States with a relatively low-cost opportunity to reduce power sector emissions, and thus national emissions.

- **In Canada, more effort is now being placed on economy-wide carbon pricing.** About 80% of Canadian power generation is already non-emitting compared with one-third in the United States. In the absence of an emissions-intensive power sector, various models of carbon pricing are advancing across Canada to reduce national emissions.

- **Carbon policies can move a country closer to its climate objectives, but for firms that compete globally, sufficiently stringent policies can displace investment and emissions to other jurisdictions.** This is a concern for Canada's large oil and gas sector, which competes globally for investment and export markets. Unilateral climate policy adds cost that could move investment, activity, and associated emissions from Canada to regions with less-stringent policies, with little or no net reduction in global emissions.

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The State of Canadian and US Climate Policy

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About this report

Purpose. Since 2009, IHS has provided public research on issues surrounding the development of the Canadian oil sands. The development of the Canadian oil sands is an important element of the climate policy debate in North America. This report explores the state of climate policy in Canada and the United States. Where is it, and where does momentum appear to be building?

Context. This is part of a series of reports from the IHS Canadian Oil Sands Dialogue. The dialogue convenes stakeholders in the oil sands to participate in an objective analysis of the benefits, costs, and impacts of various choices associated with Canadian oil sands development. Stakeholders include representatives from governments, regulators, oil companies, shipping companies, and nongovernmental organizations. This report and past Oil Sands Dialogue reports can be downloaded at www.ihs.com/oilsandsdialogue.

Methodology. IHS conducted our own extensive research and analysis on this topic, both independently and in consultation with stakeholders. This report was informed by multi-stakeholder input from a focus group meeting held in Washington DC on 9 June 2015, as well as participant feedback on a draft version of the report. IHS has full editorial control over this report and is solely responsible for its content (see the end of the report for a list of participants and the IHS team).

Structure. This report has four sections.

- Setting the stage
- Where emissions differ: US power versus Canadian oil
- The policy smorgasbord: Similarities at the top, differences at the bottom
- Conclusions

Part 1: Setting the stage

How to address climate change has become a defining question of the 21st century. Concerns about climate change—such as rising sea levels and extreme weather phenomena—are behind global efforts to cut greenhouse gas (GHG) emissions. Reducing emissions will require a degree of coordination and understanding among countries. Since 1995, the United Nations has been holding Climate Change Conferences of the Parties (COP) to develop agreements for a path toward lower GHG emissions.[1] The latest meeting was in December 2015 in Paris. For the first time, nearly 200 countries pledged to deliver emissions reductions and to report back on their progress every five years.[2]

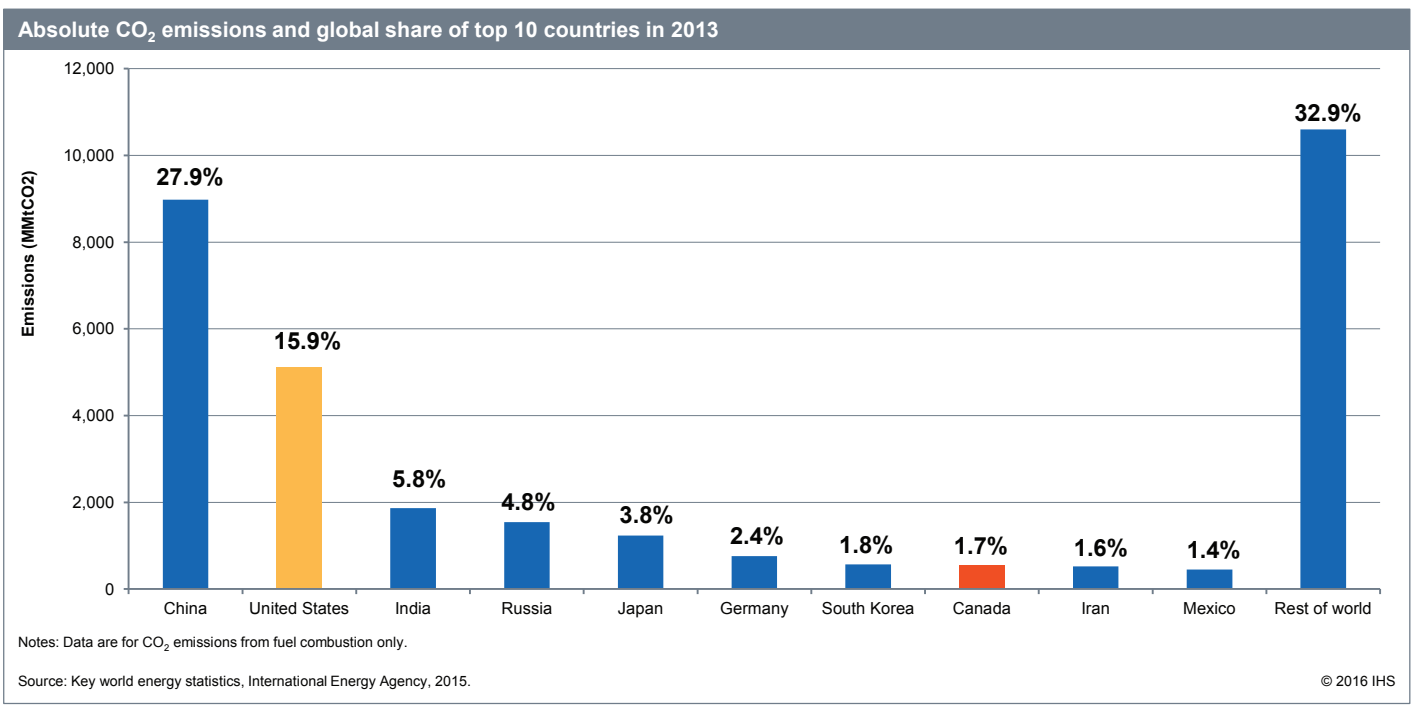
The challenge is reducing manmade emissions, of which fossil fuels are a large contributor. The prevalence of fossil fuels in the world economy is due to their abundance, competitive cost, high energy density, and infrastructure to produce and deliver them to market that has been developed over two centuries. Reducing global emissions requires government policies. On the supply side, policies generally seek to support development of renewable or low–emissions-intensive fuels and technologies. On the demand side, the focus tends to be on greater efficiency in the consumption of energy or use of alternative technologies or fuels.

Each country is unique, differing in resource endowments, geography, climate, history, and politics. Regions with a greater reliance on fossil fuels, either through production or consumption, may face greater challenges and costs than others to reduce emissions. This implies the effort and cost may differ nationally and regionally, thus resulting in a complex mosaic of policies and ambitions.

The state of Canadian and US climate policy

In 2013, two-thirds of global carbon dioxide (CO_2) emissions were concentrated among 10 countries.[3] China and the United States were the top two emitters, with nearly half of global emissions (28% and 16%, respectively). Canada ranked as the eighth-largest emitter, responsible for less than 2% of global emissions (see Figure 1).

Figure 1



1. COP 1 was held in Berlin in 1995. There have been 20 subsequent meetings.

2. For details see *www.cop21paris.org.*

3. Estimates are based on CO_2 emissions from fuels combustion only. The latest year for which international estimates are available is 2013. Source: *Key world energy statistics 2015,* International Energy Agency, 2015.

Canada and the United States both have GHG emissions-reduction targets in the shorter and longer terms. Both countries have targeted a 17% reduction below their 2005 levels by 2020. In 2015, Canada and the United States both announced longer-term targets: a 30% reduction by 2030 in Canada and a 26–28% cut by 2025 in the United States, compared with 2005 GHG emissions.[4] In 2014, Canadian and US emissions were 2% and 7% lower, respectively, than 2005 levels.

To achieve their objectives, Canada and the United States are advancing a suite of policies. Curbing emissions from power plants is a major policy focus in the United States. In the absence of an emissions-intensive power sector, economy-wide carbon pricing is expanding more rapidly in Canada. Both countries also have vehicle fuel-economy standards and support for alternative vehicle powertrains such as electric cars. The United States and Canada also support research and development of clean technologies and aim to reduce methane emissions from the oil and gas sector.

Comparing North American climate policy

The most common basis of comparison for Canada is the United States. The countries share a close social and policy relationship and their economies are highly integrated. Trade between the two countries is one of the largest in the world—nearly US$577 billion in 2015.[5]

This report will explore the Canadian and US GHG emissions profiles and the state of their current climate policies. What are the largest sources of emissions in the United States and Canada? What policies have advanced in each country? And what are the challenges to further reducing GHG emissions?

