Module 4

Climate Change Toolkit for Health Professionals

Greenhouse Gas Emissions in Canada by Sector and Region

April 2019

ACME CAPE

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Preface

This toolkit consists of eight modules which have been prepared as stand-alone documents that can be read by themselves, but they have also been prepared to complement one another. It has been designed as a tool for health professionals and students in the health care and public health sectors who want to engage more directly on the issue of climate change as educators with their patients, peers and communities, and/or as advocates for the policies, programs and practices needed to mitigate climate change and/or prepare for climate change in their workplaces and communities.

Module 1 – Climate Change – Science, Drivers & Global Response provides an introduction to climate science and discusses the human activities that are contributing to climate change, the international commitments that have been made to address it, and where we are in terms of complying with those commitments.

Module 2 – Global Health Impacts of Climate Change summarizes the direct and indirect health impacts that are occurring, and are predicted to result from, climate change, on a global scale.

Module 3 – Climate Change Health Impacts across Canada summarizes the direct and indirect health impacts that are occurring, and that are predicted to occur, in the different regions of Canada.

Module 4 – Greenhouse Gas Emissions in Canada by Sector and Region discusses the volume of greenhouse gases emitted, and the trends in those emissions, from different sectors in Canada at a national, provincial and territorial scale.

Module 5 – Climate Change Solutions with Immediate Health Benefits discusses climate solutions that can produce fairly immediate health co-benefits for the jurisdictions that implement them.

Module 6 – Taking Action on Climate Change at Health Care Facilities discusses the climate mitigation and adaptation policies, programs and practices that can be adopted and implemented by health care institutions to reduce their greenhouse gas emissions and prepare for climate change.

Module 7 – Preparing for Climate Change in our Communities discusses the climate adaptation policies and programs that can be developed by public health units or municipalities to minimize the health impacts associated with climate change.

Module 8 – Engaging in Climate Change as Health Professionals discusses the different ways in which health professionals can educate and engage their patients, the public, their peers, and their communities on the health impacts of climate change, and the policies and programs needed to mitigate climate change and prepare for it.

Module 4 – Greenhouse Gas Emissions in Canada by Sector and Region

Canada

Canada's Commitment

Canada was one of the first countries to sign and ratify the Paris Agreement, an international treaty negotiated by 194 countries in 2015 under the United Nations Framework Convention on Climate Change (UNFCCC). As set out in Article 2, the Paris Agreement "aims to strengthen the global response to the threat of climate change… including by holding the increase in global average temperature to well below 2°C above pre-industrial levels and [by] pursuing efforts to limit the temperature increase to 1.5°C, recognizing that this would significantly reduce the risks and impacts of climate change."

Under the Agreement, which allows countries to establish their own climate plans and goals, Canada committed to an economy-wide target for greenhouse gas (GHG) emissions reductions of 30% relative to 2005 levels by 2030 (Canada, 2017). According to Canada's official emissions data, this is equivalent to an absolute level of 513 megatonnes of carbon dioxide equivalent (Mt CO_2eq), or 191 Mt below current levels (704 Mt in 2016).1 [1]

While some question whether that target represents an appropriate level of ambition (CAT, 2018)—given, for example, Canada's outsized historical contributions to the stock of human-caused GHGs in the global carbon cycle; the need for developed countries, particularly top emitters, to lead emissions-reduction efforts; and the urgency of the latest scientific warnings about the likely effects of even 1.5°C of global warming (IPCC, 2018)—there is little doubt that achieving reductions of this scope will involve serious policy shifts and socio-technical challenges across every economic sector.

Pan-Canadian Framework

Canada's official plan for achieving its current national target is called the Pan-Canadian Framework on Clean Growth and Climate Change (PCF). Negotiated over the course of 2016 through public consultations and several inter-governmental working groups, the PCF has been endorsed by nearly all of the country's constitutional jurisdictions. It is thus regarded by many observers as Canada's first truly national climate plan. Currently, every province and territory except Saskatchewan has signed on to the Framework (ECCC, 2018a).[2]

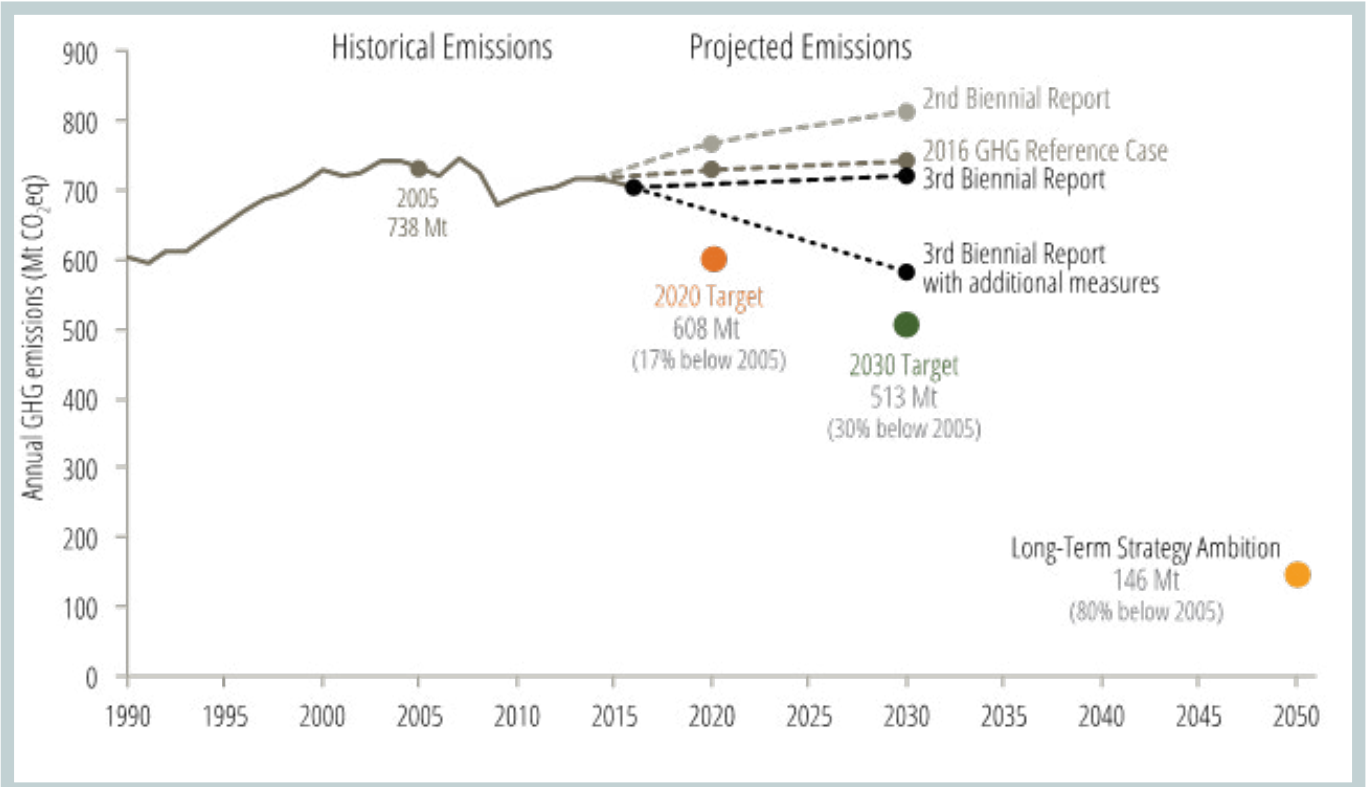

Figure 1. Total Canadian GHG emissions, 1990-2016, with successive federal projections to 2030*[Figure 1:6] Graphic provided by Pembina.

The PCF encompasses four policy "pillars" including economy-wide carbon pricing, complementary mitigation actions (e.g., sector-specific regulations), measures to support climate adaptation and resilience, and new investments in clean technology and innovation (Canada, 2016b). Due to its broad scope and its collaborative origins in federal-provincial-territorial negotiation, the PCF is also undoubtedly Canada's most comprehensive climate plan to date.

At present, after accounting for anticipated reductions from both current policies and those still under development, the federal government projects a significant shortfall to Canada's emissions target (Figure 1) (ECCC, 2018b). Nationally, Canada has yet to meet any of the climate targets set under UNFCCC processes, such as the 1997 Kyoto Protocol (from which Canada withdrew in 2011) or the 2009 Copenhagen Accord (under which Canada proposed to reduce GHGs 17% below 2005 levels by 2020). However, the Canadian government continues to reiterate its commitment to meeting its 2030 target.

Emissions Trends

Figure 2 combines historical data describing sectoral trends in Canadian GHG emissions along with government projections (dotted lines) for each sector in 2030. **Figure 4** provides a current break-

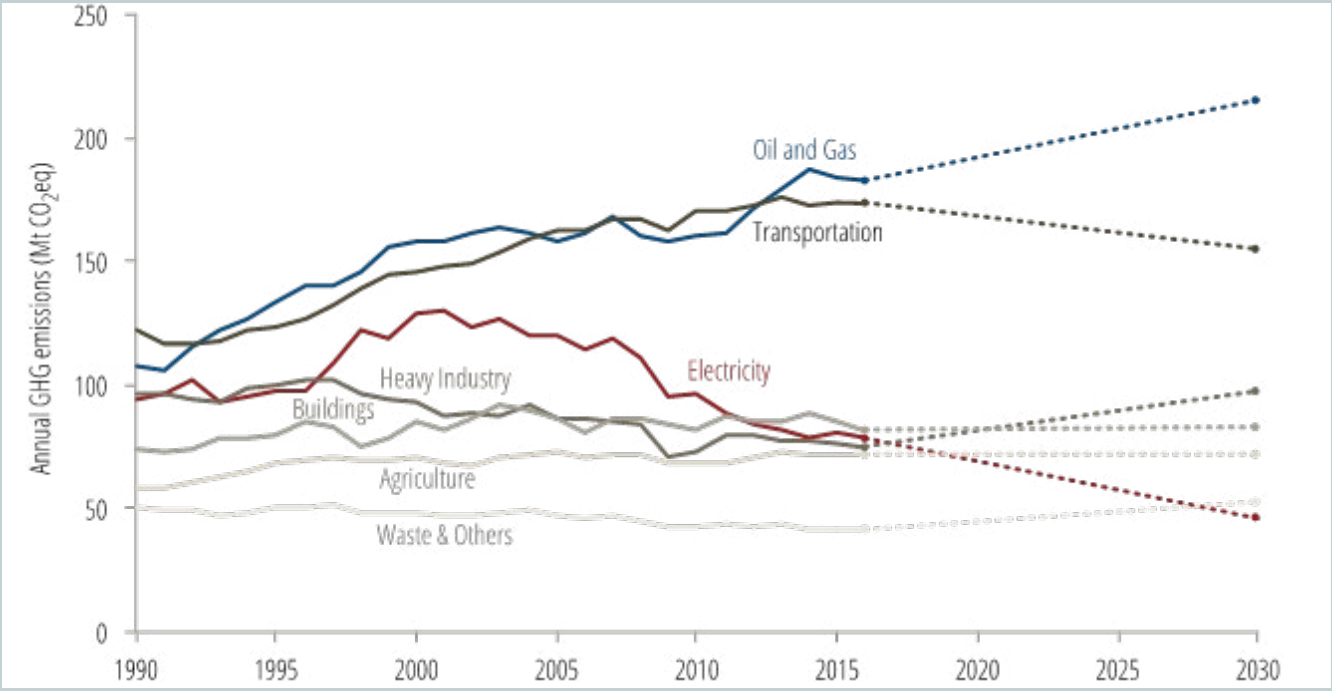

Figure 2: Canadian greenhouse gas emissions by economic sector, 1990-2016 (historical), with federal projections to 2030*Figure 2:7 Graphic provided by Pembina.

down of the total GHGs emitted by different sources of economic activity in 2016, the last year for which data are available. From 1990 to 2016, overall Canadian GHGs grew nearly 17%, driven mainly by steady emissions increases from both the oil and gas (+16%) and the transportation (+7%) sectors (ECCC, 2018d). The upstream and downstream oil and gas sector (i.e., extraction and production through refining and distribution) is the largest contributor to Canadian emissions. Although conventional oil production has remained essentially constant since the turn of the century, unconventional oil production—especially from bitumen in Alberta's oil sands—has surged over the same period (Robins, 2016). Meanwhile, the transportation of people and goods is responsible for fully one-quarter of Canadian GHG emissions and is the second-largest contributor to the national inventory. Emissions from transportation rose steadily from 1990 to 2010, driven mainly by growth in emissions from on-road vehicles (including light-duty personal vehicles and heavy-duty trucks), which constitute more than two-thirds of that sector's GHGs (ECCC, 2018d). While passenger transport (cars, light trucks, and motorcycles, plus buses, rail, and domestic aviation) has fallen slightly as a share of total transport GHGs—from 57% in 1990 to 54% in 2016—emissions from freight transport (heavy duty trucks, rail, domestic aviation, and marine) have

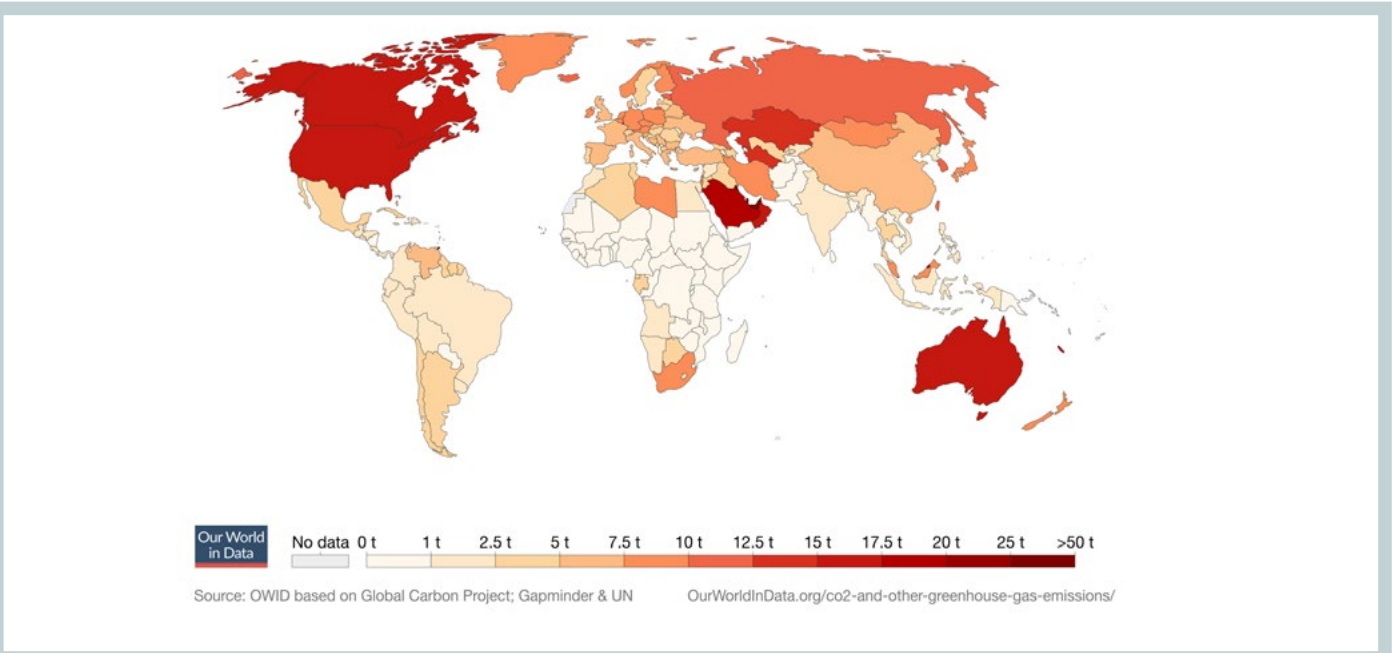

Figure 3: Average carbon dioxide (CO_2) emissions per capita, 2016 (tonnes per year)
Data Source: (Ritchie and Roser, 2019)

surged 15 percentage points over the same period, from 26% to 41%. The latest GHG projections from Environment and Climate Change Canada (ECCC) suggest freight will reach parity with personal transport by 2030 and surpass it sometime shortly thereafter (ECCC, 2018b).

