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The Role of Alberta in Canada's Failure to Meet Copenhagen Targets

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Abstract: Canada's latest projections for greenhouse gas emissions fall well short of meetings its obligations under the Copenhagen accord. In spite of this shortcoming, Canada has made progress in reducing greenhouse gas emissions under its federal sector-by-sector regulatory approach. There is wide variation between provinces concerning reducing greenhouse gas emissions with many Canadian provinces successfully reducing emissions in line with Copenhagen accord commitments. Alberta's role in reducing greenhouse gas emissions relative to other provinces is shown in this study to require greater effort. This study addresses Alberta's role in the failure of Canada to meet required greenhouse gas reductions by 2020 and puts forth strategic options for transitioning toward a low-carbon economy. This study is relevant to Canadian policy makers by illustrating gaps in Canadian climate policy and Canada's ability to meet international commitments in reducing GHG emissions. This study offers analysis of the current state of Canadian policy concerning GHG emissions and offers insight on long-term strategy options. This is particularly relevant during periods of political change such as the current transition federally as well as provincially in Alberta in 2015.

Key words: Climate change policies, domestic policy instruments, energy policy, electricity generation, particularly, transitioning

INTRODUCTION

Canada committed to reduce greenhouse gas emissions 17% from 2005 levels by 2020 under the Copenhagen accord. This sets Canada's carbon budget for 2020 at 607 Megatonnes (Mt.) of CO_2 equivalents (CO_2e). Canada's latest greenhouse gas emissions estimate for 2020 is 746 Mt., failing to reach emission targets by a wide margin. Among the largest sources of greenhouse gas emissions in Canada are the electricity, oil and gas and transportation sectors as displayed in Table 1.

Canada is a federation consisting of the federal government as well as 10 distinct provinces which are responsible for controlling provincial greenhouse gas emissions. Many Canadian provinces have honored their Copenhagen commitment while other provinces have increased overall emissions, notably the province of Alberta. Canada's efforts at mitigating climate change have resulted in many achievements as well as failures. Canada was both the first country to ratify and subsequently withdraw from the Kyoto protocol. Within emission-intensive industries, Canada became the first country to ban traditional coal-fired electricity production plants while the oil and gas sector has experienced extensive growth, since, global efforts began curtailing carbon emissions.

Table 1: Canadian greenhouse gas emissions per industry sector

Industry sector	2005 emissions (in Mt. CO_2e) (EC, 2014)	2020 Projected emissions (in Mt. CO_2e) (EC., 2014)
Oil and gas	162	204
Transportation	168	167
Buildings	84	98
Electricity	121	71
Emissions-intensive and trade-exposed industries	87	90
Agriculture	68	70
Waste and others	49	46

Canada's progress in greenhouse gas emission reductions: Canada has reduced greenhouse gas emissions in both the transportation and electricity sectors as well as achieved overall reductions in many Canadian provinces. This section reviews federal policy in both the transportation and electricity sectors.

Federal policy in the transportation sector: Canada has both increased fuel efficiency of vehicles as well as decarbonized transportation fuels. While decreasing overall fuel consumption through efficiency gains, the decarbonization of transportation fuels further reduces greenhouse gas emissions.

In 2010, the Federal government released the passenger automobile and light truck greenhouse gas emission regulations (LDV1) which prescribe progressively higher annual emission standards for new

vehicles of model years 2011-2016. Regulations were expanded in 2015 (LDV2) which apply more stringent fuel efficiency standards for light-duty vehicles of model years 2017-2025. Under both phases of light-duty vehicle regulations, spanning model years 2011-2025, the fuel efficiency of news cars will increase by 41% and light trucks will increase by 37% compared to model year 2010. (EC., 2014).

Additionally, the Federal Government passed legislation which requires 5% renewable content in gasoline and 2% in diesel fuel and heating oil. This requirement substitutes biofuels for fossil fuels which results in lowering use of fossil fuels and thereby decreasing greenhouse gas emissions. The provinces of British Columbia, Alberta, Saskatchewan, Manitoba and Ontario have also enacted legislation regulating the carbon intensity of transportation fuels with varying measures.