This report is divided into four sections:

- Setting the stage
- Where emissions differ: US power versus Canadian oil
- The policy smorgasbord: Similarities at the top, differences at the bottom
- Conclusions

For background information on climate change and the common policy-related terminology used throughout the report, please refer to the box "Primer: Climate change and policy."

Primer: Climate change and policy

The most common GHGs are CO_2, methane (CH_4), nitrous oxide (N_2O), and hydrofluorocarbons. GHGs have different global warming potential, meaning that their ability to trap heat in the Earth's atmosphere varies. For example, CH_4 and N_2O are about 25 times and 298 times more potent than CO_2.[i] Yet on an equivalent mass basis, CO_2 emissions greatly exceed other GHGs. In 2014, for example, CO_2 emissions were about 190 times and 4,100 times larger than CH_4 and N_2O emissions in the United States.

Data sources and limitations

Unless otherwise stated, GHG emissions data in this report are from the Canadian and US 2016 National Inventory Reports (NIRs).[ii] These papers report 2014 emissions.

4. Source: "U.S. Reports its 2025 Emissions Target to the UNFCC," The White House Office of the Press Secretary, accessed 4 August 2016, and "Government of Canada announces 2030 emissions target," Government of Canada, accessed 4 August 2016.

5. Source: Trade in goods with Canada, US Census, accessed 4 August 2016.

Primer: Climate change and policy (continued)

There are uncertainties and limitations with emissions data. This is partly because GHGs are emitted by both large sources such as power plants as well as numerous small sources such as cars and buildings. This can complicate accurate measurement of GHG emissions. Some emissions data come from reporting, others come from detail models. Although the UN has established frameworks for reporting national inventory of emissions, subtle differences can still exist. For example, Canada reports GHG emissions from its oil and gas industry and by subindustries (e.g., oil sands) in its NIR, whereas the United States currently does not.

What is a climate change policy?

The term "climate policy" can be ambiguous as various measures and regulations can affect GHG emissions. For example, policies aiming to create jobs, diversify the economy, enhance energy security, reduce air pollutant emissions, and support new technologies may all contribute to development of a lower carbon economy. This study focuses on the major federal and subnational policies associated with GHG reductions.

Carbon pricing mechanisms

Throughout this report, we refer to economy-wide carbon pricing measures. There are two fundamental designs for pricing emissions: cap-and-trade and carbon tax.

Cap-and-trade: In this model, total GHG (or CO_2 in some jurisdictions) emissions of the covered entities are capped. Allowances or rights to emit GHGs may be distributed freely or auctioned off to regulated facilities (or some combination). Regulated entities may also trade and bank allowances to meet future emissions requirements.

The cap is adjusted downward over time to reduce emissions. In principle, as the cap tightens, the value of allowances increases, creating an increasing financial incentive to reduce emissions. A cap-and-trade system can provide greater certainty over the level of emissions. However, emissions prices are less certain as they are determined in the market. In practice, some programs may provide off-ramps, or offsets that can allow for greater emissions in specific sectors.

Carbon tax: Carbon tax has the advantages of being relatively simple—a tax is placed on the emissions that result from the use of different fuels. Another advantage of the carbon tax system is its transparency—the price is often fixed years in advance, providing greater certainty. Emitters can either reduce their emissions or pay the carbon tax. Unlike a cap-and-trade system there is no direct limit placed on emissions, but it does provide greater price certainty.

Money raised by the carbon tax or auction of allowances can be used by governments to reduce emissions elsewhere in the economy, invest in new technologies, or offset the economic impact of the carbon price to disadvantaged sectors or groups.

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i) These values are expressed over a 100-year period and are based on the IPCC Fourth Assessment Report, published in 2007. Both the United States and Canada use this basis for their emissions reporting. Source: Climate change 2007: Working Group I: The physical science basis, Intergovernmental Panel on Climate Change, accessed 4 August 2016.

ii) Source: "Inventory of U.S. greenhouse gas emissions and sinks: 1990-2014," Government of the United States, Environmental Protection Agency, 2016, and "National inventory report 1990-2014: Greenhouse gas sources and sinks in Canada," Government of Canada, Department of Environment and Climate Change Canada, 2016. Note that GHG emissions in this IHS report exclude land use, land-use change and forestry (LULUCF) emissions.

Part 2: Where emissions differ: US power versus Canadian oil

The United States has the largest national economy in the world, and Canada's ranks 10th. On many economic indicators, such as population and GDP, the United States is about 10 times larger than Canada (see Table 1). This is also true for GHG emissions. In 2014, the United States' and Canada's emissions were 6,870 million metric tons of carbon dioxide equivalent ($MMtCO_2e$) and 732 $MMtCO_2e$, respectively. Canada's emissions are roughly equivalent to those of Texas, the largest emitting state in the United States.

Table 1

Comparison of the United States and Canada based on selected economic and emissions criteria (2014)

	Population (millions)	GDP (trillion US$)	GHG emissions ($MMtCO_2e$)	Emissions per capita (ton CO_2e/ capita)	Emissions intensity (ton CO_2e/ million US$)
United States	318.9	17.35	6,870	21.5	396
Canada	35.5	1.78	732	20.6	410

Source: World Bank Group, US Environmental Protection Agency, Environment and Climate Change Canada, US Census, Statistics Canada

The shares of emissions by source are different in the United States and Canada (see Figure 2). Electric power generation, particularly from coal, is the single largest emitter in the United States, followed closely by the transportation and industrial sectors. In contrast, the industrial sector is the largest emitter in Canada, followed by the transportation and power sectors. Buildings and agriculture each account for about one-tenth of US and Canadian emissions. For this reason and for brevity, this report focuses on the power, transportation, and industrial sectors.

Power sector: A tale of two countries

Different sources of electrical power generation result in different GHG emissions in Canada and the United States. Canada's power sector is dominated by hydroelectricity. The US power sector is dominated by fossil fuels, with coal and natural gas each currently accounting for roughly one-third of total generation.[6]

Greater hydroelectric endowment and generation relative to national demand have made the Canadian power sector less carbon-intensive than the United States, and it contributes to a lower share of national GHG emissions. This difference is exacerbated by the United States' greater reliance on coal. Despite declines in recent years, coal accounted for about 34% of total US electricity generation in 2015. Natural gas supplied 32% of generation, followed by nuclear at around 20%.[7] Use of coal for power generation produces more GHG emissions than other fossil fuels—about double those of natural gas. On an absolute basis, GHG emissions from the US coal power plants are more than double those of the entire Canadian economy—1,570 $MMtCO_2e$ and 732 $MMtCO_2e$ in 2014, respectively. In contrast, hydro and nuclear were the top two sources of power generation in Canada, providing 61% and 18% of national generation in 2014, respectively. Coal and natural gas accounted for 11% and 5%, respectively.[8] In 2014, power accounted for 11% of Canadian national GHG emissions, compared with 30% in the United States.

Power-related GHG emissions have been declining in both countries. In the United States, low natural gas prices from the shale gas boom and increased coal-fired power plant retirements have led to a shift from coal to natural gas-fired generation. This, combined with greater energy efficiency and an increase in wind and solar generation, led to a 15% decline in US power-related GHG emissions in 2015 from 2005 levels. The single largest improvement in Canada's electricity GHG emissions is attributable to the policy-driven phase-out of Ontario's coal fleet, completed in 2014.[9]

6. There exist subnational variations in both countries, mainly driven by availability of natural resources. For example, parts of the Canadian Prairie region (Alberta and Saskatchewan) with lower hydropower potential but greater coal deposits historically opted for a greater reliance on coal power. Subnational variations exist in the United States as well. For example, less than 1% of power in California is derived from coal.