Over the full record (1990-2016), emission increases from oil and gas and transportation have mostly offset emission decreases in the electricity (34%), heavy industry (13%) and waste and others[3] (13%) sectors (ECCC, 2018d). The substantial decline in electricity sector emissions, in particular, is expected to continue as provinces accelerate the phase-out of their coal-fired power generation assets—as mandated under the PCF—in favour of more non-emitting sources or natural gas.

Declaration of Ambition

In signing the UN Secretary-General's June 2018 Declaration of Ambition, the Minister of the Environment and Climate Change has acknowledged the need for deeper cuts to domestic emissions (UNFCCC, 2018). For now, however, the federal government remains focused on achieving Canada's current target through policy measures announced as part of the PCF (Rabson, 2018).

Yet it is worth noting that, in addition to facilitating the creation of the PCF, the federal government was also amongst the first Paris Agreement signatories to submit its "long-term low-GHG development strategy" as required under Article 4.19. While cautioning that it is neither "a blueprint for action" nor "policy-pre-

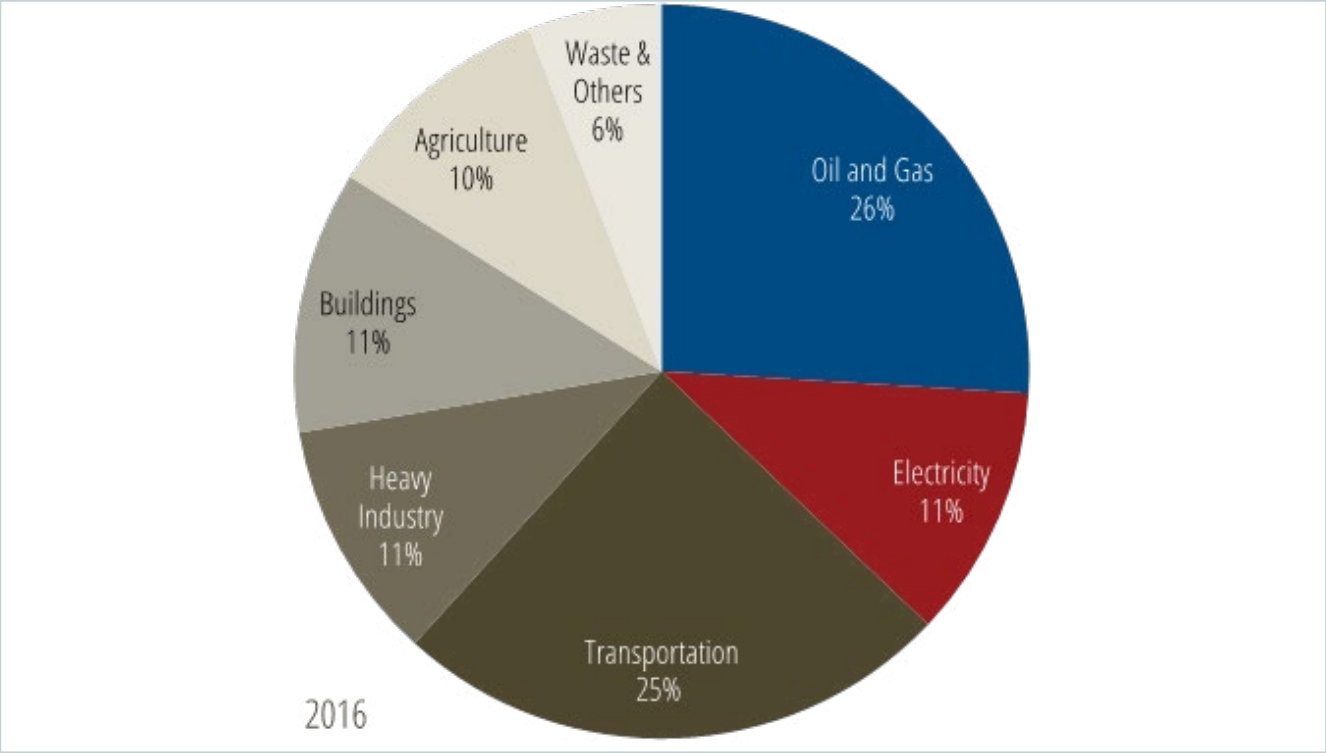

Figure 4: National greenhouse gas emissions by economic sector, 2016. Graphic provided by Pembina.

scriptive," this mid-century strategy (as it has become known) outlines a long-term intent to achieve deep decarbonization (>80%) of the economy **(see Figure 1)**, in line with scientific findings that a 50-50 chance of staying within the Paris Agreement's 1.5-degree temperature target requires global emissions cuts of 70-95% by 2050 (Government of Canada, 2016a).

Canada's Contribution

Canada was responsible for about 1.7% of total global emissions in 2014 (WRI, 2018). While Canada's share of overall GHGs is much smaller than that of major emitters like China or the United States, on an absolute basis, Canada is nonetheless one of the top ten global emitters **(Figure 5)** (ECCC, 2018d). Moreover, on a per person or per capita basis, Canadians are one of the very highest-emitting peoples of the world. Though estimates vary, we are certainly in the top three **(Figure 3)** (Ritchie and Roser, 2019; Robins, 2016; Boothe and Boudreault, 2016)[4]. Canadians' high emissions are partly due to the country's vast northern geography and cold climate, its relatively small and dispersed population, and its traditional economic base: it takes a great deal of energy to move people and goods across the country, to heat buildings through cold winters, and to extract

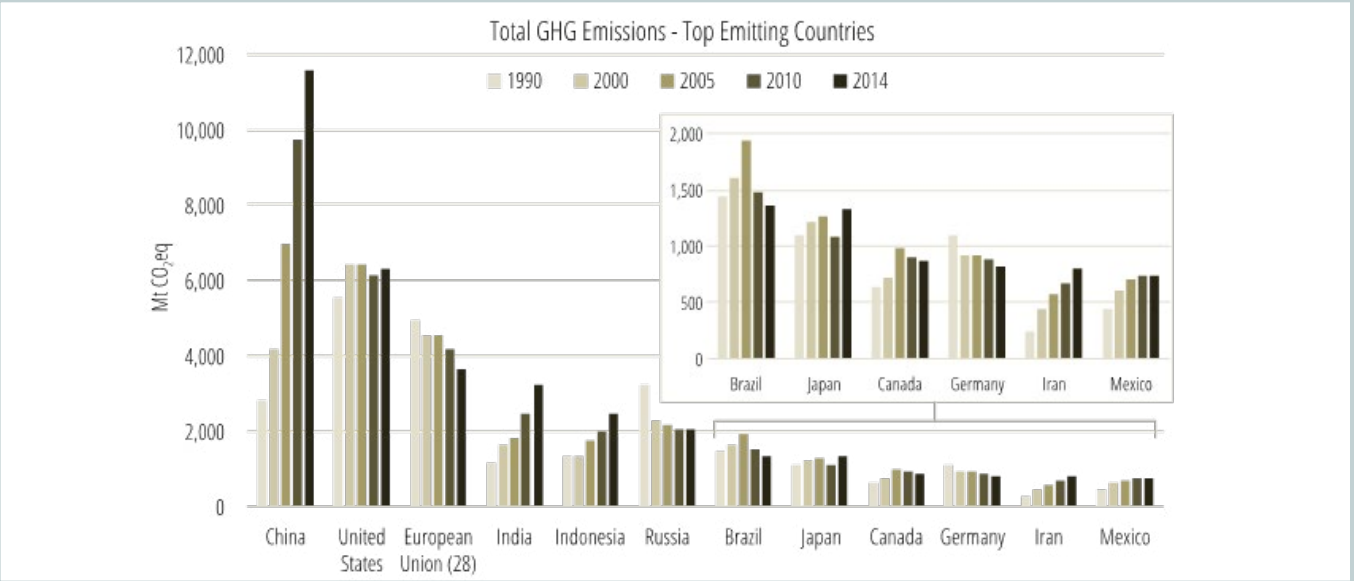

Figure 5. Top twelve global greenhouse gas emitters, selected years.
Data Source: World Resources Institute, Climate Watch, CAIT Climate Data Explorer.

and process raw materials (Robins, 2016).

Still, amongst other top-ten national emitters, Canada is the only country with a population under 100 million, and it outranks the United States, Russia, Japan, China, India, and the European Union as one of the highest per-capita emitters in the world (Frank, 2018). In other words, on any reasonable measure of global equity with respect to climate action, Canadians emit much more than their fair share.

With that said, according to ECCC, Canadian per capita GHG emissions have declined from 22.7 tonnes (t) CO_2eq per person in 2005 to 19.4 t CO_2eq per person in 2016 (ECCC, 2018b, 13). This is the lowest level since 1990, when the record began. ECCC's modelling suggests per capita emissions will continue to decrease over the next decade and reach 16.7 t CO_2eq per person in 2030. However, this expected improvement is mainly driven by a projected 16% increase in population from 2016 to 2030, rather than by policy-driven cuts to GHG emissions, which fall by only 0.5% over the same period (in the government's main "reference case" projection scenario) (ibid.).

Per Capita and Provincial-Territorial Contributions Across Canada

It is also important to note that, when calculated on a national basis, Canada's per capita emissions mask substantial variation between the per capita GHGs of different provinces and territories.[5] The national average flattens differences in the population size, energy sources, emissions levels, and industrial activities

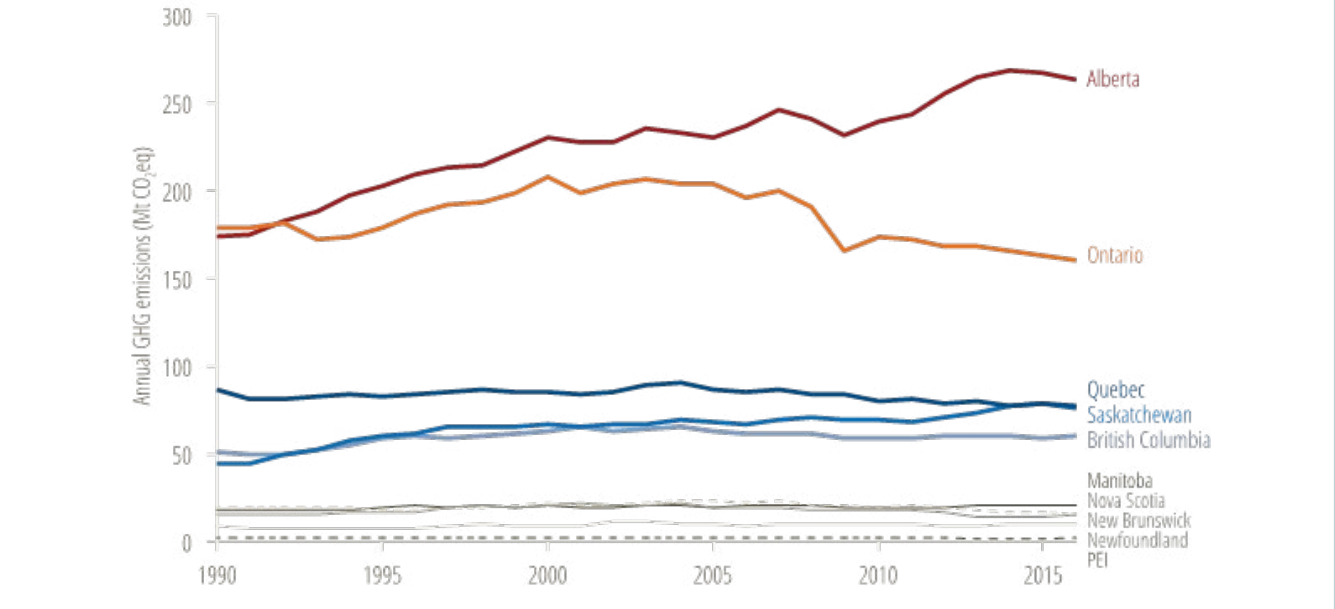

Figure 6: Provincial greenhouse gas emissions, 1990-2016. Graphic provided by Pembina.

characterizing the economies of each sub-national jurisdiction (see provincial and territorial profiles for jurisdiction-specific information on per capita emissions). On a per capita basis, Alberta and Saskatchewan would rank among the world's highest national emitters, while Québec, Ontario, and British Columbia would qualify among the least GHG-intensive countries in Western Europe (Boothe and Boudreault, 2018, 12). Taken together, these five provinces constitute 90% of Canada's total emissions; Alberta and Ontario alone are responsible for 60% (ECCC, 2018d).