The renewable content fuel regulations as well as the fuel efficiency standards for light-duty vehicles and light trucks, are estimated to reduce greenhouse gas emissions by 11-13 Mt. in 2020 (Anonymouse, 2012 a-c).

Federal policy in the electricity sector: Canada has one of the lowest carbon-emitting electricity systems in the world currently and emissions from the electricity sector are projected to decrease a further 39 Mt. between 2005- 2020. Approximately 80% of Canada's electricity is produced from non-carbon emitting sources, predominantly hydroelectric power which compares favorably to the US share of <33% and China of <20% share of electricity from non-carbon emitting sources. In 2009, over 90% of the total electricity for Quebec, Manitoba and Newfoundland was produced from renewable sources (Nyboer and Lutes, 2012) other non-greenhouse gas emitting sources such as wind and solar power is expected to grow from 0.36% of Canada's electricity production to 7.5% between 2005-2020 (Anonymous, 2014).

The Federal government enacted legislation in 2015 which resulted in Canada becoming the first major coal user to ban construction of traditional coal-fired electricity facilities. It is estimated that although, 34 of the 47 coal-fired electricity generating plants operating in Canada would not be subject to the regulation until after 2020, 6 Mt. of emission reductions will result in 2020 (Anonymous, 2012).

Coal releases 1001 g CO_2e/kWh, the highest emission level of any electricity source. This compares to just 46 g CO_2e for solar, 12 g for wind and 4 g per kWh for hydro (Anonmous, 2012) Consequently, coal used in electricity production will account for the largest share of global CO_{2e} emissions until 2035 (International Energy Agency (Anonymous, 2013a-c). The switch from coal to alternative fuel sources for electricity not only results in significant greenhouse gas emission reductions but also promotes the utilization of Canada's vast renewable energy potential.

Table 2: Alberta emissions sector breakdown

Industry sector	2005 emissions (Mt. CO_2e) 2020	Projected emissions (Mt. CO_2e)
Oil and gas	96	145
Electricity	50	42
Transportation	27	31
Other industry, manufacturing and construction	19	30
Buildings and houses	16	24
Agriculture, forestry and waste	25	23
Total	233	4294

Alberta government (2015)

The role of Alberta in Canada's failure to meet Copenhagen targets: Alberta contains 11.6% of Canada's population and is projected to produce approximately, 40% of Canada's greenhouse gas emissions in 2020. While most provinces have reduced overall greenhouse gas emissions, Alberta's total emissions are expected to rise from 233.8 Mt. CO_2e to 287 Mt. CO_2e from 2005-2020, an increase of 22.8%. In 2012, Alberta's per capita greenhouse gas emissions of 64 CO2e/person was higher than every country in the world. Alberta's provincial objective is to reduce greenhouse gas emissions by 50 Mt. below business as-usual conditions by 2020 (Anonymouse, 2008). This provincial strategy hinges on Carbon Capture and Storage [CCS], accounting for 70% of Alberta's planned emission reductions.

Jeneroux (2014) however, only 4 CCS projects have been initiated and two have been abandoned. The two remaining projects are projected to decrease greenhouse gas emissions by 2.76 Mt. by 2016, at a cost of over $1.3 billion (Anonymouse, 2008).

As displayed in Table 2, Alberta's greenhouse gas emissions predominantly result from the oil and gas sector as well as electricity production. This section begins by reviewing Alberta's oil and gas sector and follows with an analysis of Alberta's electricity sector.

