Chapter 3

Climate Change: Ontario's Plan to Reduce Greenhouse Gas Emissions

1.0 Summary

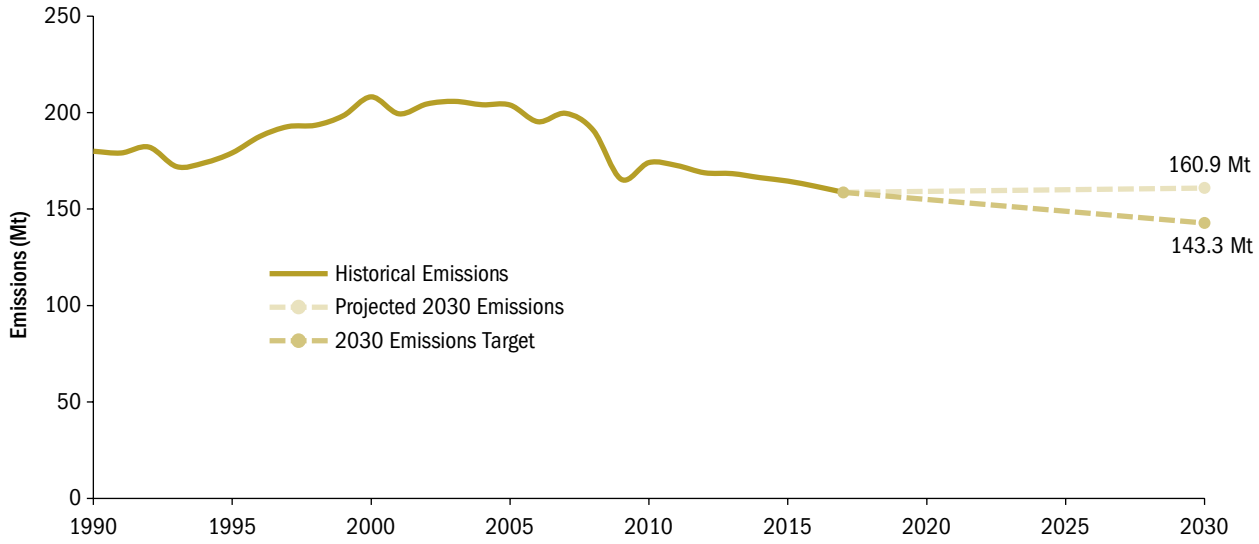
High concentrations of greenhouse gases in Earth's atmosphere, mainly from humans burning fossil fuels, have contributed to an increase in the planet's average surface temperature. While global temperatures vary from year to year, eight of the warmest years on record have occurred in the past 10 years (2009-2018). Human-caused climate change includes higher average global temperatures (often called global warming) as well as more local and regional events, such as heat waves, droughts and increased storm events.

Greenhouse gas emissions in Ontario reached a historical peak of 208 megatonnes (Mt) in 2000. Since then, Ontario's emissions have decreased. According to the most recent data, Ontario's 2017 emissions were 159 Mt. Canada produces 1.5% of global emissions (see **Figure 10**). Ontario produces 22.2% of the Canadian total, and 0.3% of global emissions. The average emissions per person per year in Ontario of 11 tonnes are the second-lowest in Canada after Quebec. However, this is higher than in many developed countries, and almost twice the world average of six tonnes per person per year. With Ontario's well-educated population and its history of innovation in technology, Ontario is well-positioned to demonstrate leadership with its decision to further reduce its emissions while being economically competitive.

Scientific, public and political attention to the impacts posed by climate change has increased in recent years. Established by the United Nations Environment Programme and the World Meteorological Organization in 1988, the Intergovernmental Panel on Climate Change (Panel) is dedicated to providing the world with an objective, scientific view of climate change, its natural, political and economic impacts and risks, and possible response options. Over the years, the Panel has released five assessment reports with increasing clarity on the science of climate change and the contribution that human-caused emissions have had on global warming. In 2014, the Panel warned that climate change was already having widespread impacts on human and natural systems, and that continued greenhouse gas emissions would increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems.