Figure 6 presents time series data showing the historical contribution of each Canadian province to the national GHG inventory, as well as each province's relative ranking in terms of their absolute emission levels (note that territories are not included due to their very low emissions profiles). As the figure shows, Alberta and Ontario are the highest and second-highest provincial emitters, respectively. Progress by the latter in achieving reductions since 2005—mainly from its coal phase-out in the electricity sector—has been offset by increased emissions in the former—mainly from increased oil and gas production, but also to a lesser extent from growth in heavy-duty trucking (ECCC, 2018d).

The provincial and territorial profiles in the following pages provide a quick reference for the major emissions sources and trends in each of Canada's sub-national jurisdictions. Unless otherwise stated, emissions data cited are drawn from ECCC's 2018 National Inventory Report, Parts 1 and 3 (ECCC, 2018d). Population data are from Statistics Canada's annual estimates.

British Columbia

British Columbia is Canada's fifth-highest emitting province and its third most populous. In 2016, the province emitted just over 60 Mt CO_2eq, or approximately 9% of Canada's total GHG emissions. On a per capita basis, British Columbians emit 12.4 t CO_2eq per year, placing the province at the low end (ninth) amongst all the provinces and territories.

Oil tanker in Burrard Inlet, Vancouver BC. Photo by Lewis Pratt.

Under its Climate Change Accountability Act, British Columbia has legislated targets to reduce GHGs by at least 40% below 2007 levels by 2030, 60% by 2040, and 80% by 2050. The main contributors to its provincial emissions inventory are

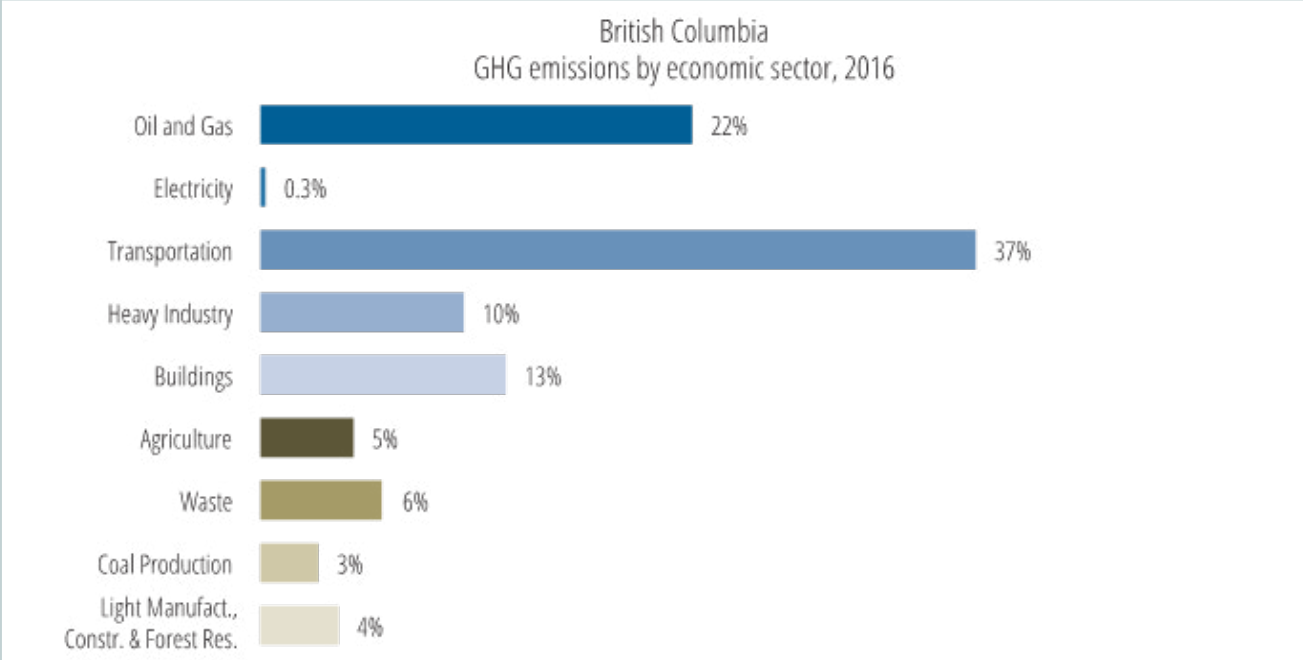

Figure 7: British Columbia GHG emissions by economic sector, 1990-2016. Graphic provided by Pembina.

British Columbia

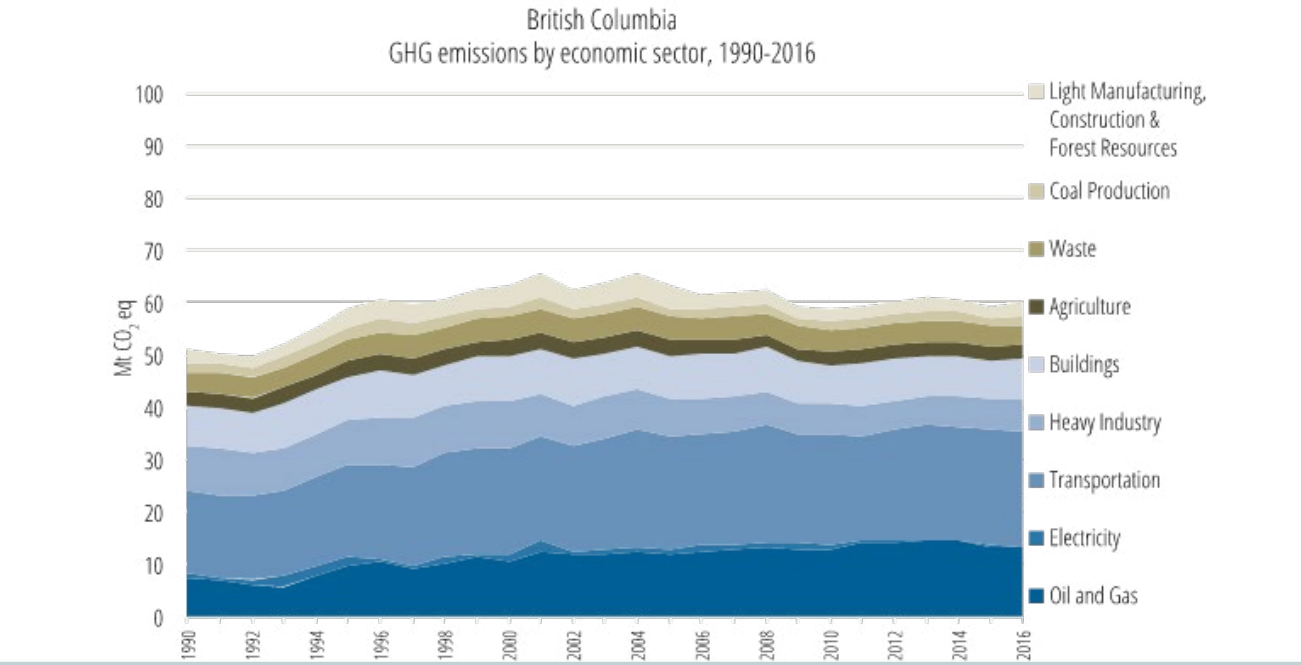

Figure 8: British Columbia GHG emissions by economic sector, 1990-2016. Graphic provided by Pembina.

the transportation, oil and gas, and buildings sectors, which together make up nearly three-quarters of provincial GHGs.

From 1990 to 2016, emissions from transportation, including both passenger and heavy-duty on-road freight vehicles, grew nearly 40% (6.2 Mt), with most of the growth occurring by 2005. Over the full period, oil and gas sector emissions grew 77% (5.8 Mt), driven exclusively by the expansion of the province's natural gas industry (production, processing and transmission) (ECCC, 2018d).

Transport truck on the Coquihalla highway in B.C. Photo by BC Ministry of Transportation

Alberta

Alberta is Canada's fourth most populous province and by far its highest emitting. In 2016, the province emitted nearly 263 Mt CO_2 eq, or about 37% of Canada's total GHG emissions. On a per capita basis, Albertans emit 62.7 t CO_2eq, more than the people of every other province except Saskatchewan.[8]

Alberta's GHG inventory is dominated by oil and gas extraction and production, which account for nearly half of provincial emissions. From 1990 to 2016, while annual emissions from conventional oil production actually declined, emissions from oil sands (open pit min-

Air pollution from coal industry. Photo by Veeterzy on Unsplash.

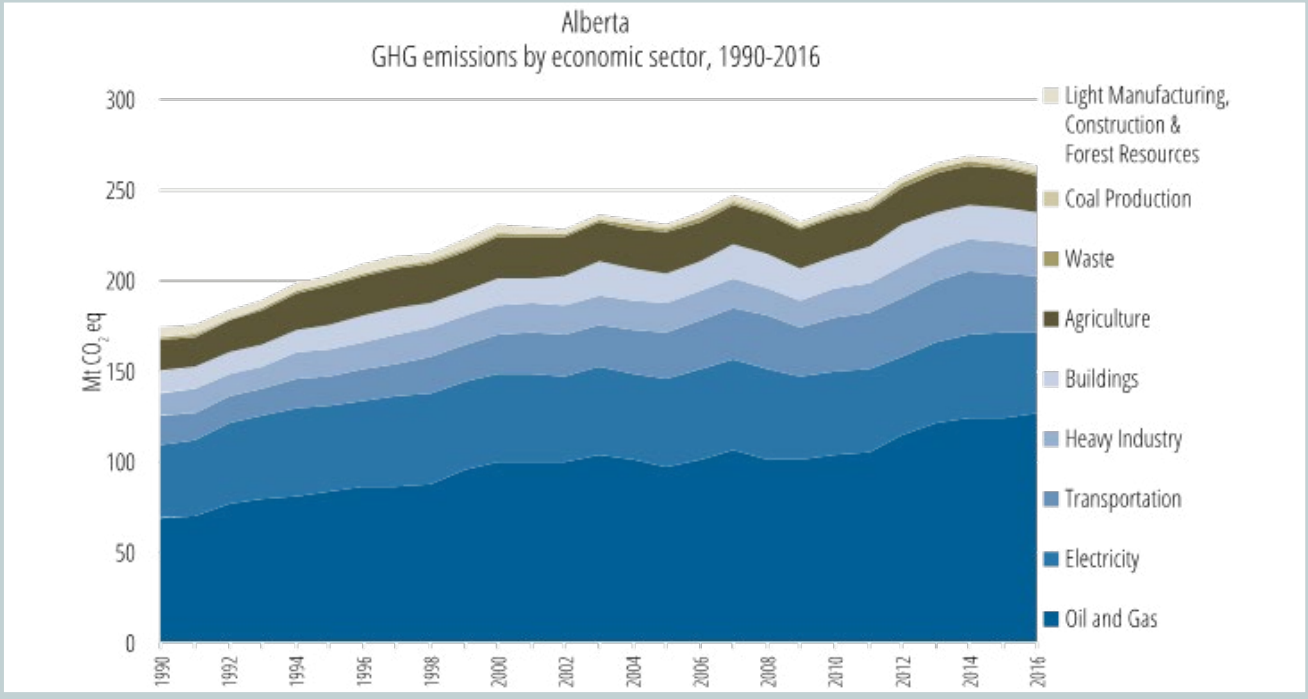

Figure 9: Alberta GHG emissins by economic sector, 1990-2016. Graphic provided by Pembina.

Alberta

ing, in situ extraction[9], and bitumen upgrading) increased by 85% to 120 Mt.

In addition, Alberta's electricity sector generates more GHG emissions than that of any other province, due to its size (3rd largest electricity producer behind Quebec and Ontario) and its reliance on coal-fired power. Approximately 89% the province's electricity is generated from fossil fuels: about 50% from coal and 39% from natural gas. The remaining 11% is produced from renewables, such as wind, hydro, and biomass (NEB, 2019). In 2016, Alberta's power sector generated 45 Mt, or 57% of total Canadian GHG emissions from electricity production. As a key pillar of its Climate Leadership Plan, the province has indicated it will phase-out coal-fired power by 2030.

Finally, emissions from transport in the province have nearly doubled since 1990, particularly on account of increased activity (and a more than tripling of GHGs) from heavy-duty trucking (ECCC, 2018d).

Aerial footage from space of Millenium Open Pit Mine in Alberta that produce oil sands processed to recover bitumen. Photo by NASA Jet Propulsion Laboratory.

Saskatchewan

Saskatchewan is Canada's sixth most populous province and its second highest emitting. In 2016, the province released over 76 Mt CO_2eq into the atmosphere or nearly 11% of Canada's total GHG emissions. On a per capita basis, Saskatchewanians emit 67.1 t CO_2eq, more than the inhabitants of any other province and 244% above the national average of 19.4 t CO_2eq per capita.

Wheat. Photo by Nitin Bhosale on Unsplash.