Oil and gas industry: While the oil and gas sector accounts for the largest share of Canada's greenhouse gas emissions, there are currently no regulations concerning greenhouse gas emissions in the sector. (Anonymouse, 2012). Instead, government subsidies and favorable investment incentives offered to the oil and gas industry continue to encourage growth in greenhouse gas emissions. The continued expansion of the oil and gas

Table 3: Oil and gas sector- greenhouse gas emissions

Resources	2005 (Mt. CO_2e)	2020 (Mt. CO_2e)	Change (Mt. CO_2e)
Natural gas production and processing	56	37	-19
Conventional oil	32	31	-1
Oil Sands	34	101	+67
Oil and natural gas transmission	16	9	-7
Downstream oil and gas	24	19	-5
Liquid natural gas production	0	2	+2
Total	162	200	+38

(EC., 2014)

sector, coupled with the lack of regulations concerning greenhouse gas emissions in the industry, countervail Canada's commitment to reducing greenhouse gas emissions.

As shown in Table 3, the oil and gas sector continues to both grow as well as undergo structural changes. Alberta's oil sands produced 52% of Canada's oil in 2010 and is projected to increase to 71% by 2025. (Anonymous, 2015a-c) The growth in greenhouse gas emissions from the oil sands is projected to nearly triple from 2005-2020 and comprise greater than half of all oil and gas industry emissions. This results in the continued growth of greenhouse gas emissions in the oil and gas sector in spite of emission reductions in other oil and gas sector components. The remainder of this study focuses on oil sands production within the oil and gas sector due to its large proportion of greenhouse gas emissions and anticipated growth.

Government policy expanding oil sand activity: The Alberta government established the generic oil sands royalty regime in 1997 with the goal of increasing production beyond 1 million-barrels-per-day [mbd] by 2020 (Woynillowicz *et al*., 2005). Government incentives and favorable investment conditions led to this goal of 1 mbd achieved in 2004, 16 years earlier than planned. These government measures predominantly remain intact today and continue to spur growth in the oil sands.

In 2008, the oil and gas sector received $1.38 billion in federal subsidies as well as $507 million from the government of Alberta (Anonymous, 2010). These subsidies encourage oil sand production and expansion and are meant to achieve four outcomes: to encourage companies to build on future reserves to develop new oil fields, reduce operational costs and conduct research and development for enhanced oil recovery and environmental protection. Lower operational costs for oil sand companies lead to increased production and greater greenhouse gas emissions.

In addition, Alberta's government provides an initial royalty holiday for oil sand companies, charging only a nominal 1-9% of gross revenue depending on the price of oil, until bitumen sales have enabled investors to recover a long list of costs. The objective is to entice private investment as the royalty holiday allows corporations to begin earning project-specific profits much earlier than they would otherwise (Campanella and Bower, 2013). This is a powerful incentive for reinvesting profits into expansion in order to delay higher royalty payments, leading to increased oil sands activity. Once project payout is reached, oil sands developers are required to pay 25% royalty on net project revenue only after the company has recovered all project costs incurred during the year including 100% of capital, operating and development costs and the company has earned a rate of return on its investment equal to the Government of Canada long term bond rate. This royalty structure serves to expand production and emissions.

The income distribution for oil sands production further promotes rapid development of the oil sands. The current royalty regime leaves 53% of net revenue with oil sand companies while Albertans receive only 32% and Canada 15%, from oil sands developments. According to Canadian oil industry data, Canada ranks ahead of only 4 countries studied in total government take of revenue, behind Saudi Arabia, Iran, Venezuela, Algeria, UAE, Kazakhstan, China, Russia, Indonesia and Norway. (Anonymous, 2009a, b) Another report comparing Venezuela and Alberta's oil sands finds that Venezuela's government take being four times that of Alberta (Nikiforuk, 2015).

The oil sands are projected to expand production beyond 5 mbd by 2030. The lack of regulations in the oil sand industry coupled with the investment conditions and government subsidies promote this expanded production and increase in greenhouse gas emissions. The oil sands produced 7% of Canada's greenhouse gas emissions in 2010 and is forecast to surpass 14% in 2020 (Grant *et al*., 2013). By 2020, the oilsands are expected to exceed all passenger transportation in Canada, all electricity generation and exceed emission levels from every province in Canada except Alberta and Ontario.