Partly in response to scientific and public concerns about the significant risks to humankind and biological diversity posed by climate change, international bodies, and national and subnational (e.g., Ontario) governments established targets and made commitments to reduce greenhouse gas emissions. The 2015 United Nations Paris Agreement characterizes climate change as an "urgent threat." The Paris Agreement outlines a goal of holding "the increase in the global average temperature to well below 2°C above pre-industrial levels" while pursuing "efforts to limit the temperature increase to 1.5°C." Limiting the global temperature

Figure 1: Ontario's Historical Greenhouse Gas Emissions, Projected Greenhouse Gas Emissions, and 2030 Target
Prepared by the Office of the Auditor General of Ontario



increase to 1.5°C would help avoid some of the more severe impacts associated with higher global temperatures.

With the proclamation of the *Cap and Trade Cancellation Act, 2018* (Act), the Ontario government committed to establish greenhouse gas emission-reduction targets, and the Ministry of the Environment, Conservation and Parks (Ministry) became required to prepare a new climate change plan.

In November 2018, the Ministry released "Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan" (Plan). The Plan was posted for a 60-day public comment period on the Environmental Registry on November 29, 2018.

At the time the Plan was drafted, the Ministry estimated that, if no further emission-reduction actions are taken, Ontario's greenhouse gas emissions would increase by 0.1 Mt—from an estimated 160.8 Mt in 2018 to 160.9 Mt in 2030. Also known as the "business-as-usual forecast," this is Ontario's projection of future emissions if economic growth continues and no additional emission-reduction initiatives are taken. Estimating this forecast as accurately as possible is important because it provides the starting point for assessing and planning emission-reduction programs.

The Plan sets a target to reduce Ontario's greenhouse gas emissions to 30% below 2005 levels by 2030. Based on the emissions data available to the Ministry at the time, this represents a reduction to 143.3 Mt by 2030—17.6 Mt lower than the 2030 business-as-usual forecast of 160.9 Mt (See **Figure 1**). The Plan states that this target aligns Ontario with Canada's 2030 target under the Paris Agreement (30% below 2005 levels by 2030).

To achieve Ontario's proposed 2030 target, the Plan outlines eight areas where the Ministry expects emissions reductions (see **Figure 2**). The Ministry estimated reductions for each area based on proposed initiatives and various assumptions.

Our audit focused on the process the Ministry used to develop the Plan, and the evidence underlying the proposed emissions reductions identified in the Plan to achieve the 2030 target.

Our audit found that the Ministry's projected emissions forecast, and the estimated emissions reductions for all eight areas, are not yet supported by sound evidence. As a result, our analysis found that the initiatives in the Plan have the potential to achieve between 6.3 Mt and 13.0 Mt of the 17.6 Mt emission-reduction target. Specifically, we found:

- **The Plan's "business-as-usual" emissions projection for 2030 was re-estimated**

Figure 2: Emission-Reduction Areas in Plan to Reach 2030 Target

Prepared by the Office of the Auditor General of Ontario

Plan Area	Description	Ministry Estimate (Mt)[1]	OAGO Revised Estimate (Mt)	Section References in This Report
"Business As Usual" Emissions Forecast	**Ontario's 2030 emissions if no new emission-reduction actions taken**	**160.9**	**163.6[2]**	**S.4.3**
Emissions Reductions		**Reduced By**		
Low Carbon Vehicles Uptake	Increased uptake of electric vehicles	2.6	0.0	**S. 4.4.1**
	Increased uptake of compressed natural gas-powered freight vehicles	0.2	0.0	**S. 4.4.2**
Clean Fuels	Increased renewable content in gasoline	1.0	1.0	No issues noted
	Increased renewable natural gas supply	2.3	0.0	**S. 4.4.3**
Federal Clean Fuel Standard	Proposed federal standard that would require fuel suppliers to reduce the carbon intensity of their fuels	1.3	0.0–6.5	**S. 4.4.4**
Natural Gas Conservation	Natural gas conservation and efficiency programs delivered by utilities	3.2	3.2	**S. 4.4.5**
Industry Performance Standards	Facility- or sector-specific standards for industry to pay a price for emissions that exceed set levels	2.7[3]	1.0	**S. 4.4.6**
Emission Reduction Fund	Loans to pay for the capital costs of energy-efficiency projects for buildings	0.5	0.3	**S. 4.4.7**
	Reverse auction (funding projects with the lowest cost emission reductions)	0.1	0.0–0.1	**S. 4.4.8**
Other Policies	Improved diversion of food and organic waste from landfills	1.0	0.7	**S. 4.4.9**
	Implementation of the GO Regional Express Rail across the GO Transit network	0.1	0.1	**S. 4.5**
Innovation	Increased energy storage capacity	0.3	0.0	**S. 4.4.10**
	Cost-effective fuel switching (from high-carbon heating to electricity in buildings)	0.2	0.0	**S. 4.4.10**
	Future Innovation (other future market-developed technologies)	2.2	0.0	**S. 4.4.11**
Net Emissions Reductions[4]		**17.6**	**6.3–13.0**	
Net Emissions		**143.3**	**150.6–157.3**	