Emissions from Saskatchewan have increased 71% since 1990. The single largest contributor to this trend was the oil and gas sector, which saw upstream emissions more than double (from 10.9 Mt to 22.8 Mt in 2016)—mostly from increased pro-

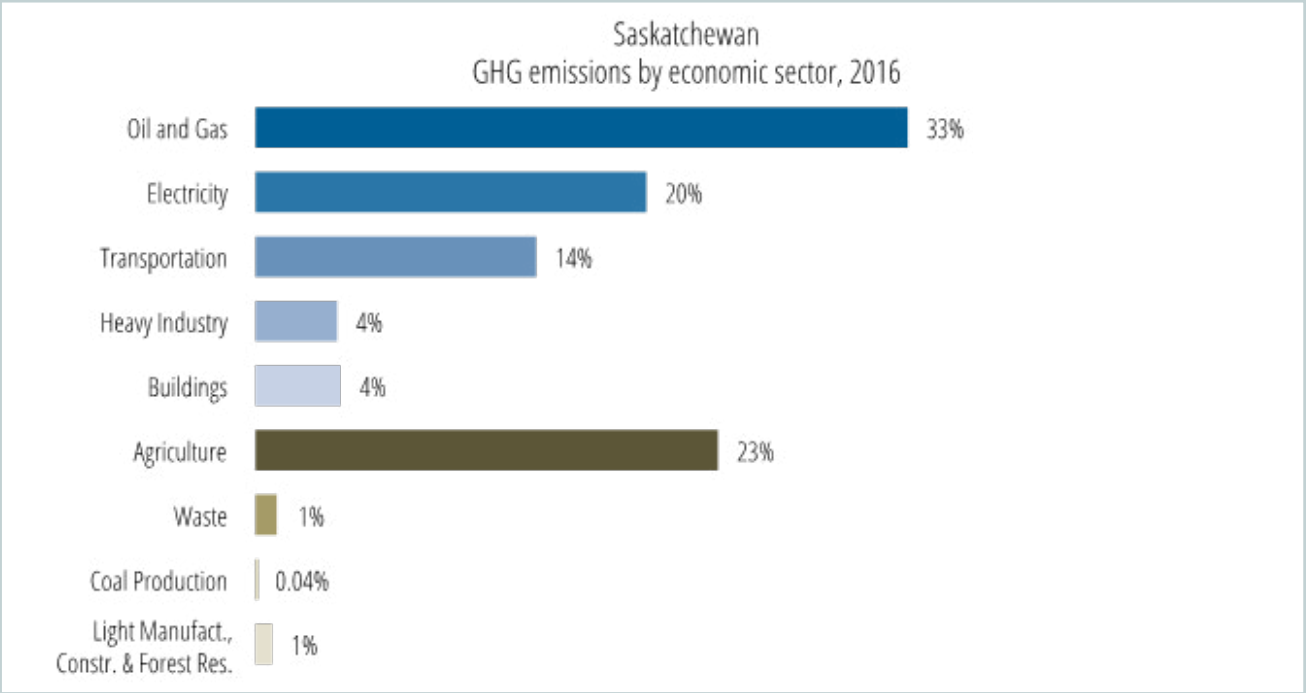

Figure 10: Saskatchewan GHG emissions by economic sector, 1990-2016. Graphic provided by Pembina.

Saskatchewan

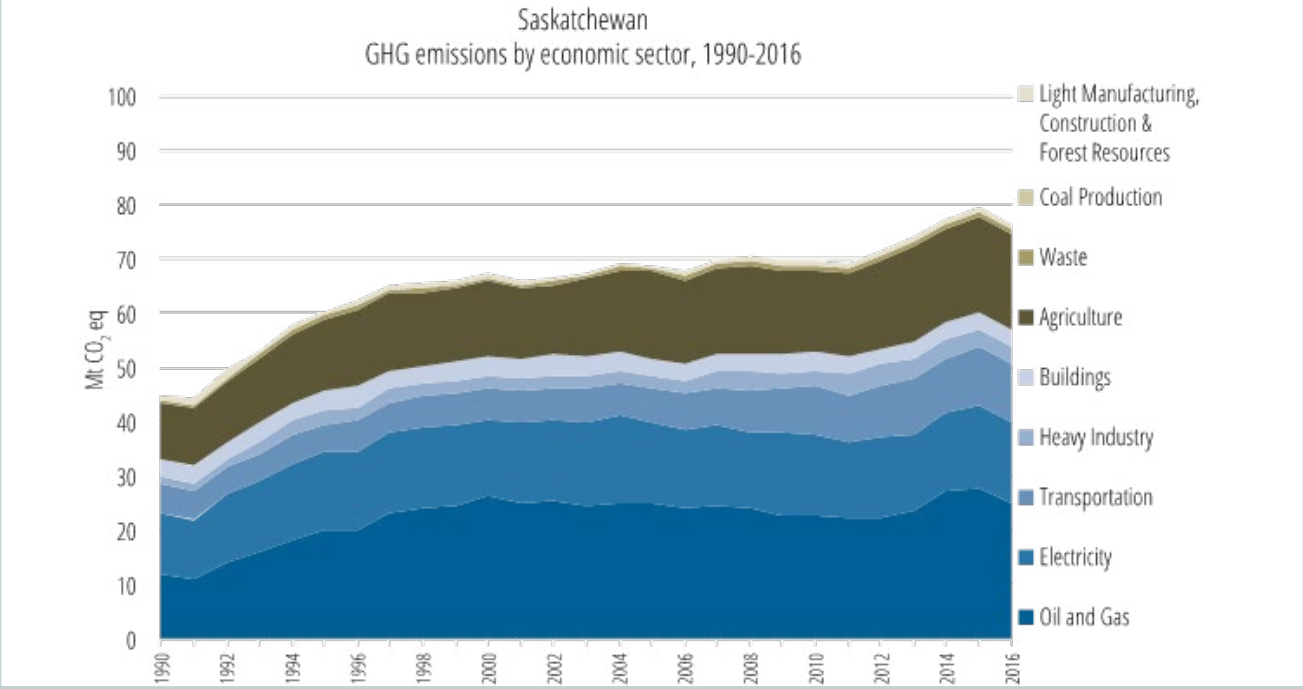

Figure 11: Saskatchewan GHG emissions by economic sector, 2016. Graphic provided by Pembina.

duction of conventional oil, but also from the emergence of a small oil sands upgrading industry. Downstream emissions also rose steadily as a result of greater petroleum refining. Saskatchewan's emissions growth also resulted from increases of emissions from agriculture (including on-farm fuel use, crop production and fertilizer use, animal housing, and manure production), transport (where emissions from freight transport increased by 325%) and electricity generation.

The province's electricity sector produces the second highest amount of GHG emissions after Alberta, primarily because of its reliance on coal-fired generation. In 2016, Saskatchewan's power sector emitted 15 Mt of emissions, or 19% of total Canadian GHG emissions from power generation. The southern part of Saskatchewan has some of the highest wind energy and solar photovoltaic (PV) generation potential in Canada (NEB, 2019).

Manitoba

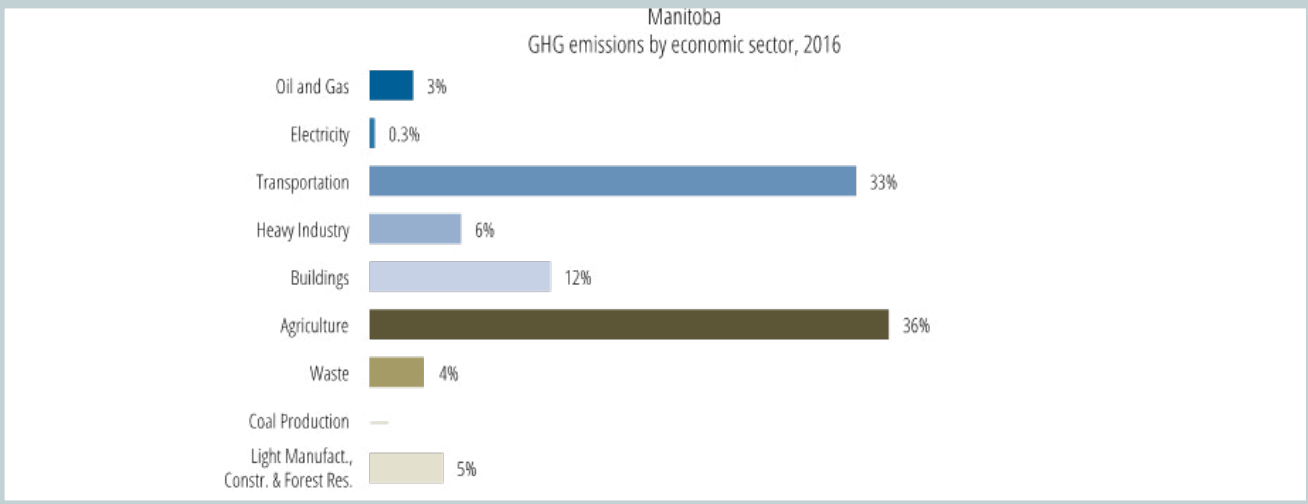

Figure 12: Manitoba GHG emissions by economic sector, 2016. Graphic provided by Pembina.

Manitoba is Canada's fifth most populous province and one of its lowest emitting. In 2016, the province emitted about 21 Mt CO_2eq, or just under 3% of Canada's total GHG emissions. On a per capita basis for that year, Manitobans emitted 15.9 t CO_2eq—less than Nova Scotians and the Canadian average, but more than British Columbians.

The largest emitting sectors in Manitoba are agriculture (36%), transportation (33%), and residential and commercial buildings (12%). Manitoba generates virtually all of its electricity from renewable sources. For this reason, it emits less than 0.1 Mt of GHGs from its electricity sector (approximately 0.1% of total Canadian GHG emissions from power generation).

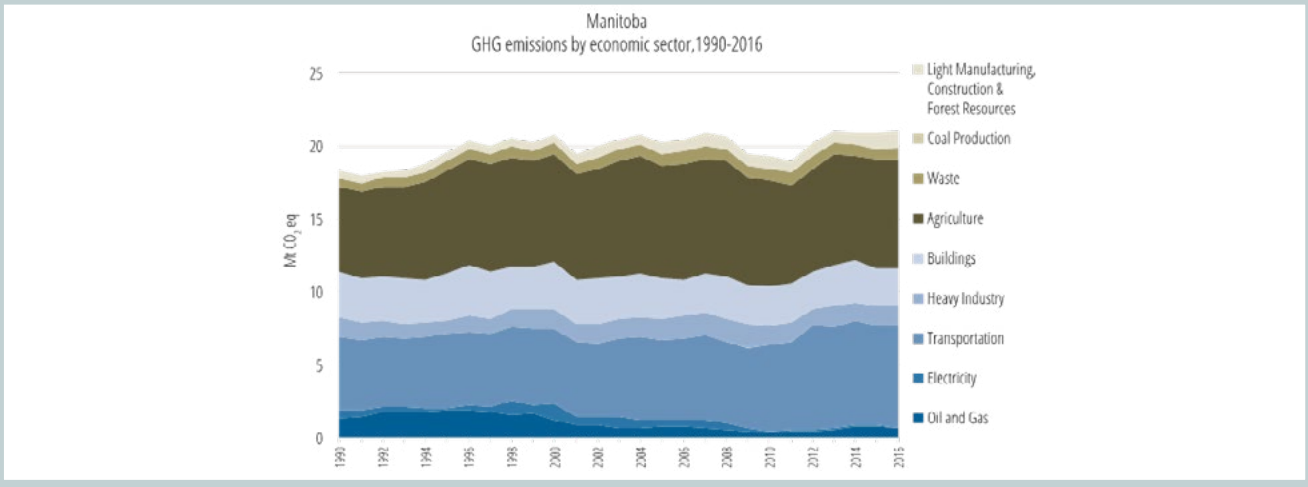

Figure 13: Manitoba GHG emissions by economic sector, 2016. Graphic provided by Pembina.

Ontario

Ontario is Canada's most populous province and consequently one of its highest emitting. In 2016, the province emitted just under 161 Mt CO_2eq or about 23% of Canada's total GHG emissions. On a per capita basis for that year, Ontarians emitted 11.6 t CO_2eq. Thus, while the province is Canada's second-highest emitter on an absolute level, in per capita terms, it is third lowest in Canada, bested only by Quebec and the Yukon.

Ontario's emissions have fallen 10% since 1990. The three largest emitting sectors in Ontario are transportation (35%), buildings (residential and commercial) (21%), and heavy industries (19%), including iron, steel, and chemicals. In the transportation sector, emissions grew 34% between 1990 and 2016 (from 41.6 Mt to 55.8 Mt), with passenger transport climbing to 33.9 Mt or 60% of provincial transport emissions, and freight transport growing 118% to 18.3 Mt, or fully one-third of provincial transport GHGs (11% of the overall provincial total).

Over the past quarter-century, emissions

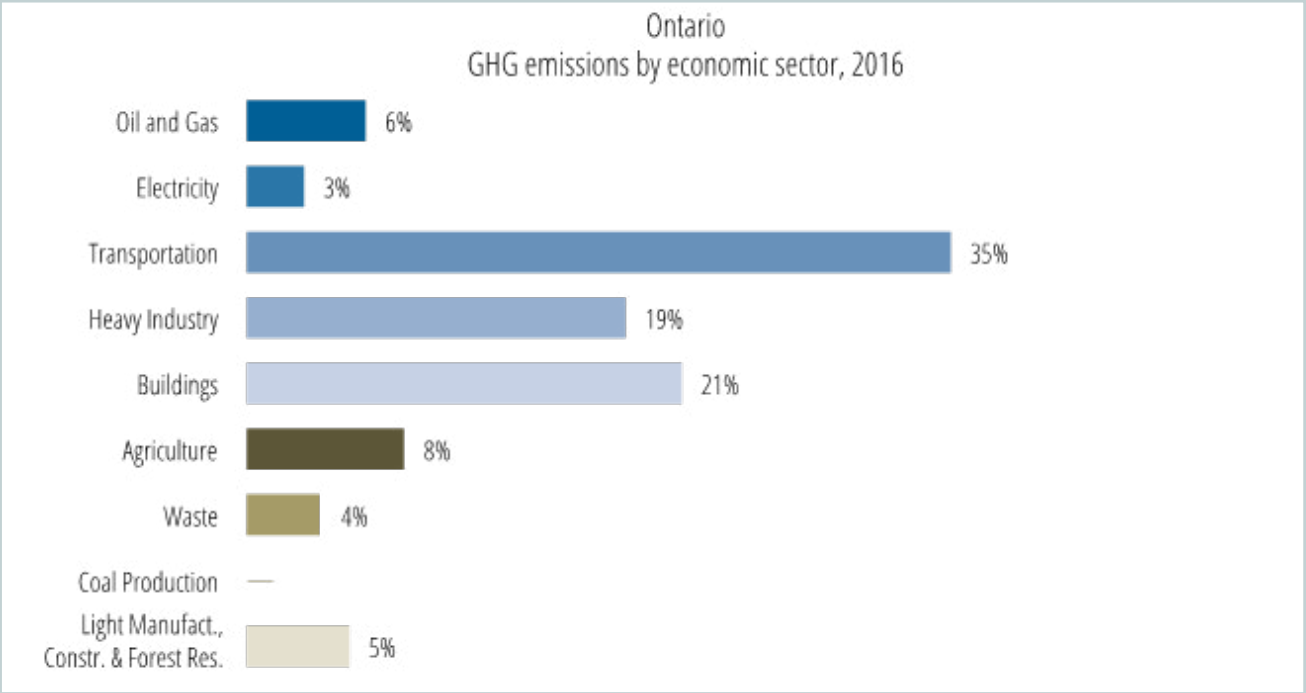

Figure 14: Ontario GHG emissions by economic sector, 1990-2016. Graphic provided by Pembina.