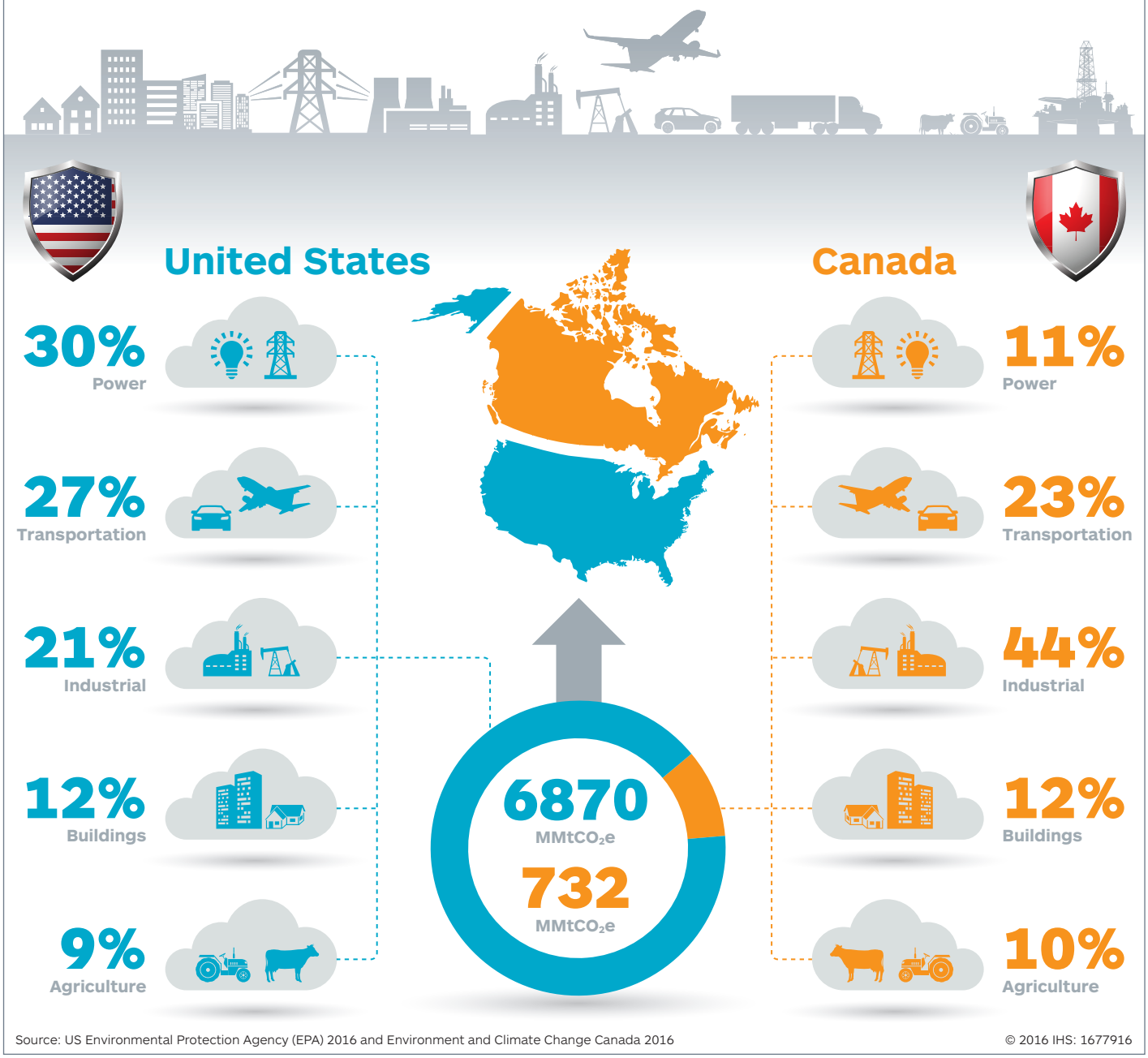
7. Source: *Annual Energy Outlook 2016*, US Energy Information Administration, accessed 4 August 2016.

8. Source: *National inventory report of greenhouse gas sources and sinks in Canada: 1990-2014,* Government of Canada, Department of Environment and Climate Change Canada, 2016.

9. For more information, see *The End of Coal,* Government of Ontario, Ministry of Energy, accessed 4 August 2016.

Figure 2

Comparison of US and Canadian 2014 GHG emissions and contributions of economic sectors to national emissions



Source: US Environmental Protection Agency (EPA) 2016 and Environment and Climate Change Canada 2016

Oil and gas and other industrial emissions: Canada's elephant in the room

The industrial sector includes manufacturers of fertilizers, chemicals, cement, pulp and paper, refined petroleum products (e.g., gasoline), steel and non-ferrous smelters, and extractive industries including mining as well as oil and gas production. This sector is the largest source of GHG emissions in Canada, accounting for 44% of national emissions in 2014. US industrial emissions are larger in absolute terms—about 4.5 times those of Canada. However, with 21% of national emissions, the industrial sector ranks behind the power and transportation sectors in the United States.

The disparity between Canadian and US industrial emissions has been increasing. From 2005 to 2014 US industrial emissions declined 2% while Canadian emissions increased 7%.[10] While Canadian industrial emissions increased alongside oil and gas production growth, particularly in the oil sands, the United States benefited from gradual transition toward a less-energy-intensive service-oriented economy and industrial power shift from coal to natural gas.

Oil and gas emissions: Large contributor to Canada's industrial emissions

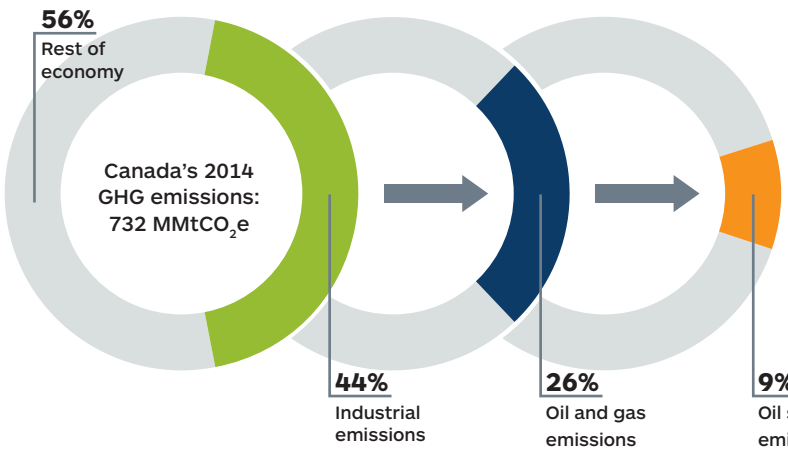
As a large exporter, the oil and gas sector is a greater share of national emissions in Canada. This is exacerbated by the scale of the Canadian economy—almost one-tenth the size of the US economy. In 2014, industrial emissions made up 44% of Canada's emissions; of that, the oil and gas sector accounted for 26% of national emissions, and of that oil sands production emissions accounted for 9% of Canada's total emissions (see Figure 3).

Canada's upstream oil and gas industry has historically been driven by US demand: Canada is the United States' largest source of imported crude oil and natural gas.

Upstream oil and gas is a smaller share of US industrial and national emissions compared with Canada. This is principally because of the larger scale of emissions from the power and transportation sectors in the United States. This is accentuated by the United States being a large net importer of crude oil and gas while Canada is a net exporter. Although US oil and gas imports have fallen in recent years as domestic production has increased, net imports remained nearly twice those of Canada's net oil and gas exports in 2015.[11]

Figure 3

Share of oil and gas sector of Canada's total GHG emissions in 2014



Source: Environment and Climate Change Canada, 2016

The GHG emissions intensity of Canadian oil sands production has been a focus of attention. Numerous studies, including by IHS, have found that production of oil sands crudes can emit more GHGs than the average crude consumed in North America. In a 2014 study, IHS found that on a well-to-wheels life-cycle basis oil sands crudes ranged from 1% to 19% higher than the average crude consumed in the United States in 2012.[12] However, there are some crudes, such as heavy oil from California or imports from Venezuela, that have similar emissions intensities as oil sands.

In 2015, Alberta introduced a policy capping GHG emissions from the oil sands. Alberta also introduced a new performance standard to further incentivize the industry to reduce the emissions intensity of production. Alberta's climate policies are discussed in more detail in Part 3.

For more detail on the oil sands emissions trend, see the box "Oil sands emissions trends."

10. In 2005–14, US industrial emissions declined from 1,486 $MMtCO_2e$ to 1,462 $MMtCO_2e$ while Canada's emissions increased from 303 $MMtCO_2e$ to 323 $MMtCO_2e$.

11. US net imports of oil and gas in 2015 were about 7.3 million boe per day, or 25% of its domestic demand. Canada's net exports were nearly 3.3 million boe per day, or 50% of its domestic oil and gas production.

12. For more details, see the IHS Energy Special Report *Comparing GHG intensity of the oil sands and the average US crude oil.* May 2014. Available for download from ihs.com/oilsandsdialogue.

Oil sands emissions trends

Over the past decade, Canada was the third-fastest-growing producer of crude oil in the world, behind the United States and Iraq. This was driven almost exclusively by the continued expansion of the Canadian oil sands. Along with production growth, absolute GHG emissions also increased. In 2005–14 oil sands production and emissions nearly doubled, from close to 1 MMb/d and 34 $MMtCO_2e$ in 2005 to more than 2 MMb/d and 68 $MMtCO_2e$. During this period, oil sands' contribution to national emissions increased from 4% to 9%.[i]

Growth in GHG emissions from oil production is not unique to Canada. Other countries have also experienced production growth and inherently emissions growth. For instance, the United States experienced an extraordinary revival in crude oil production, expanding more than 4 MMb/d from 2009 to 2015. More recently, Iranian oil production has increased sharply, by about 0.8 MMb/d in the first half of 2016, as a result of the lifting of sanctions in connection with the nuclear agreement.

i) Oil sands production data are for synthetic crude oil and (non-upgraded) bitumen.