1. Note that the Plan does not account for the potential impact of the federal carbon pricing system.
2. In August 2019, our Office received an updated 2030 projection from the Ministry of 163.6 Mt. This includes a 4.1 Mt increase in electricity sector emissions due to changes in the electricity sector since Ontario's 2017 Long-Term Energy Plan was released.
3. Subsequent to the release of the Plan, the Ministry finalized the Industry Performance Standards. The Ministry now estimates that 1.0 Mt in emissions reductions will be achieved in 2030.
4. Net emissions reductions may not add due to rounding.

in August 2019 to be 163.6 Mt. Since November 2018, new information has been incorporated into the model the Ministry used to project emissions. In August 2019, our Office requested that the Ministry re-run the model to estimate the 2030 projection again. This time, the model estimated that Ontario's emissions in 2030 would be 163.6 Mt if no further emission-reduction actions are taken—2.7 Mt higher than the projection

on which the Plan is based. This changed projection is a result of a number of factors, including new emissions data. Moreover, in November 2018, when projecting what Ontario's business-as-usual emissions would be in 2030, the Ministry included electricity-sector policies factored into Ontario's 2017 Long-Term Energy Plan. The Long-Term Energy Plan is based on initiatives that were in place in 2017 that would lower the emissions of electricity generation. Some initiatives, including renewable energy contracts, were cancelled before the Ministry calculated its 2030 projection. This demonstrates that projected emissions will change due to a number of factors and should be regularly re-estimated to account for changes in policies and programs.

- **The Plan's estimate for emissions reductions from Low Carbon Vehicles Uptake includes reductions from cancelled programs that supported electric vehicle adoption.** In estimating the 2.6 Mt in emissions reductions from the uptake of electric vehicles, the Ministry assumed there would be 1.3 million electric vehicles on Ontario's roads by 2030. This is a more than 3,000% increase from approximately 41,000 electric vehicles in 2019. This estimate is based on a number of factors, including the impact of programs that were cancelled in summer 2018. These programs provided incentives for leasing or buying electric vehicles, and installing workplace and home charging stations. The Ministry has not yet identified any planned initiatives that could increase the uptake of electric vehicles in Ontario to achieve the greenhouse gas reductions forecasted for this area.
- **The Plan estimates emissions reductions from natural gas customers switching to renewable natural gas, though evidence shows that the higher cost of renewable natural gas means that few customers would switch.** To achieve 2.3 Mt of emissions reductions, the Plan proposes that Ontario require utilities to offer customers the option of purchasing renewable natural gas. However, evidence in both Ontario and British Columbia has shown that few natural gas utility customers purchase renewable natural gas. In fact, during the Plan's development, Ministry staff estimated there would be "negligible" emissions reductions (0.0049 Mt in 2030) from this voluntary initiative because of the higher costs and therefore lower sales of renewable natural gas. Instead of using the staff analysis, the emissions reductions in the Plan are based on a submission to the Ministry from the Ontario Energy Association (OEA), an industry association that represents Ontario's electricity and natural gas utilities, among other companies. In its submission, the OEA described the potential to achieve 2.3 Mt of emissions reductions through renewable natural gas supply as "illustrative and [indicated that] more pilot programs are required to demonstrate provincial and regional potential."
- **The Plan relies on the federal government's proposed Clean Fuel Standard for emissions reductions of 1.3 Mt by 2030. The Standard is not yet finalized, and is tentatively planned to come into effect two to three years from now.** Since 2017, Environment and Climate Change Canada has held consultations to develop a Clean Fuel Standard to reduce Canada's greenhouse gas emissions. By setting performance standards for liquid, solid and gaseous fossil fuels, the proposed standard would require fuel suppliers to reduce emissions throughout the life cycle of their fuels. In June 2019, Environment and Climate Change Canada released a proposed regulatory approach and plans to continue consultations over the next few years. Liquid fuel regulations are planned to take effect in January 2022 and gaseous

and solid fuel regulations would take effect in January 2023. Because the Plan counts on reductions from the implementation of these proposed federal regulations to meet its 2030 target, there would be an emission-reduction shortfall if the federal regulations are not implemented.