Ontario

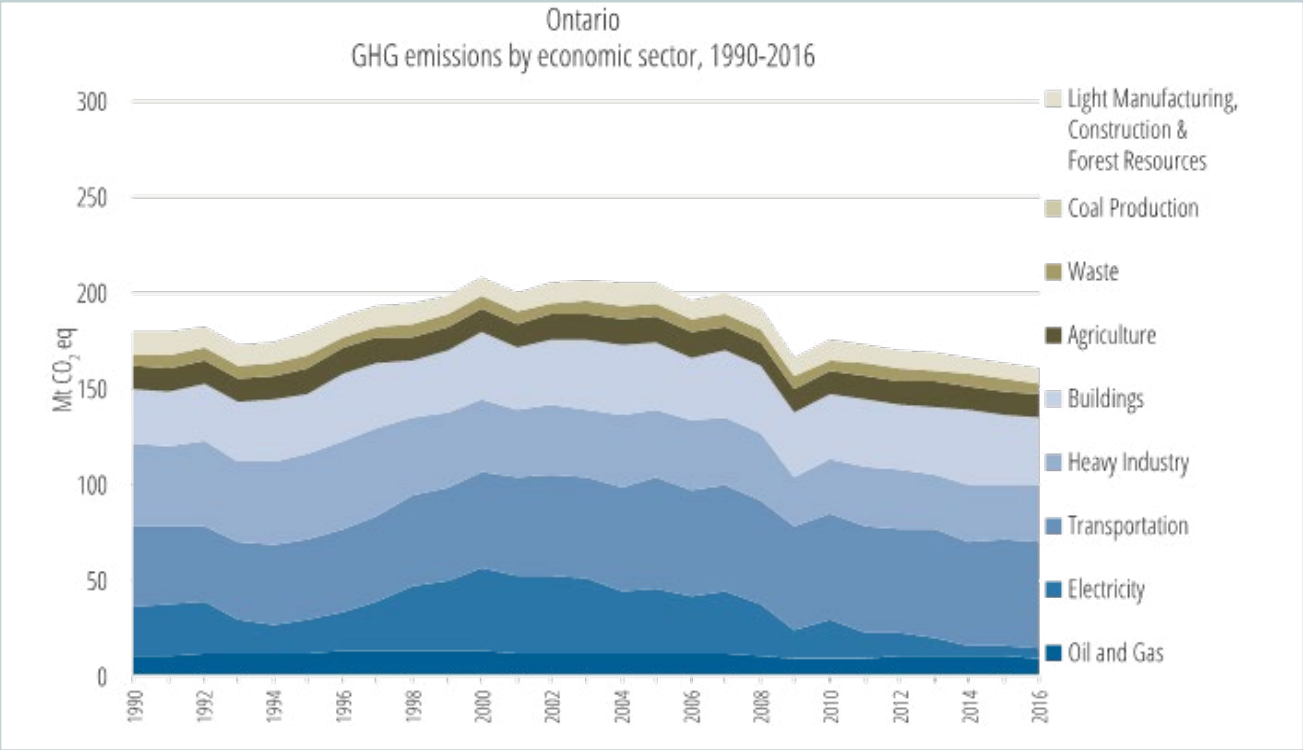

Figure 15: Ontario GHG emissions by economic sector, 1990-2016. Graphic provided by Pembina.

from heavy industry in Ontario declined by 30% (to 30 Mt in 2016); the share of this sector in provincial GHGs fell by 5%. While iron and steel production, pulp and paper, and smelting and refining all reduced their GHG output, the majority of the overall decrease in industry emissions was achieved through reductions from chemical and fertilizer manufacturing.

In 2016, Ontario's electricity sector emitted 4.5 Mt or 6% of total Canadian GHG emissions attributable to power generation. The province's electricity sector emissions peaked in 2000 at 42.6 Mt before a substantial decline that was prompted by the government decision to phase out coal-fired generation. The phase-out took approximately a decade and was complete by 2014.

Quebec

Quebec is Canada's second most populous province and the third most significant contributor to national emissions. In 2016, the province emitted 77.3 Mt CO_2eq or 11% of Canada's total GHG emissions. Quebec's annual emissions per capita are the lowest amongst all Canadian provinces at 9.4 t CO_2eq—52% below the Canadian average of 19.4 t per capita. The province has set a GHG reduction target for 2030 of 37.5% below 1990 levels.

Traffic on Jacques-Cartier Bridge.
Photo by Abdallahh.

The largest emitting sectors in Quebec are transportation (41%), heavy industries, including smelting, cement, and chemicals (19%), and buildings (residential and commercial) (14%). Power

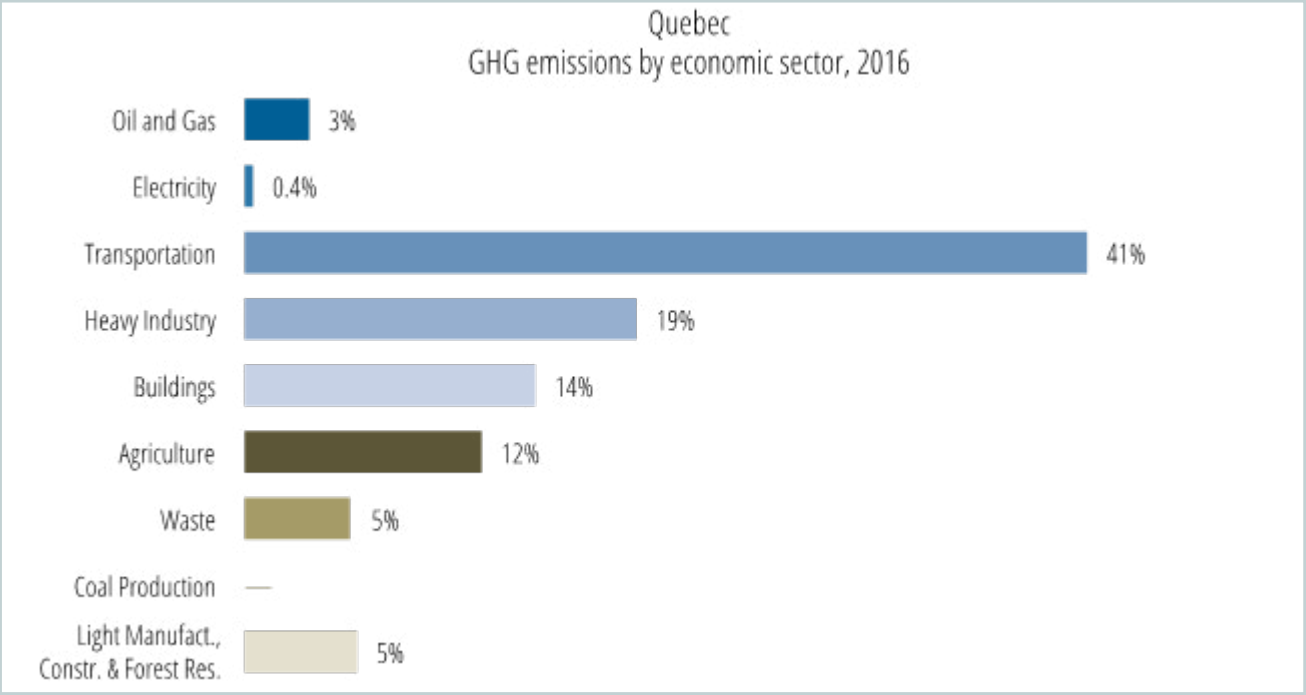

Figure 16: Quebec GHG emissions by economic sector, 2016. Graphic provided by Pembina.

Quebec

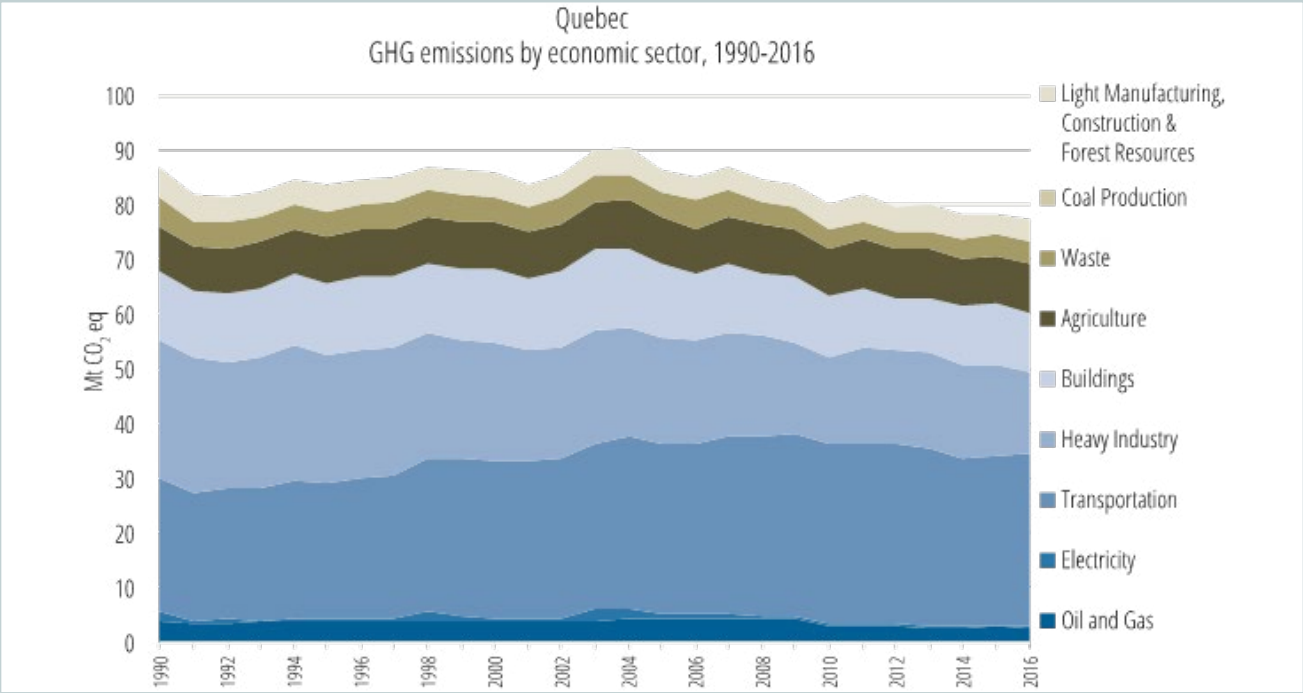

Figure 17: Quebec GHG emissions by economic sector, 2016. Graphic provided by Pembina.

production in the province is virtually emissions-free, and Quebec is Canada's largest electricity producer, with hydroelectric stations constituting 99% (45,036 megawatts) of its total installed generation capacity in 2017 (NEB, 2019).

Transportation sector emissions in Quebec increased almost 28% from 1990 to 2016. In terms of power production, nearly all of the electricity produced in Quebec comes from renewable sources, hydro in particular. In 2016, Quebec's power sector generated 0.3 Mt emissions or approximately 0.4% of Canada's overall electricity sector GHG emissions.

Centrale de Beauharnois, au Québec. Photo by Gilles Douaire.

New Brunswick

New Brunswick is Canada's eighth most populous province and among the smaller contributors to national emissions. In 2016, the province emitted 15.3 Mt CO_2eq, or 2.2% of total Canadian GHG emissions. The province's annual emissions per capita, at 20 Mt CO_2eq, are slightly above the Canadian average.

New Brunswick's emissions have declined by 5% since 1990. The largest emitting sectors in New Brunswick are electricity generation (32% of GHGs), transportation (28%), and oil and gas (primarily petroleum refining) (17%).

Irving Oil Refinery, Saint John NB. Photo by Cusack5239.

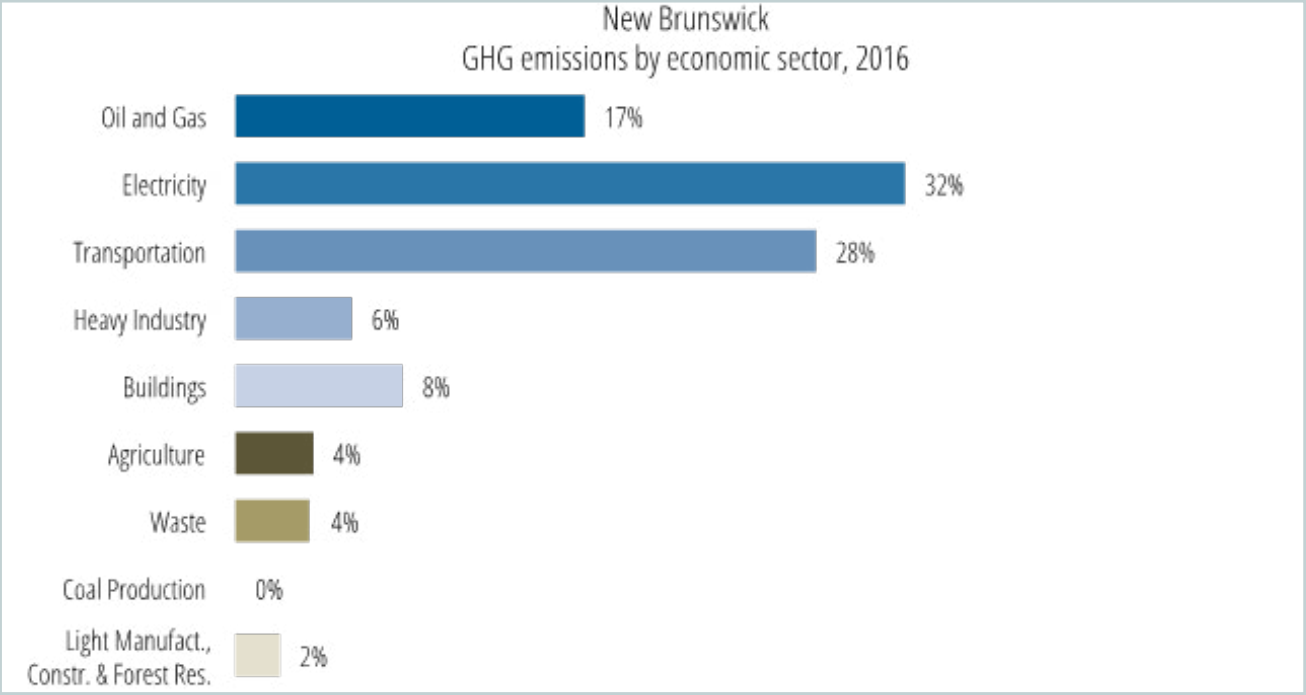

Figure 18: New Brunswick GHG emissions by economic sector, 2016. Graphic provided by Pembina.