MATERIALS AND METHODS

Electricity production: While Canada has made progress in decarbonizing its electricity system overall as described above, Alberta remains reliant on fossil fuels for electricity production. Alberta generated 63.2% of the total coal-fired electricity in Canada in 2013 (Statistics Canada). While providing 63.7% of the electricity in Alberta, (Glave and Thibault, 2014) coal-fired electricity accounted for

approximately 85% of Alberta's greenhouse gas emissions in the electricity sector (Anonymouse, 2015) In 2020, Alberta is projected to account for 42 Mt. of the Canadian total of 71 Mt. of greenhouse gas emissions (59.2%) from the electricity sector. Emissions from Alberta's electricity sector is equivalent to roughly half of the emissions from all cars in Canada and nearly as much as Alberta's oil sands. A major obstacle in reducing Alberta's dependence on coal for elec tricity production is the difficulty in financing renewable electricity facilities. Renewable energy production facilities feature large upfront capital costs, while lower operating expenses, when compared with fossil fuel plants (Granovskii *et al*., 2007). The operating costs and fixed costs are approximately equal for fossil fuel power stations and approximately 20/80, respectively for renewable electricity facilities (Rowlands, 2005). These large initial costs create uncertainty when considering investment in renewable energy developments. Furthermore, the province's deregulated electricity market does not encourage the use of renewable energy. The SGER cap of $15 per tonne of greenhouse gas emissions provides little incentive for switching from fossil fuels. Externalities associated with air quality not priced into fossil fuel use further provides advantages for fossil fuels through their unaccounted effects on society (Glave and Thibault, 2014).

Policy choices for alberta: Greenhouse gas emission targets under the copenhagen accord are a preliminary stage in the global transition toward a low-carbon economy necessary in averting the most serious effects of climate change. Canada has made progress in many areas regarding greenhouse gas emission reductions, including the transportation and electricity sectors. Nevertheless, Canada is projected to exceed its target level of emissions for 2020 by a large margin. This signals the need for refining policy in Canada. However, when excluding Alberta, Canada has reduced greenhouse gas emissions by 12.4%, since, 2005 as displayed in Table 4 of paramount importance in decarbonizing Canada's economy is targeting reductions in greenhouse gas emissions in Alberta. This requires progressive policy choices in Alberta's oil sand industry and Alberta's electricity sector, Alberta's two largest sources of greenhouse gas emissions as will be discussed.

Government policy options for the oil sand industry: Currently, Alberta has legislation which applies to all large greenhouse gas emitters including many oil sand operators. The Specified Gas Emitters Regulation (SGER)

Table 4: Canada's greenhouse gas missions excluding Alberta

Resources	2005 (Mt. CO_2e)	2020 (Mt. CO_2e)	Change (%)
Newfoundland	10.3	8	-22.3
Prince Edward Island	2.1	2	-4.8
Nova Scotia	24.0	15	-37.5
New Brunswick	20.6	16	-22.3
Quebec	90.2	80	-11.3
Ontario	211.0	170	-19.4
Manitoba	20.7	23	+11.1
Saskatchewan	69.5	73	+5.0
British Columbia	64.4	69	+7.1
Yukon, Northwest territories and Nunavut	2.5	2	-20.0
LULUCF Contribution (Refer to evironment Canada (available at https ://ec.gc.ca/ges-ghg/ default.asp?lang=En and n = E0533893-1 and offset = 5 and toc=hide) for details on Canada's LULUCF credit.)		-19	
Total	502.2	440	-12.4

(EC; 2020 data source EC., 2014)

applies to large polluters that emit more than 100,000 tonnes of greenhouse gases annually and caps emission intensity at 12% below the facilitie's average for 2003-2005.1 This covers approximately 45% of Alberta's emissions and includes 56 oil and gas facilities representing 54% of oil and gas greenhouse gas emissions (Anonymous, 2015).