Transportation: A shared challenge

Transportation—cars, trucks, buses, trains, ships, planes, and pipelines—is the second-largest source of emissions in both countries, accounting for about one-fourth of all emissions.[13] Transportation emissions primarily result from the combustion of refined petroleum products, such as gasoline and diesel, to transport goods and people.[14]

From 2005 to 2014, transportation emissions in the United States fell about 9% while Canadian emissions remained relatively flat. This difference was driven by an array of factors, such as slower economic and population growth in the United States as well as greater penetration of more efficient powertrains and alternative technologies (e.g., hybrid cars) compared to Canada.

Liquid hydrocarbons are expected to remain the dominant fuel source for transportation in the coming years. IHS expects that under existing policies, North America's demand for gasoline, diesel, and jet fuel may decline by about 6% from 2016 to 2030. Tightening fuel-efficiency standards and use of alternative technologies such as hybrids and electric cars will mitigate GHG emissions. But the dominance of gasoline and diesel is likely to remain for some time.[15] Ongoing demand for petroleum products has implications for upstream oil producers—like tight oil and oil sands—as this underpins global demand for crude oil.

Part 3: The policy smorgasbord: Similarities at the top, differences at the bottom

Canada historically has sought to align GHG reduction policy with its largest trading partner, the United States, over concerns that unilateral action could hinder its industrial competitiveness. However, this drive for alignment may be changing.

This section discusses the development of GHG reduction policy in Canada and the United States first at the national level then at the subnational level.

North America's climate policy: Shrouded in politics

Federal governments in Canada and the United States have the authority to regulate GHG emissions. Both governments have authority over issues that transcend state and provincial borders and on matters of public health. US state governments have authority to enact climate policies within their jurisdictions provided they do not interfere with

13. In 2014, transport accounted for 27% (1,810 $MMtCO_2e$) and 23% (171 $MMtCO_2e$) of emissions in the United States and Canada.

14. In 2014, road transport accounted for 84% of US transportation emissions. Aviation, marine, rail, and pipelines were smaller shares.

15. See the *IHS Energy Long-Term Planning and Energy Scenarios.*

interstate trade. Similarly, Canadian provinces have broad authority to manage resources within their borders and enact policies to reduce GHGs and other pollutants.

A lack of consensus among political actors and the complexity of the US legislative system have impeded previous efforts to pass new federal climate legislation, such as the Waxman-Markey Bill in 2009, which would have established a national cap-and-trade system. The Obama administration has focused on leveraging existing legislation and regulations as opposed to creating new laws. Notably, the US Environmental Protection Agency (EPA) has been advancing regulations to reduce GHG emissions under the Clean Air Act (CAA).[16]

In Canada, the federal government has the authority to restrict and manage pollutants deemed to be toxic under the Canadian Environmental Protection Act (CEPA) of 1999.[17] However, development of a national policy in Canada is complicated by highly autonomous provinces with distinctive energy endowments and socioeconomic characteristics. For example, Alberta and Saskatchewan have large endowments of fossil fuels with less hydro potential compared with other regions. Fewer regional governments—10 Canadian provinces compared with 50 US states—means that provinces are significant actors in national GHG policy conversations.[18] For instance, two provinces in Canada—Alberta and Ontario—alone account for three-fifths of national GHG emissions. In the United States, it takes the top 14 states to emit a comparable national share of emissions.

Competitiveness concerns have encouraged policy alignment with the United States

The close economic relationship with the United States has raised concerns that introducing policies out of step with the United States could disadvantage export-oriented Canadian businesses against their US peers.

Unilateral climate policy can add costs to domestic export-dependent firms that their competitors may not face. In this circumstance, firms that compete globally may physically relocate or lose out to their competitors. Along with this, the investment, employment, and emissions get redistributed to jurisdictions with less-stringent policies. If countermeasures are not taken, the local economy with more advanced climate policies may be negatively impacted. This is not a concern unique to Canada, but it weighs heavily given the close trade relationship with the United States and Canada's large export-oriented oil and gas sector, which competes globally and with US firms for investment, labor, and markets. This contrasts with electrical power generation, for instance, which is more insulated from competitiveness concerns because of technical and economic limitations to large-scale power transportation.[19]

Differences in approach emerging as Canada advances carbon pricing

An array of policies has advanced on both sides of the border with the most aggressive efforts to date targeting emissions from power generation. Historically, both federal governments have sought GHG reductions from specific sectors rather than establishing an economy-wide price on carbon. However, this may be changing in Canada. A shift in political control and the reality that Canada would be challenged to achieve the same reductions using similar policy as the United States have renewed interest in a national carbon price.[20] Meanwhile, support for national emissions pricing in the United States continues to be politically contentious and complicated by separation of powers.[21] In the absence of large emissions

16. The CAA was passed in 1970 to reduce air pollutants that were known to cause harm to human health and the environment. More recently, the CAA has been leveraged to regulate GHG emissions. This became possible only after a Supreme Court ruling in 2007 held that GHGs met the definition of air pollutant under the CAA and a finding by the EPA in 2009 that determined GHGs may endanger public health and welfare. For details, see *Massachusetts et al. v. Environmental Protection Agency et al,* US Supreme Court, http://www.supremecourt.gov/opinions/06pdf/05-1120.pdf, accessed 4 August 2016.

17. For details on the CEPA, refer to *The CEPA Review,* Government of Canada, Department of Environment and Climate Change Canada, accessed 4 August 2016.

18. Canada also has three territories, which cumulatively host about 0.3% of Canada's population and emissions.

19. For example, Canada is the largest exporter of electricity globally, but exported less than 10% of its production in 2014. Source: *Key world energy statistics 2015,* International Energy Agency, 2015.

20. Canada's federal and provincial governments agreed in March 2016 to develop a national climate policy that may introduce a national price floor for carbon in Canada. By October 2016, a federal policy package, being devised in collaboration with the provinces, is expected to be announced. For more information, see "Communique of Canada's first ministers," Prime Minister of Canada, accessed 4 August 2016.

21. President Barack Obama has mentioned support for emissions pricing over regulations. For example: "I have long believed that the most elegant way to drive innovation and to reduce carbon emissions is to put a price on it." Source: Evan Lehmann, "Obama calls carbon price better than regulations," *Scientific American,* 2 December 2015, accessed 4 August 2016.

from the power sector, as in the United States, Canada faces the prospect of seeking greater reductions from other parts of its economy.

The costs of reducing emissions can vary across the economy and sectors. For example, the shale gas revolution has provided North America an abundance of inexpensive natural gas. From 2008 to 2015, the price of natural gas fell more than 70%. Recent IHS analysis estimated that at current consumption rates, North America has more than 40 years of natural gas supply at under US$4/MMBtu prices.[22] The shale gas revolution has dramatically improved the economics of natural gas power generation, reducing the cost of shifting from coal to gas. Without shale gas, the US transition from coal power generation would likely have come at higher costs and at a slower pace.

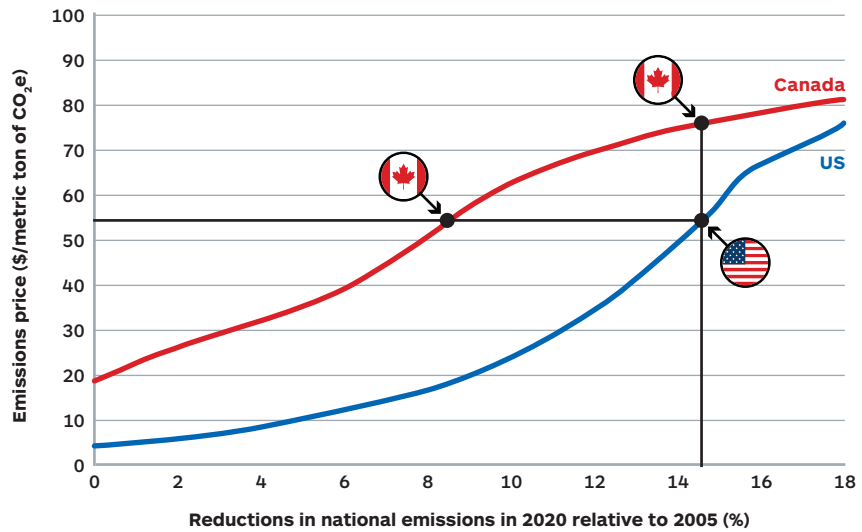
Compared to the United States, Canada has fewer power sector reduction opportunities to switch from coal to natural gas. Canada already has one of the lowest-carbon intensive power sectors globally, with more than 80% of its electricity generated from non-emitting sources. This suggests that for Canada to achieve a similar level of emissions reductions, actions will be required in other sectors that may come at a higher price. The National Round Table on the Environment and Energy (NRTEE) 2011 report found that similar emissions prices in Canada and the United States would drive fewer reductions in Canada (see Figure 4).[23] To put it another way, emissions reductions can be achieved at a lower cost in the US market than in Canada.