- **The Plan double counts some emissions reductions that are targeted by more than one program.** The expected emission-reduction impact of the Plan was estimated by measuring the impact of several initiatives, most of which were estimated in isolation. The emission-reduction impacts of some initiatives will overlap with those of others. The Ministry partially accounted for this overlap but double counted in some instances. This resulted in an overstatement of total emissions reductions. For example, the Plan contains two separate programs aimed at reducing emissions from natural gas use (Natural Gas Conservation and an Emission Reduction Fund, referred to in the Plan as the Ontario Carbon Trust). The Plan estimates 3.2 Mt in emissions reductions from Natural Gas Conservation programs. These programs provide incentives to customers, including residential, commercial and industrial customers, to reduce their natural gas use. In estimating these reductions, the Ministry based its calculations on a study that modelled various future potential scenarios. The Ministry selected a scenario that assumes that all cost-effective natural gas conservation would be funded and achieved. Under such a scenario, homeowners would not require loans through the Emission Reduction Fund to take measures to reduce the use of natural gas, like insulating attics and basements. The Plan overestimates the emissions reductions associated with the Emission Reduction Fund, as it does not account for the overlap of the Emission Reduction Fund and Natural Gas Conservation, and attributes emissions reductions achieved through residential natural gas conservation to both programs. Furthermore, the Plan estimates 2.7 Mt in emissions reductions in 2030 from the Industry Performance Standards. This is an overestimation as it does not account for the overlap with both Natural Gas Conservation and the federal Clean Fuel Standard. Since releasing the Plan, the Ministry finalized the Industry Performance Standards and now estimates that this initiative will result in only 1.0 Mt in emissions reductions by 2030.
- **The Plan improperly counts emissions reductions expected from reducing exported organic waste.** Food and organic waste that is sent to landfill decomposes and creates methane, a potent greenhouse gas. Currently, approximately 40% of Ontario's municipal solid waste for disposal is exported and landfilled in the United States. The Ministry expects about 0.3 Mt of emissions reductions will result from diverting food and organic waste that would otherwise be exported and landfilled in the United States. However, the guidelines of the Intergovernmental Panel on Climate Change require the emissions generated by this exported and landfilled waste to be counted in the United States' emissions inventory—not Ontario's inventory. Therefore, any reduction in these emissions would be accounted for in the United States.
- **The Plan states that Future Innovation will reduce emissions, but no emission-reduction programs have yet been identified.** The Ministry estimates that 2.2 Mt of emissions reductions by 2030 will come from Future Innovation. The Ministry was unable to provide any evidence to support this estimate, indicating that the amount represents the projected remaining emissions needed to reach the 2030 target. At the time of our audit, there were no planned initiatives or

staff assigned to develop initiatives to achieve emissions reductions in this area.

In reviewing the process used by the Ministry to develop the Plan, our Office learned that Ministry staff estimated 2030 emissions based on three scenarios: the Reference Case (the emissions expected if no new climate policies are pursued); the Climate Change Plan Case (the emissions expected if initiatives in the Plan are put in place); and the Extended Policy Case (the emissions expected if additional or enhanced policies are pursued). Ministry staff internally noted that actions in the Plan are not yet sufficient to achieve the 2030 target; staff estimated that implementing initiatives in the Plan could likely achieve only 10.9 Mt in emissions reductions, 6.7 Mt less than the 17.6 Mt presented in the Plan.