There are four options for complying with the SGER regulation-reduce emissions, purchase Alberta-based offset credits, purchase or use "emissions performance credits" or pay into a climate change fund at a rate of $15 per tonne. This option of paying $15 per tonne into the climate change fund provides unlimited opportunity for operator's compliance toward SGER regulations. In effect, any emission reductions that cost more than this $15 ceiling is not cost effective. With CCS estimates ranging from $70 to more than $150 per tonne, (Anonymouse, 2009) the much lower option of paying into the climate change fund at $15 per tonne virtually guarantees that no reductions in greenhouse gas emissions occurs through CCS.

In addition to the flexibility in compliance with SGER, the low cost of compliance undermines the effectiveness of encouraging reductions in greenhouse gases. Alberta charges a $15 per tonne cost to pollute which is half of neighboring British Columbia's carbon tax and far lower. At the time of this writing, the newly elected provincial government had committed to strengthen cap emissions 20% by 2017 and carbon levies doubled from $15-30. Than Norway's $71 per tonne cost. Considering a facility must only reduce emissions by 12% at a maximum cost of $15 per tonne, a net compliance cost of $1.80 per tonne

results. This is the equivalent of between 18-22% barrel of oil produced and therefore has negligible effect on oil price, oil production and creating incentives for reducing emissions.

If the government goal is to control emissions within the oil sands, regulations must create meaningful incentives to reduce emissions. While the SGER's current cost of 18-22% barrel to emit greenhouse gasses offers little incentive for reductions, higher penalties would send appropriate signals to companies to reduce greenhouse gas emissions. This requires significantly raising the SGER compliance cost as well as strengthening the cap on emissions. Matching British Columbia's $30 per tonne carbon tax with a longer-term, transparent plan to progressively raise the SGER compliance cost will serve to create meaningful incentives for greenhouse gas reductions within the oil sand industry.

In addition to the necessary changes to the SGER as described above, government subsidies and incentives for oil sand operators need to be reevaluated. Subsidies and incentives for the oil sand industry undermine Canada's commitments concerning greenhouse gas emissions while leaving governments with less resources to initiate programs for reducing emissions. In spite of the higher corporate taxes and royalty payments from expanding oil sand activities, the shift of labor toward the more capital-intensive oil sand industry results in an overall decrease in labor taxes. This labor shift coupled with the government outlay of subsidies results in government balances worse-off as a result-Alberta government balance decrease of 5% and the federal government by 1% (Sawyer and Stiebert, 2010). Elimination of government subsidies for oil sand operators would help reduce greenhouse gas emissions, be a source of funding for further greenhouse gas reduction programs and encourage the use of renewable energy by levelling costs.

RESULTS AND DISCUSSION

Policy options for decarbonizing Alberta's electricity system: Recent federal regulations banning coal-fired electricity use natural gas-powered electricity stations as the baseline for new plants. While natural gas is a much less intensive fuel source for greenhouse gas emissions, it remains much more carbon-intensive than renewable sources.

Furthermore, natural gas is subject to price fluctuations resulting from the predicted increase in demand for natural gas of more than half from current levels, fastest among all fossil fuels by 2040 (Anonymous, 2014). As a result, transitioning to natural gas rather than utilization of renewable energy sources faces uncertainty in price as well as producing greater greenhouse gas emissions. Therefore, it is prudent for Alberta to join the majority of other Canadian provinces in developing renewable sources of electricity from both economic and climate change perspectives.

In order to successfully grow renewable energy production capacity in Alberta, government policy is required to promote an economic environment conducive for investment in renewable energy projects. Policy instruments for promoting renewable energy production include Renewable energy Standards (RPS), currently used in Nova Scotia and New Brunswick and feedin tariffs, currently used in Ontario (Hoicka and Rowlands, 2011). RPS require electricity providers to acquire low-carbon sources of electricity, thereby stimulating demand. This provides the valuable function of ensuring market demand for low-carbon electricity. Nova Scotia which previously had a heavier dependence on coal than Alberta has required 40% of electricity be provided by renewables by 2020 (Renewable Electricity Regulations) Nova Scotia's electricity sector regulations will result in a 25% reduction in greenhouse gas emissions from 2007-2020 and 55% from 2007-2030 (Anonymous, 2013).