New Brunswick

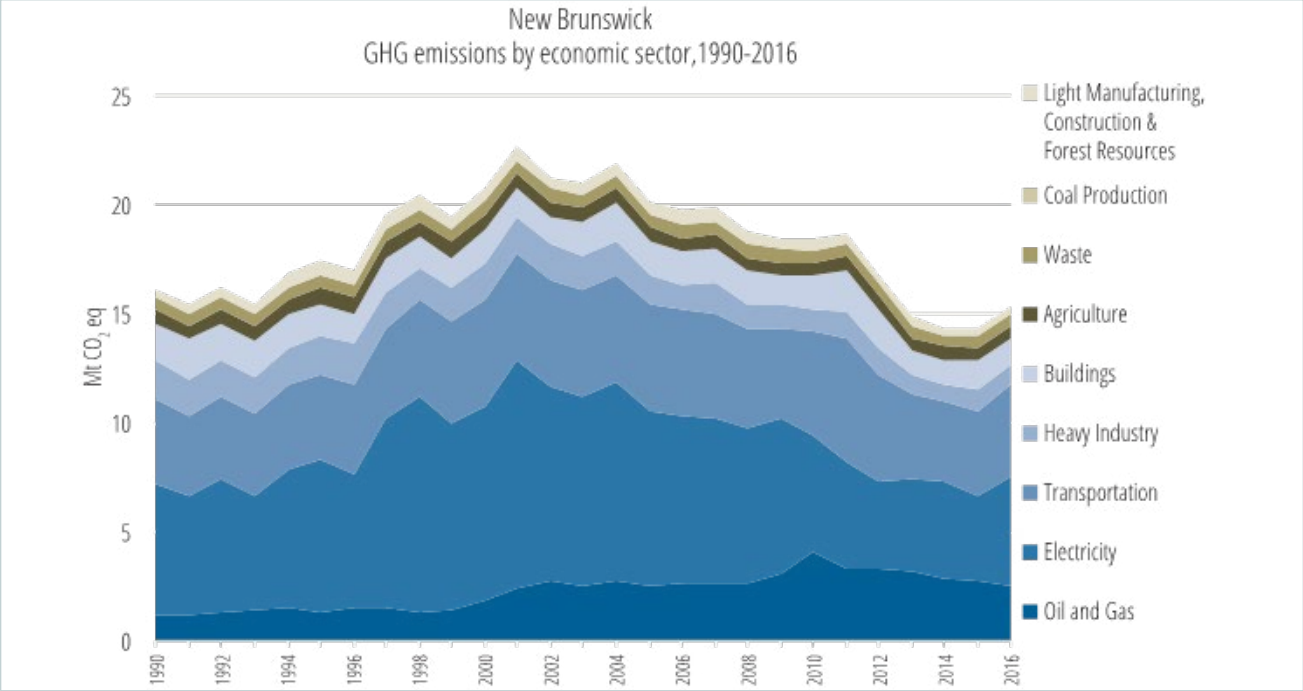

Figure 19: New Brunswick GHG emissions by economic sector, 2016. Graphic provided by Pembina.

In 2016, New Brunswick's electricity sector emitted 4.9 Mt or 6% of Canada's GHG emissions from power generation. The province and its Crown-owned utility plan to increase the portion of non-nuclear renewables in electricity generation from 28% in 2015 to 40% in 2020 (NEB, 2019). New Brunswick's major coal-fired power plant, Belledune Generating Station, will also be affected by the federal government's national 2030 coal phase-out policy.

Coal plant. Photo by koushik das on Unsplash.

Prince Edward Island

Prince Edward Island is Canada's least populous province and the smallest provincial contributor to national emissions. In 2016, the province emitted 1.8 Mt CO_2eq or 0.3% of total Canadian GHG emissions. On a per capita basis, Islanders emit 12.3 t CO_2eq annually, placing them 37% below the Canadian average. The province's total emissions have decreased 6% since 1990.

Potato. Photo by Photo by Agence Producteurs Locaux Damien Kühn on Unsplash.

The largest emitting sectors in PEI are transportation (48% of emissions), agriculture (25%), and residential and commercial buildings (16%).

From a decarbonization perspective,

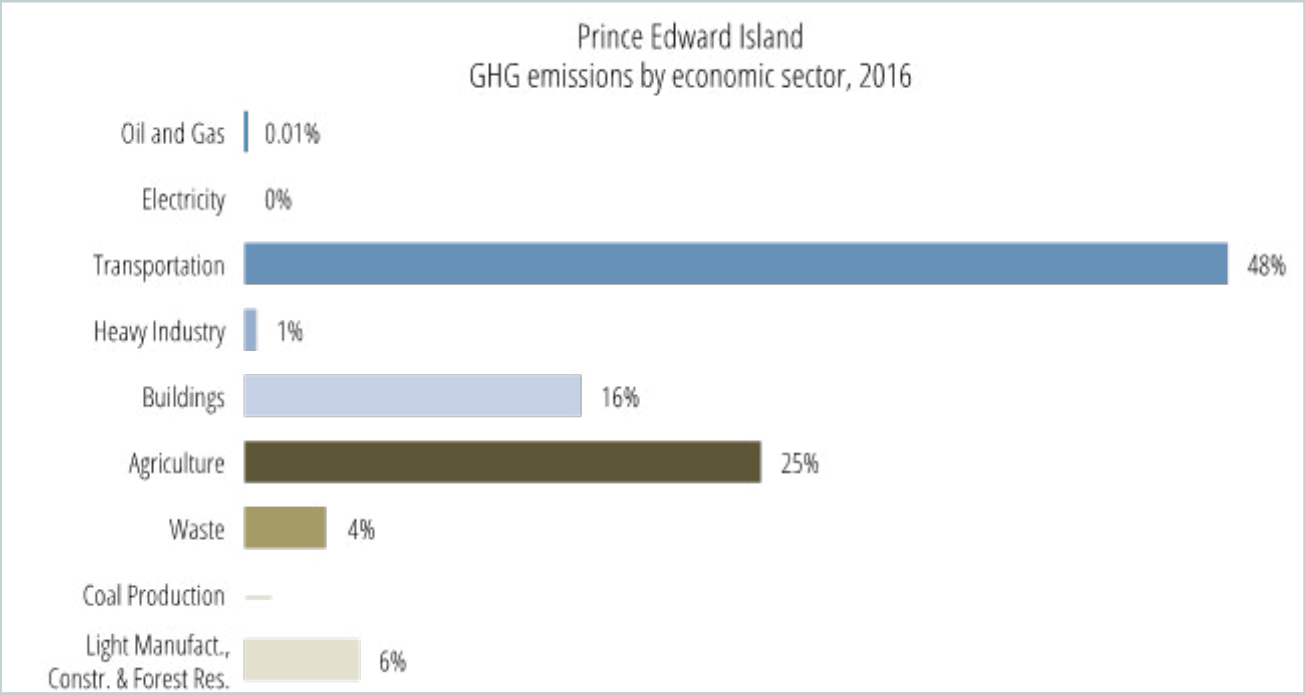

Figure 20: Prince Edward Island GHG emissions by economic sector, 1990- 2016. Graphic provided by Pembina.

Prince Edward Island

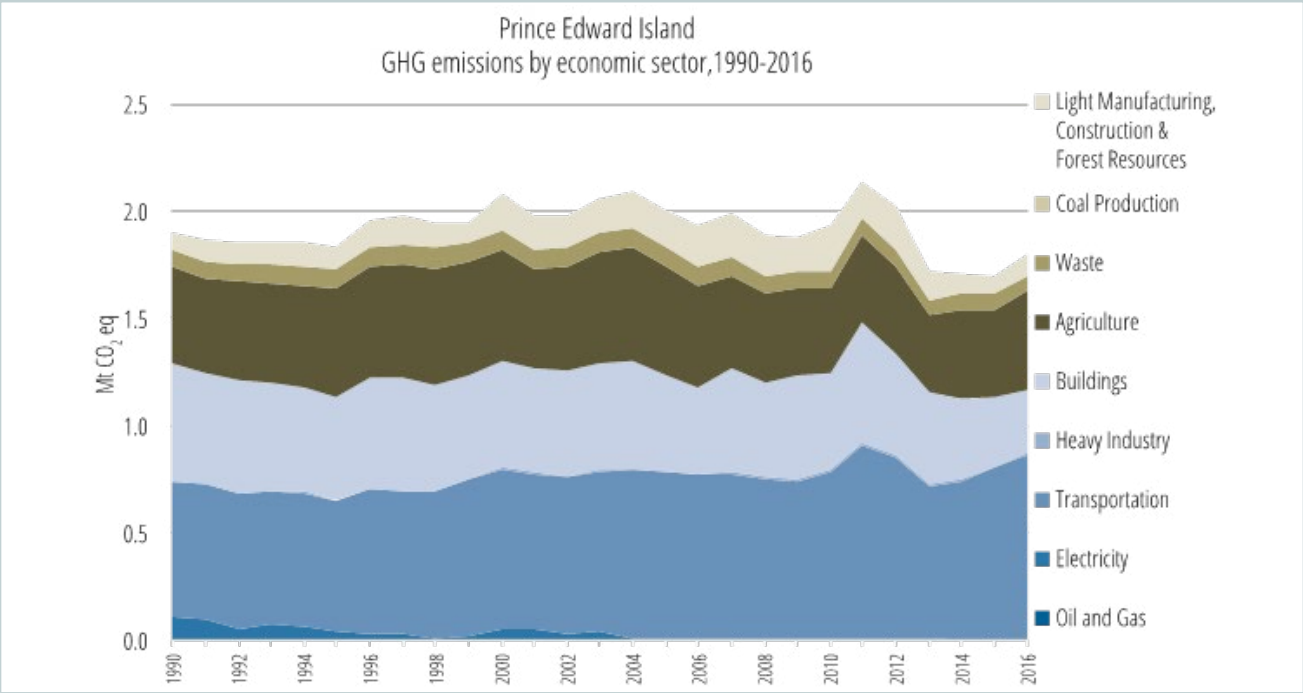

Figure 21: Prince Edward Island GHG emissions by economic sector, 2016. Graphic provided by Pembina.

Prince Edward Island is notable in that virtually all electricity produced in the province (98% in 2016) is supplied by renewable wind power. However, the Island's wind resource supplies only about 25% of PEI's electricity demand, and the province remains heavily dependent on power imports via submarine cables from New Brunswick.

Wind power. Photo by Photo by Gustavo Quepón on Unsplash.

Nova Scotia

Nova Scotia is Canada's seventh most populous province and a relatively small contributor to overall national emissions. In 2016, the province emitted 15.6 Mt CO_2eq or 2.2% of total Canadian GHG emissions. On a per capita basis for that year, Nova Scotians emitted 16.5 t CO2eq and therefore fell slightly (15%) below the Canadian average. Total provincial emissions have declined by 20% since 1990.

White freight truck on grey concrete road. Photo by Orlando Leon on Unsplash.

The largest emitting sectors in Nova Scotia are electricity generation (42% of emissions), transportation (31%), and buildings (residential and commercial) (13%).

Historically, Nova Scotia has relied on coal-fired power for most of its electricity production; in 2016, 63.7% of its pow-

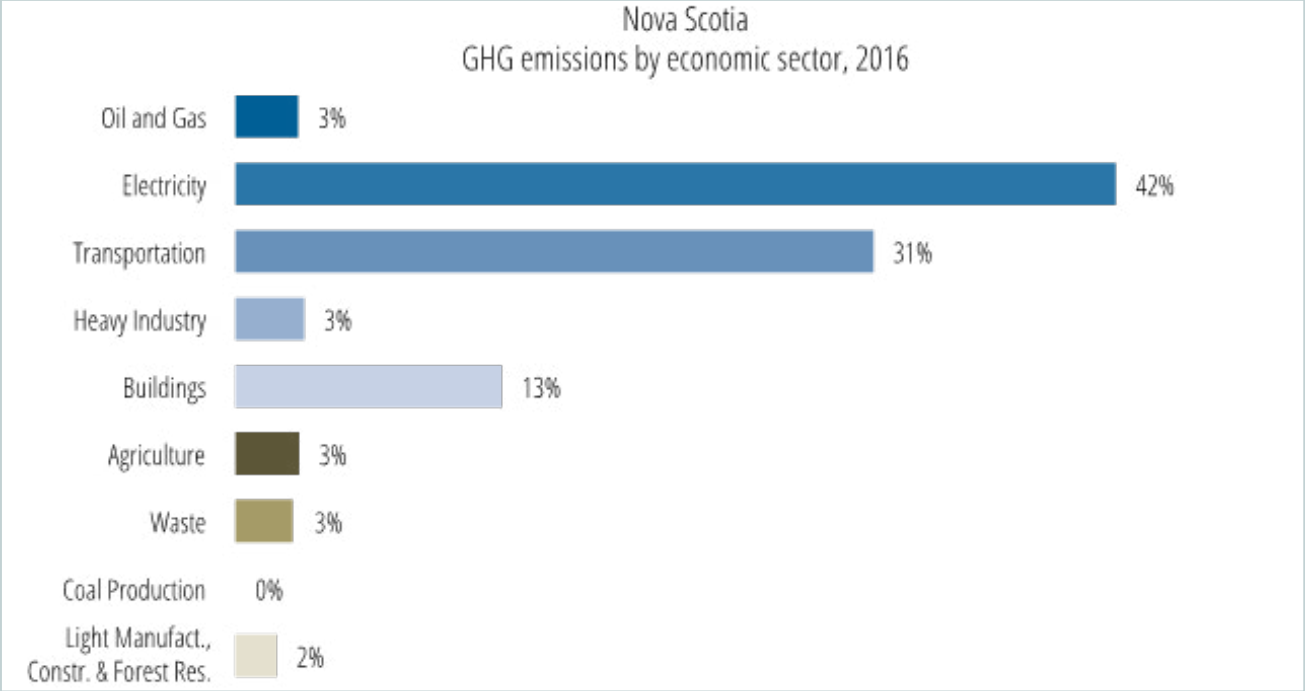

Figure 22: Nova Scotia GHG emissions by economic sector, 2016. Graphic provided by Pembina.