Our audit also found that:

- **The Ministry did not fully estimate costs for more than half of the emission-reduction areas included in the Plan.** Of the 147 proposed initiatives that the Ministry compiled and considered for inclusion in the Plan, 69 were identified as having the potential for measurable emissions reductions. Of these, the costs of implementation were estimated for 28 (41%). Of the eight emission-reduction areas that were ultimately included in the Plan, the Ministry estimated the total costs for three areas. When the Ministry released the Plan, it had not yet evaluated the total costs of the other five: Low Carbon Vehicles Uptake, Clean Fuels, the federal Clean Fuel Standard, Industry Performance Standards, and Innovation.
- **An expert panel has not yet been appointed to provide advice on Ontario's climate change plan.** Under the *Cap and Trade Cancellation Act, 2018*, the Minister may appoint panels to provide advice to assist in developing the climate change plan.
- **Other provincial ministries are making decisions that may increase Ontario's emissions.** Under the Plan, the Ministry of the Environment, Conservation and Parks has the responsibility to co-ordinate Ontario's actions on climate change. However, many of the emission-reduction initiatives in the Plan are not within the Ministry's control and are the responsibility of other ministries. The Ministry is the lead for five initiatives, which account for 5.6 Mt (31%) of the estimated 17.6 Mt reductions expected from implementing the Plan. Several recent decisions by other ministries and agencies, such as the expansion of natural gas infrastructure, changes to the Building Code, and amendments to the Growth Plan for the Greater Golden Horseshoe, are likely to adversely impact Ontario's emission-reduction goals. The government has established a cross-ministry Climate Change Leadership Team to make climate change a cross-government priority, but it is unclear whether the team has the capacity and resources to deliver results. The team has no authority over whether ministries adopt its recommendations, and instead must rely on working collaboratively and making suggestions. It is working on several pilot projects that could support decision making in other ministries.

Overall Conclusion

Our audit concluded that the emission-reduction estimates in the Plan are not based on sound evidence or sufficient detail. In its current early state, the Plan is not likely to achieve its proposed emission-reduction target. The Ministry recognizes that more time is needed to develop, refine and update the Plan for future publication.

Given the limited time available to develop the Plan, the Ministry was unable to use an integrated model to properly select, design or accurately estimate reductions associated with emission-reduction initiatives. Our assessment of the assumptions and emissions double counting found that the Plan overestimates the emissions reductions expected. Overall, our analysis found

that the initiatives in the Plan have the potential to achieve between 6.3 Mt and 13.0 Mt of the 17.6 Mt emission-reduction target (see **Figure 2**). Ministry staff estimated that implementing initiatives in the Plan could achieve about 10.9 Mt in emissions reductions. Additional, unidentified policies would be needed to fill the gap.

Our audit also found that most of the initiatives to reduce emissions lay outside the Ministry's control, and that recent decisions by other ministries could undermine progress.

This report contains 19 recommendations, consisting of 22 actions, to address our audit findings.

OVERALL MINISTRY RESPONSE

The Ministry appreciates the work of the Auditor General and the recommendations on how we can best move forward with our greenhouse gas reduction initiatives.

Our Made-in-Ontario Environment Plan was developed using the best available information and modelling at the time. The province will continually evolve the Plan with updated modelling, information and actions so that it contains the most effective and affordable ways to reduce greenhouse gas emissions. We remain committed to lowering greenhouse gas emissions to 30% below 2005 levels by 2030, a target that aligns with the federal government's Paris commitments.

The province has already taken significant steps to reduce our greenhouse gas emissions, with Ontario's emissions down 22% since 2005. We continue to take important actions such as finalizing Ontario's Emissions Performance Standards for large, industrial emitters to ensure polluters are accountable for their greenhouse gas emissions.

The Auditor General points out ways that we can strengthen our Plan by ensuring emission-reduction efforts are based on current and best-available information, public reporting, and improving collaboration on emission-reduction efforts across the government.

We will consider the Auditor General's report and recommendations carefully as we continue to consult and collaborate with stakeholders and other governments to evolve and implement our Plan.

2.0 Background

With the proclamation of the *Cap and Trade Cancellation Act, 2018*, the Ontario government committed to establish greenhouse gas emission-reduction targets, and the Ministry of the Environment, Conservation and Parks (Ministry) became required to prepare a new climate change plan. In November 2018, the Ministry released "Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan" (Plan) for public consultation.