An array of policies advancing on both sides of border

In recent years, policy initiatives have increased in Canada and the United States. A summary of the major federal GHG policies that have advanced in the power, industrial, and transportation sectors is shown in Table 2. The following section discusses these policies in more detail.

Figure 4

Canada harmonizes on emissions reduction target versus emissions price with the United States



Source: Adapted from Figure 14 in "Parallel paths: Canada-US climate policy choices," National Round Table on the Environment and Economy (NRTEE), 2011.

Power sector: Primary focus of US climate policy efforts

Canada's federal government moved earlier to address GHG emissions from power plants in 2012. US federal carbon policies in the power sector have primarily aimed at regulating emissions through existing legislation, as well as supporting development of renewables. Because the US power sector contributes to a greater of share of national emissions and is more emissions-intensive, it has the potential to deliver greater GHG reductions in relation to Canada.

In the last few years, the focus of US power sector policy efforts has been through the Clean Air Act. This has resulted in the Carbon Pollution Standards (CPS) and the Clean Power Plan (CPP). The two rules broadly aim to limit coal emissions and encourage generation from low-carbon sources. However, both rules are facing litigation and their future is uncertain. In addition, the US federal government also incentivizes renewable electricity generation through tax credits, which were extended in late 2015.

22. From 2008 to 2015, the Henry Hub price, the main benchmark for natural gas in North America, fell from US$9.78/MMBtu to US$2.60/MMBtu. IHS estimates North America currently has about 1,400 Tcf of gas supply at under US$4/MMBtu prices, 40 times larger than its 2015 consumption level. For details, see IHS Press Release *North America's Unconventional Natural Gas Resource Base Continues to Expand in Volume and Decrease in Cost,* 23 February 2016, accessed 4 August 2016.

23. Source: *Parallel Paths: Canada-US Climate Policy Choices,* NRTEE, 25 January 2011.

Table 2

Summary of key federal climate policies in the United States and Canada

Sector	Canadian policy	US policy
Power	CO_2 performance standard for new and modified coal power plants	Carbon Pollution Standards (CPS): rules to regulate CO_2 emissions from new, modified, and reconstructed power plants
		Clean Power Plan (CPP): a rule to regulate CO2 emissions from existing power plants*
		Renewable Tax Credits
Industrial (including oil and gas)	Announced intention to regulate and reduce:	Proposed regulations to regulate and reduce:
	- Methane emissions from oil and gas industry	- Methane emissions from oil and gas sector
	- GHG emissions from chemical and nitrogen-fertilizer plants	- HFCs emissions
	- Hydrofluorocarbons (HFCs) emissions	
Transportation	Fuel-efficiency standards for light-duty and heavy-duty vehicles	Fuel-efficiency standards for light-duty and heavy-duty vehicles
	Renewable fuels standards	Renewable fuel standards

*In February 2016, the US Supreme Court put CPP on hold pending judicial review on its legality.

Source: US EPA and Environment and Climate Change Canada

Canada also has federal measures to regulate power emissions. The Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations came to force in 2015. They require coal-fired power plants eventually to either retire or adopt the carbon capture and storage (CCS) technology.

In general, federal policies and regulations in both countries either aim to or have the practical effect of reducing emissions from coal-fired power plants or promoting cleaner fuels and technologies for power generation. For additional details on these policies, see the box "Federal regulations on power generation emissions."

Regulating oil and gas and other industrial emissions

Current federal efforts in Canada and the United States are focused primarily on reducing methane emissions. The largest source of methane emissions in Canada and the United States is the fugitive emissions associated with the production and transportation of oil and gas.

Federal regulations on power generation emissions

United States

As the single largest source of US emissions, the power sector is the centerpiece of US emissions-reduction policy. Efforts consist of several key initiatives, most notably the Carbon Pollution Standards, the Clean Power Plan, and federal renewable energy tax credits.

The Carbon Pollution Standards were finalized in 2015 and set CO_2 emissions standards for new, modified, and reconstructed fossil fuel power plants in the United States. This regulation imposes a minimum efficiency standard for natural gas power plants and effectively requires new coal-fired power plants to adopt CCS technology.[i] This policy is expected to prevent the construction of new conventional (without CCS) coal-fired power plants.

The Clean Power Plan was finalized by the EPA in 2015 and regulates CO_2 emissions from existing power plants. The CPP focuses on cutting emissions in the power sector by encouraging fuel switching from coal to natural gas, implementing more renewable energy, and improving the efficiency of existing coal plants. According to the EPA's assessment, the CPP could lead to a 32% reduction in power sector CO_2 emissions in 2030 below 2005 levels.[ii] This policy would underpin declining emissions in the sector occurring

Federal regulations on power generation emissions (continued)

from access to cheap and abundant shale gas, coal plant retirements, and increased renewable penetration. However, the future of the CPP is uncertain as it faces multiple judicial challenges.[iii] Most recently, the US Supreme Court put the rule on hold pending review of its legality.

The Federal Renewable Power Tax Credits provide direct financial support for deployment of renewable power generation. The extension in December 2015 of credits for wind and solar photovoltaic power has positive implications for these technologies. Solar projects that begin construction by the end of 2019 are eligible for the investment tax credit (ITC), equivalent to 30% of the project's capital expenditures, which gradually steps down to 10% for projects entering construction after 2022. Wind projects beginning construction by the end of 2016 qualify for the full production tax credit (PTC) of US$23 per megawatt-hour for the first 10 years of operation. The value of the credit will step down 20% per year ending for facilities that move into construction after 2019.[iv]

Canada

The Canadian government introduced an emissions-intensity standard for coal-fired power plants in 2012, which came to force in 2015.[v] The rule set the CO_2 emissions intensity of coal-fired power plants to levels similar to an efficient (combined-cycle) natural gas power plant, ostensibly cutting allowable emissions in half. This rule effectively brings an end to building coal-fired power plants without CCS in Canada and is expected to lead to the gradual phase-out of Canada's existing coal fleet.[vi] According to the Canadian government's analysis, this regulation would reduce GHG emissions from Canada's power sector by 27% compared with the business-as-usual case for 2030.[vii] However, over time provincial policies seem to be advancing quicker than federal measures. Ontario's phase-out of coal power plants was completed in 2014. Alberta, with the largest coal fleet in Canada, announced its intention in 2015 to accelerate the phase-out of its coal emissions by 2030. Alberta's coal power plants accounted for 48% of Canada's power sector emissions in 2014.

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i) The standard for new gas turbines for power generation generally aligns with the CO_2 emissions rates of natural gas combined-cycle technology. The standard for new coal plants and steam units reflects a highly efficient supercritical pulverized coal unit with partial CCS. See Carbon Pollution Standards for New, Modified and Reconstructed Power Plants, US EPA, accessed 4 August 2016.

ii) Source: "Fact Sheet: Clean Power Plan by the numbers," US EPA, accessed 4 August 2016.

iii) For details on the CPP, see Clean Power Plan, US EPA, accessed 4 August 2016.

iv) For details, see Renewable Electricity Production Tax Credit (PTC), US Department of Energy, accessed 4 August 2016, and Business Energy Investment Tax Credit (ITC), US Department of Energy, accessed 4 August 2016.

v) For details, see Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations (SOR/2012-167), Government of Canada, Department of Environment and Climate Change Canada, accessed 4 August 2016.

vi) Existing coal plants are required to retire at roughly the age of 50 if they are unable to meet this emissions standard.

vii) For details, see Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations (SOR/2012-167), Government of Canada, Department of Environment and Climate Change Canada, accessed 4 August 2016.

Canada and the United States have pledged to reduce methane emissions from oil and gas production 40–45% below 2012 levels by 2025.[24] The United States is advancing regulations, with Canada expected to follow after consultations with the provinces. The absolute amount of fugitive methane emissions continues to be a subject of debate.