Nova Scotia

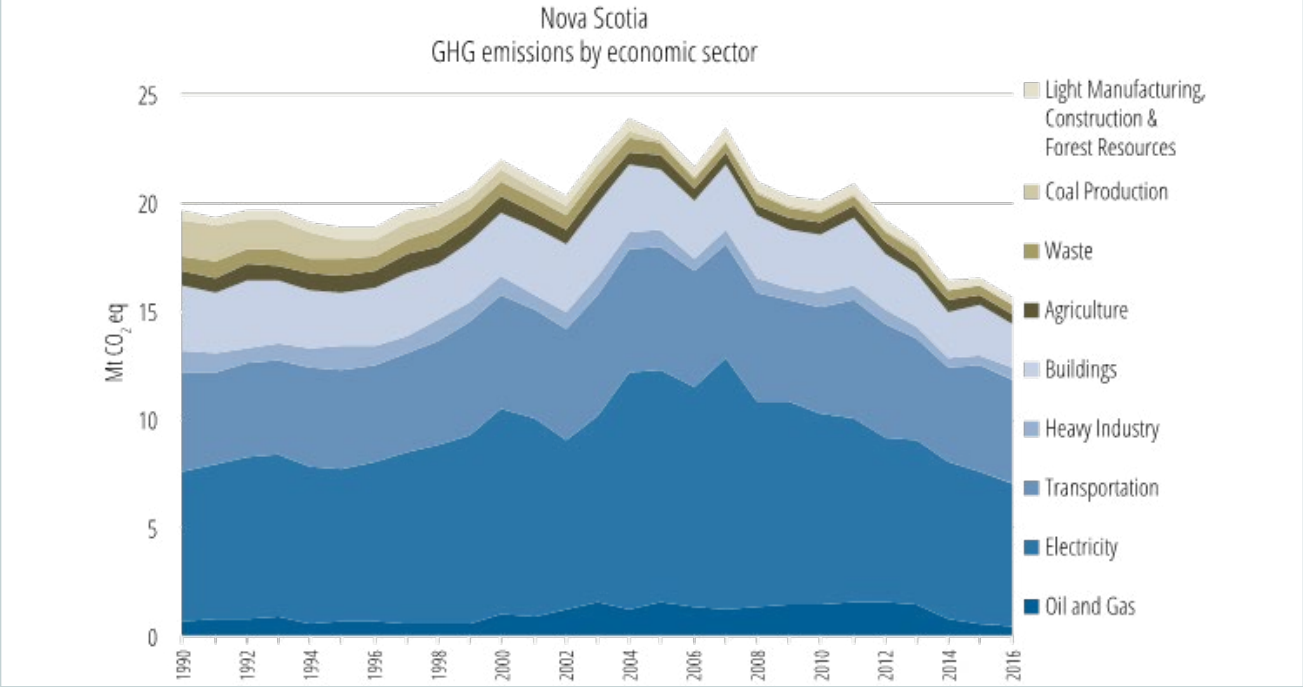

Figure 23: Nova Scotia GHG emissions by economic sector, 2016. Graphic provided by Pembina.

er was generated from coal-fired plants (NEB, 2017). However, in 2010, the province committed to grow its share of electricity production from renewable sources such as wind and hydro to 25% in 2015 and 40% in 2020. In 2016, the province's power sector emitted 6.6 Mt CO_2eq representing about 8.4% of Canadian emissions from electricity.

Lingan Generating Station located in the community of Lingan in Nova Scotia's Cape Breton Regional Municipality. This is on Cape Breton Island, in the province of Nova Scotia, Canada. Also shown are two locomotives of the SCR (Sydney Coal Railway) leaving the power station after unloading a train load of coal for the plant. Photo by Ken Heaton.

Newfoundland and Labrador

Newfoundland and Labrador are together Canada's least populous province and the second smallest provincial contributor to national emissions. In 2016, the province emitted 10.8 Mt CO_2eq or 1.5% of total Canadian GHG emissions. On a per capita basis for that year, Islanders emitted 20.3 t CO_2eq. While this is only 4% higher than the Canadian average, Newfoundland and Labrador is the third highest provincial emitter per capita (fourth highest including the Northwest Territories), behind Alberta and

Hebron Oil Platform, Newfoundland Canada. Photo by Shhewitt.

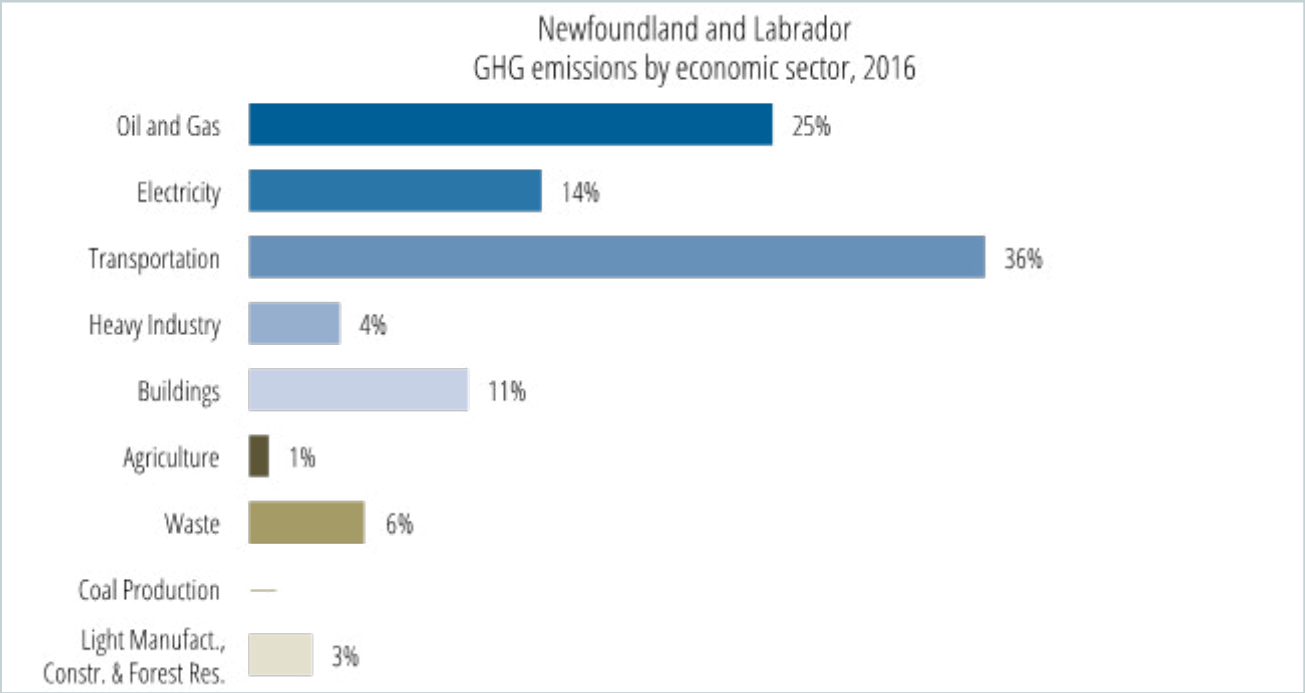

Figure 24: Newfoundland and Labrador GHG emissions by economic sector, 2016. Graphic provided by Pembina.

Newfoundland and Labrador

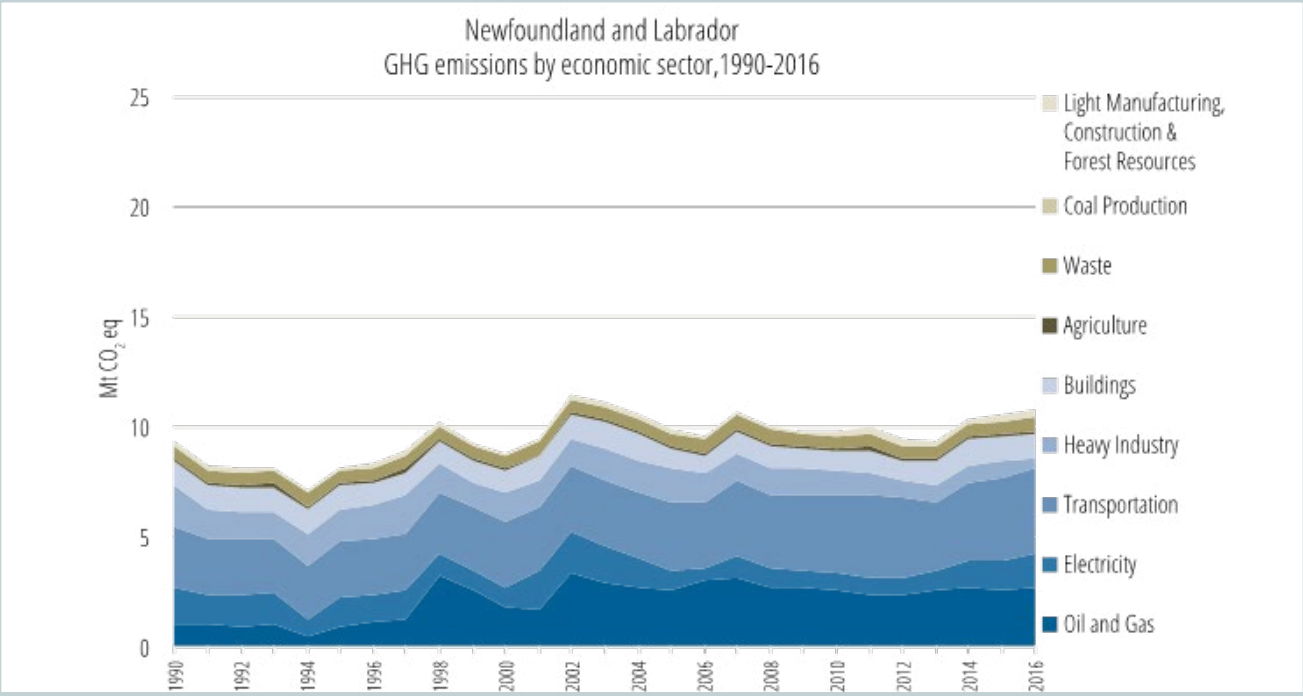

Figure 25: Newfoundland and Labrador GHG emissions by economic sector, 2016. Graphic provided by Pembina.

Saskatchewan. The province's total emissions have increased 16% since 1990.

In 2016, the largest emitting sectors in Newfoundland and Labrador were transportation (36% of GHGs), oil and gas production (25%), and electricity generation (14%). The province's GHG emissions from the oil and gas sector were 2.7 Mt. Of this total, 1.6 Mt were attributable to offshore oil production and 1.1 Mt were attributable to petroleum refining.

Siem Pilot, an offshore support vessel servicing major oil and gas companies. Photo by Ryan Sharpe.

Nunavut

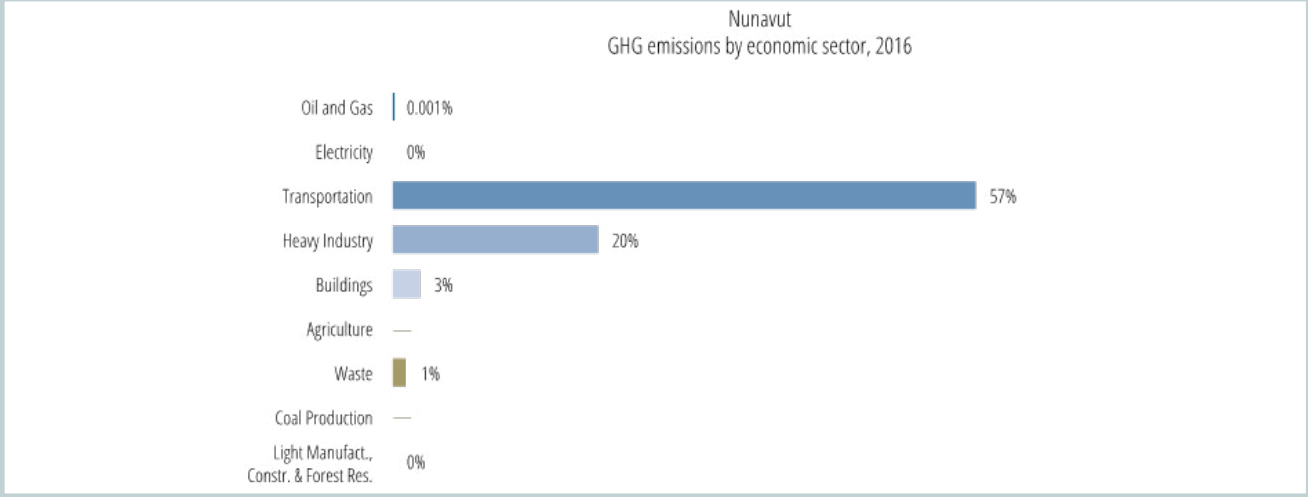

Figure 26: Nunavut GHG emissions by economic sector, 2016. Graphic provided by Pembina.

All three of Canada's territories are, on an absolute level, minor emitters (as compared with all provinces except PEI), with populations of less than 50,000 people. In Nunavut, total emissions were 0.7 Mt CO2eq in 2016—less than in the Northwest Territories but higher than in Yukon, and about 0.1% of overall national emissions. In per capita terms, territorial GHGs for that year were 18.9 t CO-2eq or 3% below the Canadian average. Emissions from Nunavut have risen 58% since 2000, the first full year following the territory's creation. The majority of GHGs in Nunavut come from transportation (split evenly between passenger and freight) and mining operations.