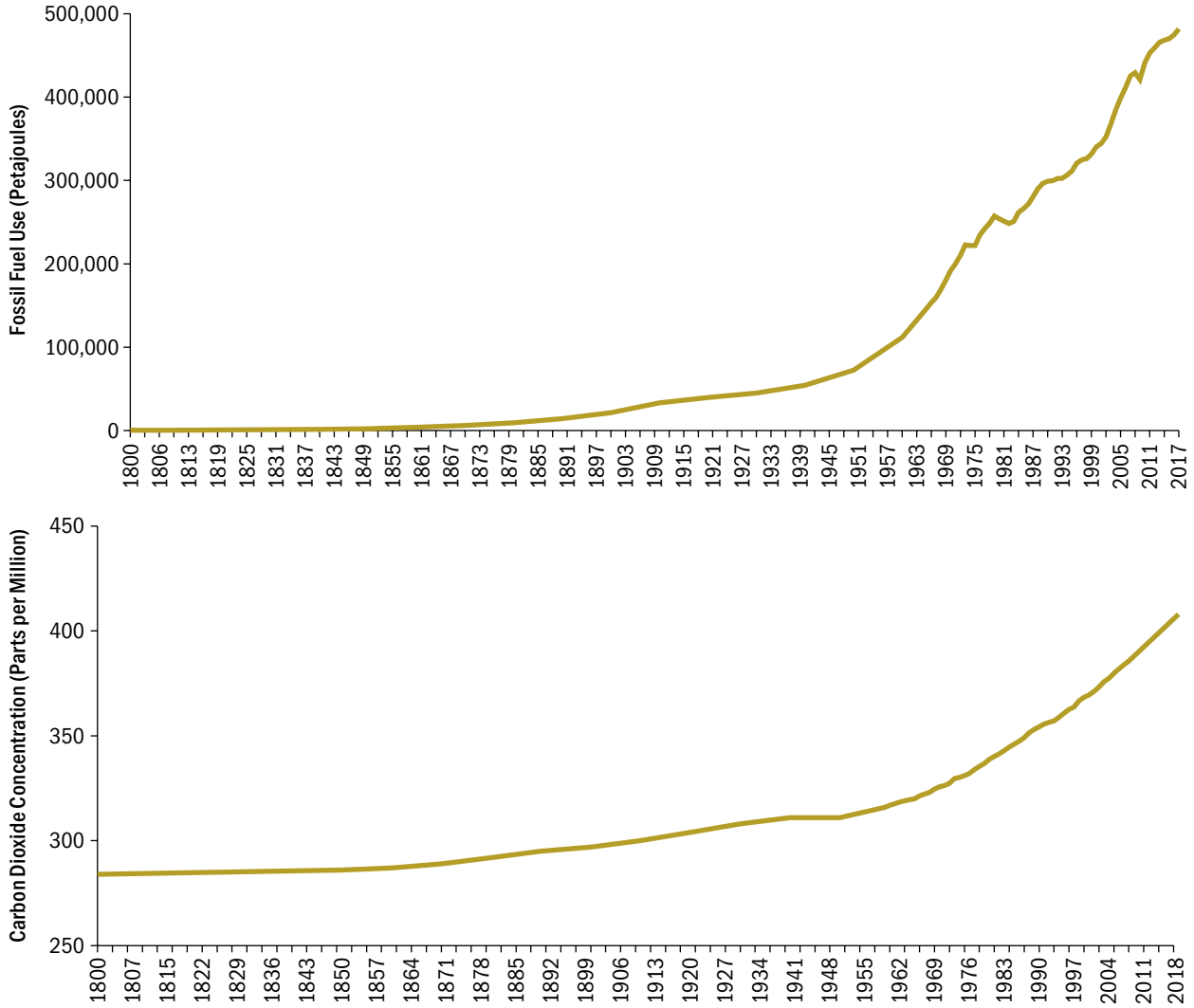
2.1 Greenhouse Gas Emissions and Climate Change

Greenhouse gases in Earth's atmosphere let the sun's energy in, but block its heat from escaping, like glass traps heat in a greenhouse. The most common greenhouse gas emitted into the atmosphere through human activity is carbon dioxide, but others, including methane and nitrous oxide, are powerful heat trappers, even at very low concentrations. Greenhouse gases, some of which are produced naturally from forest fires, volcanoes, and decomposing organic matter, have helped regulate Earth's temperature for millions of years. (For the definition of greenhouse gas and other terms, see the glossary in **Appendix 1** of this report).