Feed-in tariffs are designed to guarantee a fixed price for electricity supplied from chosen lowcarbon energy sources like wind or solar. This creates confidence in investment decisions as prices for providing electricity are fixed for a period of many years. Positive results have been observed in Ontario during its first two years of introducing its feed-in tariff for renewable energy. It resulted in more than $27 billion in private-sector investment and created more than 4,600 megawatts (MW) of renewable power (Anonymous, 2011). Germany's feed-in tariff program adopted in 2000 has collected more than $20 billion per year from the public sector for development, deployment and integration of renewable energy (Wagner *et al*., 2015). Research favors feed-in tariffs over RPS in building renewable energy capacity. Studies comparing feed-in tariffs and RPS used in Europe have found that countries with feed-in tariffs such as Germany have generally been more successful in building up a renewable energy sector than those with RPS such as the UK (Butler and Neuhoff, 2008; Menanteau *et al*., 2003). Furthermore, countries such as Italy and Denmark, that abandoned feed-in tariffs experienced stagnation in their development of renewable electricity capacity thereafter (Lauber, 2004).

Germany seeks to generate 100% of its electricity fro renewable sources by 2030 (Connolly, 2008). With Alberta's abundance of renewable energy potential, Alberta has even greater opportunity to develop clean energy and transition to an electricity system powered by renewable energy sources. In addition to contributing to Canada honoring their international responsibility in combatting climate change, the transition to an electricity system powered by renewable sources would improve the well-being of Albertans through reducing pollution, encourage the growth of an industry with growing future importance and reduce risk associated with price fluctuations with fossil fuels. Initiating a provincial feed-in tariff program to spur the development of renewable energy is a critical initial step in decarbonizing Alberta's electricity system.

Import electricity: In addition to developing provincial renewable energy capacity, Alberta has the option of purchasing electricity from neighboring provinces. Importing electricity is not only a near-term solution to decarbonize the electricity system in Alberta but also serves the secondary function of adding credibility for the province's commitment to develop its own low-carbon electricity system. Alberta can import electricity in order to achieve immediate greenhouse gas reductions by substituting neighboring province's non-carbon emitting sources for its own coal-fired electricity.

Canadian provinces already export large quantities of low-carbon electricity. In 2011, Canada exported 51.4 TwH, valued at $2.04 billion to the United States. (Anonymouse, 2012) The United States has purchased over 10% of electricity production from Quebec and Ontario and more than 25% from Manitoba, so, electricity trading provides abundant opportunity (NRC, 2013). Both nearby provinces of British Columbia and Manitoba feature vast renewable electricity potential and untapped market ready hydroelectric potential (Anonymous, 2007). Manitoba features the complementarity of wind and solar in addition to hydropower which bestows a particularly favorable collection of renewable options available for exporting electricity (Barrington-Leigh and Ouliaris, 2017). The increased opportunity for exporting electricity will further stimulate the national development of renewable energy capacity and expedite the large-scale transition to renewable fuel sources for electricity production.

CONCLUSION

Currently, Alberta has a disproportionate influence on Canada's failure to reach greenhouse gas emission targets under the Copenhagen Accord. Though, Canada has achieved results in decarbonizing their national electricity and transportation sectors, Alberta is projected to increase emissions 22.8% from 2005-2020. This study has outlined immediate-term policy choices for decarbonizing the currently intensive carbon-emitting electricity and oil sand industries of Alberta.

Alberta's newly elected provincial government as well as Canada's federal government have pledged commitment to greater efforts in reducing greenhouse gas emissions. In order for Canada to achieve meaningful reductions, it is imperative that addressing Alberta's reliance on coal for electricity as well as the growth in the oil sands be of primary focus for these governments.

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