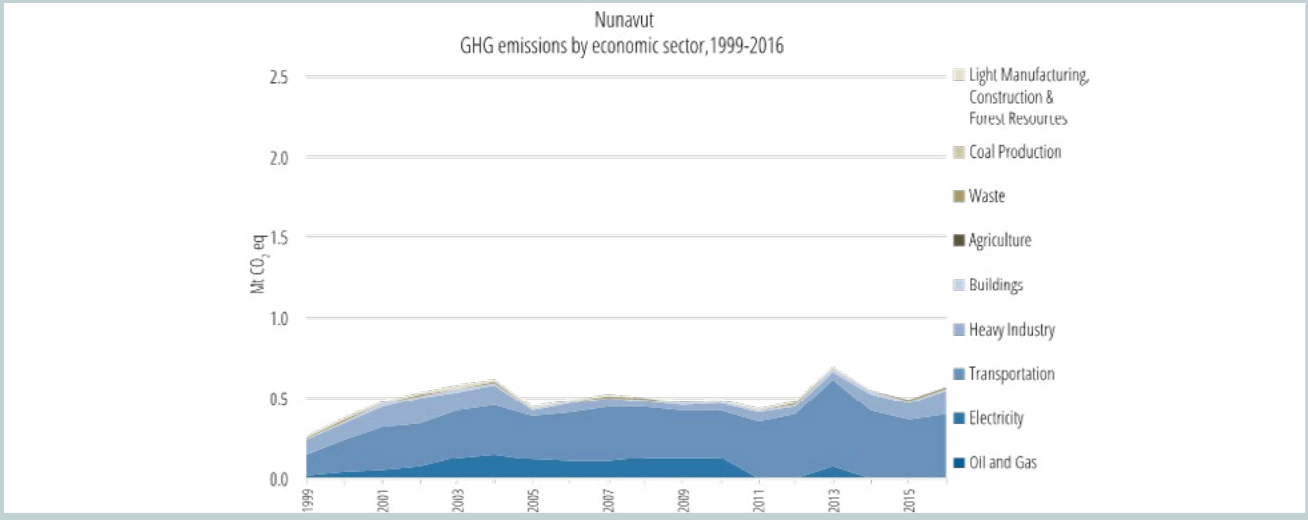

Figure 27: Nunavut GHG emissions by economic sector, 2016. Graphic provided by Pembina.

Northwest Territories

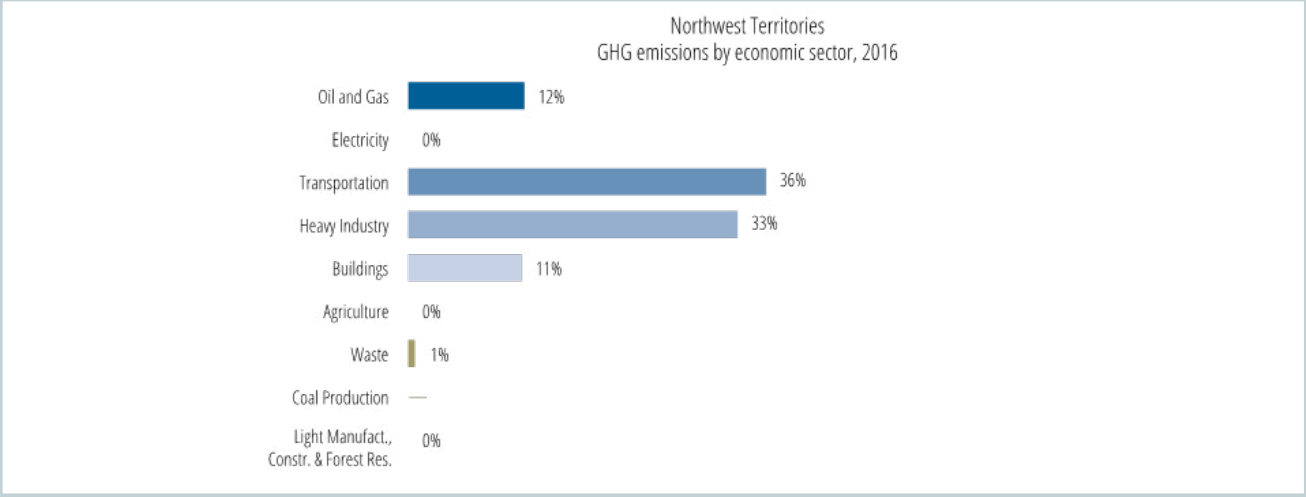

Figure 28: Northwest Territories GHG emissions by economic sector, 2016. Graphic provided by Pembina.

Total emissions in the Northwest Territories were 1.6 Mt CO2eq in 2016—the highest level of any northern Canadian territory equal to 0.2% of overall national GHGs. In per capita terms, territorial emissions were 36.1 t CO2eq or 86% above the Canadian average. The highest emitting sectors in the Northwest Territories are transportation (36% of emissions), heavy industry (specifically, mining) (33%), oil and gas production (12%), and buildings (11%). Territorial GHGs have increased 9% since 2000, the first full year after part of the Northwest Territories became Nunavut.

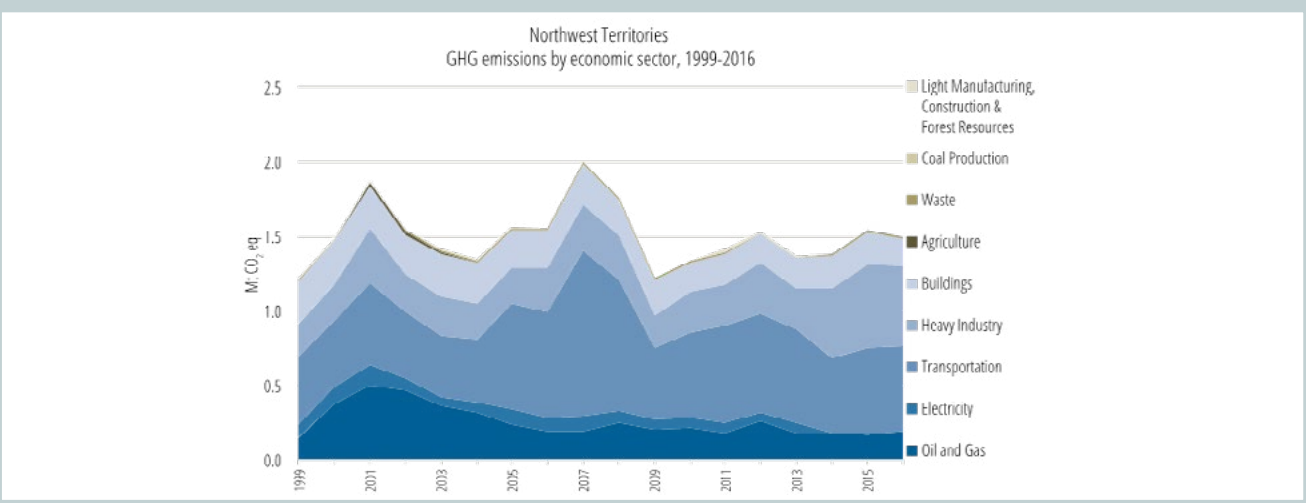

Figure 29: Northwest Territories GHG emissions by economic sector, 2016. Graphic provided by Pembina. Pembina.

Yukon

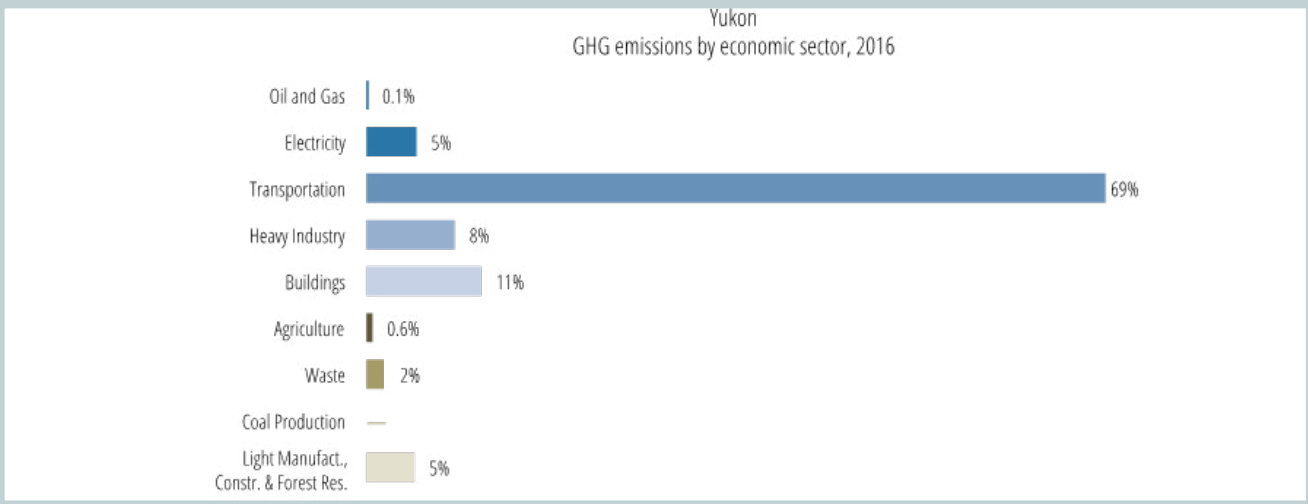

Figure 30: Yukon GHG emissions by economic sector, 2016. Graphic provided by Pembina.

Total GHGs in the Yukon were 0.4 Mt CO2eq (426 thousand tonnes [kilotonnes] CO2eq) in 2016, making it the lowest emitting of any Canadian jurisdiction and responsible for less than 0.1% of overall national GHGs.

In per capita terms, territorial emissions were 11.1 t CO2eq, or 43% below the Canadian average. Total greenhouse gas emissions from the Yukon have declined 20% since 1990. The highest emitting sectors in the Yukon are transportation (69% of emissions), heavy industry buildings (11%), heavy industry (mining) (8%), and electricity (5%).

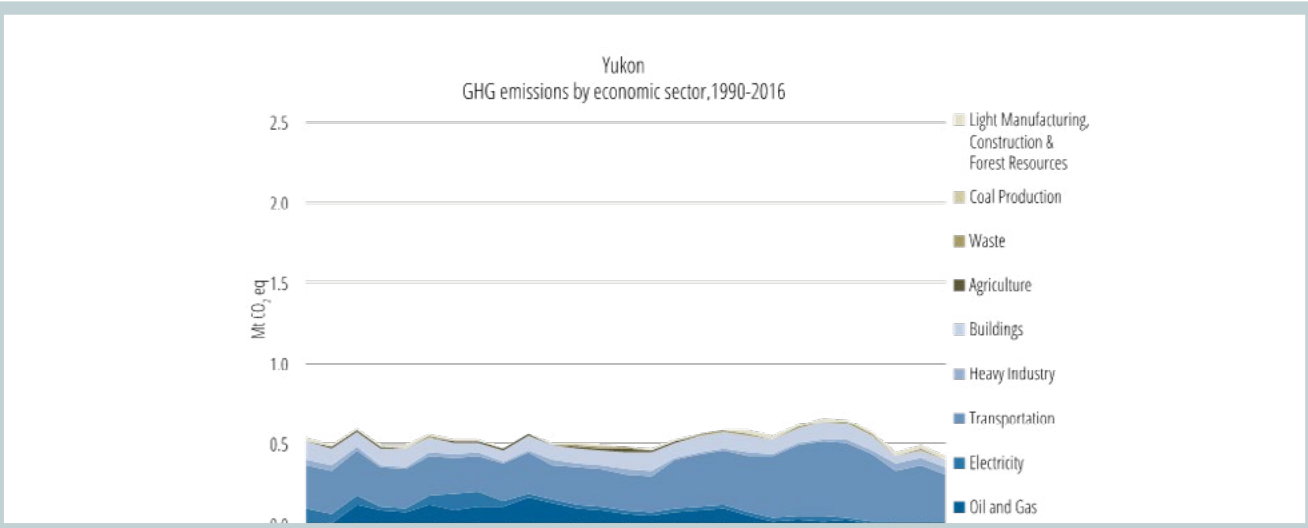

Figure 31: Yukon GHG emissions by economic sector, 2016. Graphic provided by Pembina.

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Endnotes

- 1. One megatonne is equivalent one million metric tons or one billion kilograms.
- 2. Of course, the stability of provincial support for any federal initiative (including the PCF) may depend on the governments in power (and is thus never entirely assured).
- 3. "Waste" includes solid waste, wastewater treatment, and waste incineration, while "others" includes coal production, light manufacturing, and construction and forest resources.
- 4. Figure 4 visualizes only per capita emissions of carbon dioxide (CO2), and not of other greenhouse gases (measured in CO2 equivalent).
- 5. Furthermore, per capita emissions are not necessarily equivalent to the average individual carbon footprint, nor are they the same as household emissions (which would include direct emissions from motor fuel use and residential fuel use for heating, as well as indirect emissions from the production of the goods and services that households consume). Because per capita GHGs are simply total national/provincial/territorial emissions divided by population, in the Canadian context this metric incorporates substantial industrial emissions (e.g., from stationary combustion sources, mobile or transport combustion sources, and manufacturing processes) in addition to emissions generated by individuals or households.
- 6. Figure 1:6 The very latest government emissions projections (ECCC 2018b) are not included in Figs. 1 and 2 but are roughly comparable in terms of the overall emissions trend. As compared with projections contained in Canada's 3rd Biennial Report to the UNFCCC (ECCC, 2017), the new projections show incremental improvement in the reference case (which is based on federal, provincial and territorial policies and measures in place as of September 2018, and which assumes no further government action), but not in the more optimistic "additional measures" case (which includes F-P-T mitigation policies that have been announced, but not yet fully implemented).
- 7. Figure 2: 1 Unless otherwise stated, all Canadian GHG emissions data cited in this module (e.g., in subsequent charts/graphics) derives from Canada's official emissions record, the 2018 National Inventory Report produced by Environment and Climate Change Canada (ECCC, 2018d). Greenhouse gas emissions reported as part of Canada's national inventory include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.
- 8. However, as with any per capita emissions assessment, it is important to note that this metric folds enormous industrial emissions into a simplistic rendering of individuals' carbon footprints; while Alberta's per capita emissions are over three times the national average, it is not accurate to imply that the average individual or household in Alberta leads a vastly more carbon-intensive lifestyle than the average Canadian.
- 9. Typically, in situ production uses a technique called steam-assisted gravity drainage (SAGD), which allows for the recovery of bitumen resources from deep below the surface of the ground.

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