Transportation sector: Closely aligned regulations

Canada and the United States share a highly integrated transportation system. Vehicles are manufactured and sold across both sides of the border. The trade of oil, gasoline, and diesel allows each country to meet day-to-day consumer demand. Because of the interconnected markets, policies in the United States and Canada are similar and likely to remain that way.

To reduce emissions of the transportation sector, both countries are primarily focused on improving fuel economy (i.e., miles per gallon) and lowering the emissions intensity of transportation fuels through the use of biofuels. These are discussed individually below.

Improving fuel economy: Canada and the United States have similar fuel economy standards. The latest standards will advance progressively stringent requirements for passenger vehicles, also known as light-duty vehicles, for model years 2017–25. These standards seek to nearly double the fuel economy of new vehicles by 2025 versus 2008.[25] With oil prices expected to remain relatively low for part of this time period, achieving these goals could be a challenge for automakers. Standards for larger commercial vehicles or heavy-duty vehicles are also harmonized, currently aiming to reduce GHG emissions by more than 20% over the 2014–18 model years.[26] Canada and the United States continue to advance emissions standards for future vehicles, currently focused on heavy-duty vehicles after 2018.

Lowering emissions intensity of fuels: Both countries have mandates for biofuels use. Canada has mandated a minimum of 5% renewable content in gasoline and 2% in diesel, with some provinces having more stringent requirements.[27] The US regulations are more complex. Under the Renewable Fuel Standard (RFS), the US EPA sets annual volumetric renewable content in the fuel mix. In 2016, the renewable fuel content is set at 17.4 billion gallons or approximately 10% of the expected transportation fuel mix.[28]

Greater differences emerge at state and provincial levels

Greater policy differences—some dramatic—emerge at the state and provincial level. To date, US state governments have principally focused on reducing power-related emissions whereas Canada continues to advance more economy-wide carbon pricing. In 2015, about one-third of Canada's total GHG emissions were covered by some form of provincial carbon pricing. This compares with 7% of national emissions in the United States.[29] Canadian carbon pricing is advancing and additional provincial initiatives such as Alberta's new carbon price and Ontario's cap-and-trade system could translate to up to two-thirds of Canada's emissions being covered by 2017.[30]

24. In May 2016, the EPA issued a final rulemaking on performance standards to reduce methane emissions from new sources in the oil and gas sector. The EPA also announced its intention to regulate methane emissions from existing sources. For more detail, see www3.epa.gov/airquality/oilandgas. In March 2016, Canada and the United States jointly announced they would tackle methane emission. Source: "U.S.-Canada Joint Statement on Climate, Energy, and Arctic Leadership," Prime Minister of Canada, accessed 4 August 2016.

25. For more information, see "Canada aligns regulations with United States to cut air pollution from vehicles and gasoline," Government of Canada, accessed 4 August 2016, and Regulations & Standards: Light-Duty, US EPA, accessed 4 August 2016.

26. Source: "Cutting Carbon Pollution, Improving Fuel Efficiency, Saving Money, and Supporting Innovation for Trucks," US EPA, June 2015, http://www3.epa.gov/otaq/climate/documents/420f15900.pdf, accessed 4 August 2016.

27. See Renewable Fuels Regulations (SOR/2010-189), Government of Canada, Department of Environment and Climate Change Canada, accessed 4 August 2016.

28. For more details on RFS, see Renewable Fuels Standard Program, US EPA, accessed 4 August 2016.

29. Alberta, British Columbia, and Quebec accounted for 38%, 9%, and 11% of Canadian emissions in 2014. Roughly 45% of Alberta's, 70% of British Columbia's, and 85% of Quebec's provincial emissions were covered by carbon pricing policies. Therefore, about 33% of Canada's total emissions were covered by emissions pricing in these provinces. In the United States, the two primary carbon pricing mechanisms are California and the Regional Greenhouse Gas Initiative (RGGI) cap-and-trade markets. The RGGI cap-and-trade market covered about 1% of the total US GHG emissions in 2014. California accounted for about 7% of the national GHG emissions, of which about 85% is regulated by its cap-and-trade system. The RGGI- and California-regulated emissions therefore cumulatively accounted for about 7% of total US emissions.

30. Coverage estimates are based on 2014 emissions data. IHS assumed the same coverage as in Quebec for Ontario's cap-and-trade system: 85% of provincial emissions. IHS assumed 84% of Alberta emissions will be regulated, which is the average announced range by Alberta's government (78–90%). Source: *Carbon levy and rebates,* Government of Alberta, accessed 4 August 2016.

This section reviews the provincial and state measures that have developed to date.

Major thrust of states (and some provinces) is power generation

With the exception of California's economy-wide cap-and-trade system, the majority of US state-level climate change-related policies target the power sector. In the United States these include renewable portfolio standards (RPS), energy efficiency resource standards (EERS), and the RGGI—a power sector CO_2 cap-and-trade program covering nine eastern states.

The Renewable Portfolio Standards are the most prevalent form of policy among states geared at reducing power sector emissions. Currently, 29 states have an RPS mandating a portion of their electricity come from renewable resources.[31] These regulations have been an important driver of renewable power growth in the United States. In Canada, some provinces also have renewable power mandates, such as Nova Scotia, but in general are not as widespread.[32]

The Energy Efficiency Resource Standards exist in 23 states. They require electric utilities to invest in demand-side energy-efficiency measures in an attempt to reduce their customers' electricity consumption. No similar energy-efficiency mandates exist in Canada.

Greater focus on carbon pricing in Canadian regions

Examples of carbon pricing in North America go back to 2007, when Alberta established a carbon price for large emitters (see Figure 5). British Columbia introduced a carbon tax in 2008. Nine states in the eastern United States implemented the RGGI cap-and-trade system for power sector emissions in 2009. California and Quebec established cap-and-trade systems in 2013, which they linked in 2014.

Interest in carbon pricing is building in both countries. In 2015, Ontario announced its intention to develop a cap-and-trade program in 2017 and link it with the California/Quebec system as early as 2018. Also in 2015, Alberta announced it would introduce an economy-wide tax in 2017 and a more-stringent performance standard for large emitters in 2018. Several other regions are exploring various carbon pricing measures. Manitoba has announced its intention to establish a cap-and-trade system and link with the California/Quebec (and Ontario) system.[33] Six states—Massachusetts, New York, Oregon, Rhode Island, Vermont, and Washington—are each contemplating legislation that could result in establishing carbon pricing in their jurisdictions.[34]

Table 3 summarizes the existing and advancing carbon pricing schemes in the United States and Canada. The subsequent boxes discuss the details of these policy measures.

31. Another eight states have nonbinding renewable portfolio goals. For details, see Database of state incentives for renewables and efficiency.

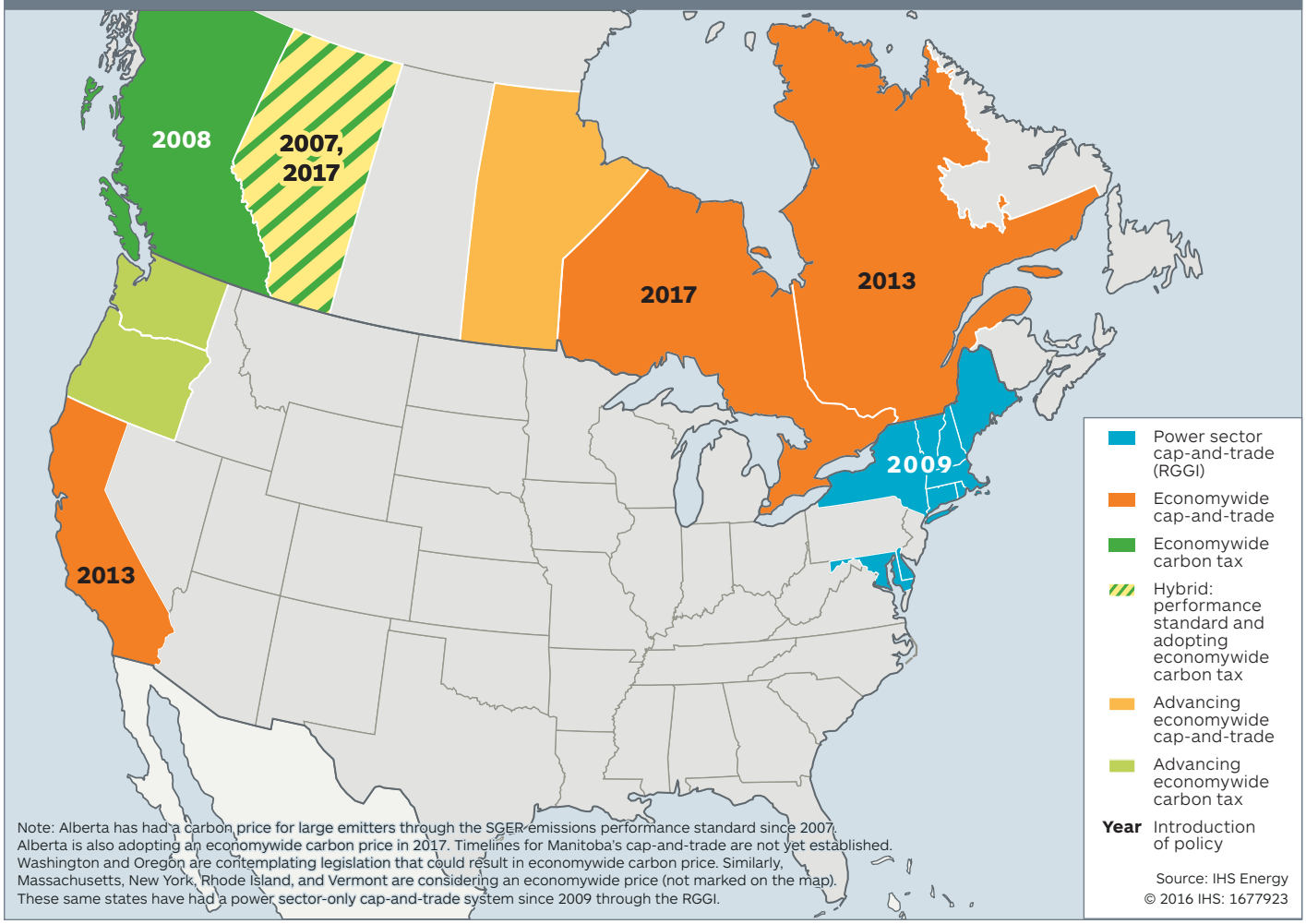
32. For details on Nova Scotia's regulations refer to "Renewable electricity regulations," Government of Nova Scotia, 8 April 2016, accessed 4 August 2016.

33. For more details, see Sustainable development, Government of Manitoba, accessed 4 August 2016.

34. For more information, refer to Peter Vali and Dallas Burtraw, "A look at six state proposals to tax carbon," Resources for the Future, 18 March 2016, accessed 4 August 2016.

Figure 5

Regions with carbon pricing schemes in Canada and the United States



Note: Alberta has had a carbon price for large emitters through the SGER emissions performance standard since 2007. Alberta is also adopting an economywide carbon price in 2017. Timelines for Manitoba's cap-and-trade are not yet established. Washington and Oregon are contemplating legislation that could result in economywide carbon price. Similarly, Massachusetts, New York, Rhode Island, and Vermont are considering an economywide price (not marked on the map). These same states have had a power sector-only cap-and-trade system since 2009 through the RGGI.

Table 3

Subnational carbon pricing schemes in the United States and Canada

Region	Policy and vintage	Price (per metric ton of CO_2e)	Coverage	Notes
California and Quebec integrated market	Cap-and-trade, 2013	US$12.39* (2015 average)	85%	California and Quebec started their individual cap-and-trade systems in 2013 and linked them in 2014. The cap includes large industrial facilities, power plants, and transportation and natural gas fuel suppliers (with annual emissions of 25,000 tons of CO_2e and above).
				Ontario committed in 2015 to start a cap-and-trade system by 2017, and is discussing linking it to the California and Quebec system.
British Columbia	Carbon tax, 2008	C$30 (since 2012)	70%	British Columbia currently has the highest price on GHG emissions in North America. This tax applies to most fossil fuel sales, subject to their carbon intensity.
Alberta**	Performance standard for large emitters, 2007	C$20 in 2016 C$30 in 2017	45%	Alberta's Specified Gas Emitters Regulation (SGER) was the first carbon pricing scheme in North America. The SGER is an emissions-intensity standard for large emitters (power and industrial sectors). As one of the compliance options, the regulated entities can pay a fee for emissions exceeding the regulatory cap on their emissions intensity.
	Carbon price, 2017	C$20 in 2017 C$30 in 2018	78–90%	Alberta will adopt an economy-wide carbon tax on transportation and heating fuel consumption in 2017.
	New performance standard, 2018	C$30 in 2018		The SGER will be replaced by a new performance standard in 2018. This new standard, which will drive best-in-class performance, compares the emissions intensity of large emitters (e.g., power plants) with the most competitive facilities in Alberta. Facilities need to match the emissions intensity of the top performers or seek other compliance options, including paying a price for their excess emissions.
US Regional Greenhouse Gas Initiative	Power sector cap-and-trade, 2009	US$6.72 (2015 average)	21%***	The RGGI is a regional cap-and-trade system among nine states and covers CO_2 emissions from power generation only. Emissions regulated under RGGI account for about 1% of total US GHG emissions. Current participating states are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. Current participating states are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont.

*Using the 2015 average exchange rate of C$1.28/US$1, this corresponds to C$16.36 per ton of CO_2e.
**In a November 2015 speech, Alberta's premier also announced a "Climate Leadership Plan" in which the province is capping oil sands emissions at 100 $MMtCO_2e$, phasing out coal emissions by 2030, and reducing methane emissions from the oil and gas sector.
***RGGI coverage is estimated as the ratio of power-related CO_2 emissions to the total CO_2 emissions from the nine participating states in 2013.

Source: IHS Energy

The expanding transnational California/Quebec cap-and-trade market

California's cap-and-trade program

California's economy-wide cap-and-trade program began in 2013. The program serves as the backstop to the state's other GHG-reduction policies that target specific sectors, such as renewable power, energy efficiency, and transportation fuel standards. These policies collectively aim to reduce emissions to 1990 levels by 2020.[i] Large emitters (defined as facilities with emissions in excess of 25,000 tons of CO_2e per year) are subject to the cap. The program currently covers power generation and industrial emissions as well as transportation and natural gas fuel suppliers.[ii]

To date, the emissions price (known as allowance price) has largely remained at a regulated minimum because the volume of available allowances has exceeded demand. The 2015 annual average allowance auction price was US$12.39 per ton of CO_2e. IHS expects the price to rise near the end of this decade as the emissions cap declines, assuming the program is not impeded by ongoing legal challenges.

The expanding transnational California/Quebec cap-and-trade market (continued)

Quebec: California's cap-and-trade goes international

At the start of 2014, Quebec linked its own cap-and-trade system with California's system. The linking of the two markets marked a historical move by subnational governments to enter into international agreements to reduce their GHG emissions.

Similar to California, Quebec facilities emitting in excess of 25,000 tons of CO_2e per year are subject to a cap. This amounts to about 85% of the provincial emissions.[iii] As in California, Quebec's cap-and-trade program is part of a broader suite of GHG-reduction policies such as promoting electrical vehicles or more energy-efficient building standards. Quebec targets a 20% reduction in GHG emissions below 1990 levels by 2020.

Interest is building for the California/Quebec cap-and-trade system

In 2017, Ontario will implement an economy-wide cap-and-trade system with the aim of linking with California and Quebec in 2018. After linking occurs, allowances and offset credits among the three jurisdictions will be fungible for compliance in any of the jurisdictions regardless of their origin. Ontario is Canada's most populous province, with 39% of the country's population. Ontario and Quebec cumulatively host 62% of Canada's population and accounted for 35% of national emissions in 2014. Manitoba has announced its intention to follow suit. However, timelines are not yet established.

i) For more information, see Assembly Bill 32 overview, California Environmental Protection Agency Air Resources Board, accessed 4 August 2016.

ii) For details, refer to Cap-and-Trade program, California Environmental Protection Agency Air Resources Board, accessed 4 August 2016.

iii) For details, refer to Quebec: a leader in the fight against climate change, Government of Quebec, accessed 4 August 2016.

British Columbia's carbon tax: Highest price in North America

British Columbia has one of the earliest carbon pricing schemes in North America. Implemented in 2008 at C$10 per ton of GHG emitted, British Columbia's carbon tax increased by C$5 per ton per year until 2012, when it reached C$30 per ton. In 2015, the provincial government reaffirmed its decision to hold the current carbon price flat until 2018 to protect the competitiveness of British Columbia's industries.[i]

Under British Columbia's system, consumers pay a price for GHG emissions from their fuel use. For example, in 2015 British Columbia's tax equated to about US$0.20 per gallon of gasoline and US$0.23 per gallon of diesel.[ii] British Columbia's carbon tax is revenue-neutral; the payments are injected back to the economy in the form of tax cuts.

i) For details, refer to "Climate leadership team report released," Government of British Columbia, 27 November 2015, accessed 4 August 2016.

ii) These tax levels correspond to about C$0.07 and C$0.08 per liter for gasoline and diesel, respectively. For more details, see "Tax rates on fuels," Government of British Columbia, Ministry of Finance, issued April 1999, revised August 2016, www.sbr.gov.bc.ca/documents_library/bulletins/mft-ct_005.pdf, accessed 4 August 2016.

Alberta: Raising the price of carbon, coverage, and capping oil sands emission

In 2007 Alberta was the first jurisdiction in North America to implement a policy to establish a price on GHG emissions. In 2015, Alberta announced a suite of new climate policies. Key measures include the strengthening of the carbon price for large emitters and the implementation of an economy-wide price on carbon.

Alberta's existing emissions performance standard and carbon price

Alberta's approach to manage its growing GHG emissions focuses on improving the GHG emissions intensity of production (i.e., emissions per barrel of oil produced or unit of electricity generated). Implemented in 2007, the Specified Gas Emitters Regulation (SGER) is an intensity-based cap-and-trade scheme for facilities that emit in excess of 100,000 tons of CO_2e annually. A cap is placed on the emissions intensity of individual facilities, not the total emissions.[i] Most oil sands facilities, refineries, power plants, and fertilizer facilities exceed this threshold and are covered by the SGER.

The SGER requires covered facilities to improve their emissions intensity compared with their own historical performance (baseline). Emitters can either reduce their emissions intensity, purchase offsets, or pay a fee (called a carbon levy) for emissions exceeding the baseline. Until 2015, the carbon price and the reduction mandate for emissions intensity were set by the government at C$15 per ton of CO_2e and up to 12% below each facility's baseline. The price and emissions cap of the SGER were tightened in 2016 and will reach C$30 and up to 20% below the baseline in 2017.

Alberta's advancing climate policy package

In 2015, Alberta announced the overhaul of its existing climate policy and rolled out a series of new policies.[ii]

- **Economy-wide carbon tax:** Alberta will implement an economy-wide carbon price on transportation and heating fuels in 2017. The carbon price will start at C$20 per ton of CO_2e in 2017 and increase to C$30 per ton of CO_2e in 2018.
- **Coal phase-out:** The phase-out of coal power generation will be accelerated and completed by 2030. There are currently 18 coal plants in Alberta, which accounted for 48% of all Canadian power emissions and 6% of Canada's total emissions.[iii]
- **Reduction of methane regulations:** Alberta aims to reduce methane emissions from the oil and gas industry by 45% below 2014 levels by 2025. The methane emissions from the oil and gas sector were estimated at 30 $MMtCO_2e$ in 2014, accounting for 24% of Alberta's upstream oil and gas GHG emissions.
- **New emissions-intensity performance standard:** The SGER will be replaced by a new performance standard in 2018, regulating large emitters such as power plants and oil and gas facilities. This new standard will compare the emissions intensity of large emitters with the most competitive facilities in Alberta producing the same product (e.g., electricity). Covered facilities will need to match the emissions intensity of the top performers or seek other compliance options, including paying a price for their excess emissions (C$30 per ton of CO_2e in 2018).
- **Oil sands emissions cap:** Alberta will cap GHG emissions from oil sands production at 100 $MMtCO_2e$ per year. In 2014, oil sands emissions were 68 $MMtCO_2e$.[iv] Production is anticipated to grow under the cap, but over time the intensity of production will be required to decline or face meeting the cap.

The government of Alberta estimates that the new carbon policy will cover 78–90% of the provincial emissions, compared with 45% under the SGER.[v]

Alberta: Raising the price of carbon, coverage, and capping oil sands emission (continued)

The oil sands emissions cap and performance standard provide a financial incentive to reduce the intensity of oil sands production. It is worth mentioning that 13 oil companies have joined together through the Canada's Oil Sands Innovation Alliance (COSIA) to set aside intellectual property rights and share technology to accelerate environmental improvements in the oil sands—this includes lowering GHG emissions.[vi] In a world that is increasingly carbon-concerned, lower-emission crudes may be more competitive.

i) For more details on the SGER, see Specified gas emitters regulation, Government of Alberta, Department of Environment and Parks, accessed 4 August 2016.

ii) For details, refer to Climate leadership plan, Government of Alberta, accessed 4 August 2016.

iii) According to the government of Alberta, this policy is expected to target emissions primarily from six operating coal power plants. The other 12 coal plants in Alberta were already expected to shut down by 2030 because of the federal regulations in place. Source: "Ending coal pollution," Government of Alberta, accessed 4 August 2016.

iv) The Alberta government has stated that GHG emissions from cogeneration units in the oil sands sector and new processing facilities will have special treatment under the emissions cap. For example, cogeneration plants have two products: steam (heat) and electricity. Emissions associated with electricity generation may not be counted toward the oil sands emissions cap.

v) For reference, see Carbon levy and rebates, Government of Alberta, accessed 4 August 2016.

vi) For more information see Canada's Oil Sands Innovation Alliance.

RGGI: The US regional power sector cap-and-trade system

The RGGI covers CO_2 emissions from power plants in nine Northeastern and Mid-Atlantic states. Started in 2009, the RGGI was the first cap-and-trade program in North America targeting CO_2 reductions. The program sets a multiyear cap for the combined CO_2 emissions of the participating states.

The RGGI allowance prices remained at or near the program minimum (below US$3 per metric ton of CO_2) through 2012 because of an oversupplied allowance market.[i] The oversupply was the result of multiple factors, including the economic recession and its impact on power demand, and an accelerated transition away from coal-fired power as natural gas prices declined and environmental policy pressures mounted. Allowance pricing began to rise in 2013 after policymakers announced that the cap would be reduced by 45% in 2014, with further incremental declines to 2020. However, allowance pricing has since cooled off in 2016 because of weaker power demand growth and emerging concerns about the longevity of the program in light of the CPP stay. The RGGI's last auction cleared at US$5 per metric ton in June 2016.

i) The RGGI is traded in short tons rather than metric tons. One short ton is 0.907 metric ton. For details, see Regional Greenhouse Gas Initiative.

Part 4: Conclusions

GHG-reduction policies are advancing in both the United States and Canada. Together, both countries have increased funding for renewable energy and are advancing regulations for oil and gas methane and vehicle fuel-economy standards. Individually, the United States has continued to pursue power generation regulations and extended the renewable power tax credits. Meanwhile, Canada is working toward a harmonized pan-Canadian carbon price. At the subnational level, US states remain primarily focused on power sector emissions. In Canada, provincial carbon pricing policies are more widespread and expanding, such as Ontario's advancing cap-and-trade system. In regions with existing carbon policy, we are seeing increases to stringency and coverage, such as Alberta's economy-wide carbon price or the inclusion of the transportation sector into the California/Quebec cap-and-trade system.

Despite the close economic ties, Canada and the United States face different challenges in reducing emissions. Greater reliance on coal power generation and an abundance of cheap natural gas offer a larger economic opportunity for the United States to reduce GHG emissions than could be achieved in Canada. This suggests that Canada may be required

to find reductions from other parts of its economy sooner—and potentially at a greater cost—than the United States. The comparatively small size of the Canadian economy contrasted against its large oil production, which competes in the global market, poses a challenge for Canada. Both countries face political hurdles as well. To date, alternative perspectives on climate change and political differences in the United States have slowed the advancement of new climate legislation. In Canada, the provincial governments with their distinct economic character will play an important role in achieving national emissions reductions.

The development of the Canadian oil sands has figured predominately in the climate policy debate in Canada and abroad. The oil sands have experienced the first tranches of the elevated climate efforts affecting North America's upstream oil and gas industry. Advancing carbon policies in Alberta aim to limit emissions and lower the intensity of production. But it is not necessarily a limitation on production itself. Should these policies encourage innovation and intensity improvements, a more competitive industry may result. However, should policies push too far ahead on their own, Canada could risk displacing economic activity and emissions to other countries with less-stringent climate policies.

Report participants and reviewers

IHS hosted a focus group meeting in Washington DC on 9 June 2015 to provide an opportunity for stakeholders to come together and discuss Canadian and US climate policies. A number of participants also reviewed a draft version of this report. Participation in the focus group or review of the draft report does not reflect endorsement of the content of this report. IHS is exclusively responsible for the content of this report.

Alberta Department of Energy

Alberta Innovates—Energy and Environment Solutions

American Petroleum Institute

Canadian Association of Petroleum Producers

Cenovus Energy Inc.

Center for Strategic and International Studies

Center for Climate and Energy Solutions

Canada's Ecofiscal Commission

Natural Resources Canada

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