However, since the 1800s, human activity has resulted in the release of large volumes of greenhouse gases into Earth's atmosphere (see **Figure 3**). The most common sources are the fossil fuels, such as coal, oil and natural gas, that are burned

Figure 3: Historical Global Fossil Fuel Use and Atmospheric Carbon Dioxide Concentration Levels

Source of data: Vaclav Smil (2017) Energy Transitions: Global and National Perspectives, BP Statistical Review of World Energy, and National Oceanic and Atmospheric Administration

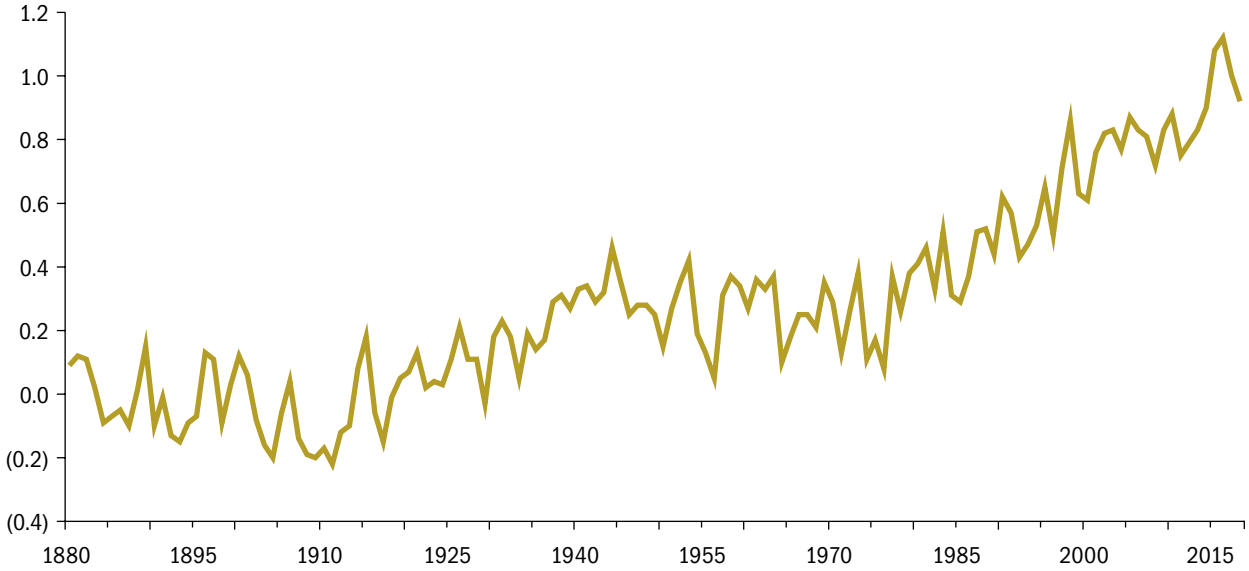


for electricity generation, industrial activities, transportation, and heating buildings. Other contributors include the decomposition of food and organic waste in landfills, excess use of artificial fertilizers, and emissions from cattle and other livestock. Deforestation and other land use changes also release carbon dioxide and methane into the atmosphere. At the start of the industrial revolution in about 1750, carbon dioxide levels in the atmosphere were about 280 parts per million (ppm). By 2018, this global average level had increased to 407 ppm.

As greenhouse gases accumulate over time, they increase global temperatures (**Figure 4**). The release of greenhouse gases from human activity has already caused an increase in global average surface temperatures of 0.8°C to 1.2°C compared with pre-industrial levels. The impact of greenhouse gas emissions on global temperature lasts for years because emissions can remain in the atmosphere for decades or more, depending on the type of gas, contributing to the cumulative total in the atmosphere. It does not matter where emissions occur—the total of all emissions in Earth's atmosphere have an impact on global warming.

Figure 4: Change in Global Average Air Temperatures Since 1880, Compared to 1850–1899 Average (°C)

Source of data: HadCRUT4: UK Met Office Hadley Centre and University of East Anglia Climatic Research Unit



In addition, increased temperatures can create feedback loops that increase warming even more. For example, oceans absorb carbon dioxide. But as ocean waters warm, they absorb less carbon dioxide. This means more carbon dioxide remains in the atmosphere, which results in even more rapid warming. Warmer temperatures melt snow and ice that reflect the sun's rays, revealing the darker water and land underneath. The darker water and land absorb more heat than snow and ice, resulting in even more warming.

Ontario is warming faster than the global average. Between 1948 and 2016, the global average temperature increased 0.8°C, while Ontario warmed 1.3°C. Environment and Climate Change Canada expects the rate of warming in Ontario to be almost double the global average by the end of this century. This is due to a number of factors, including the melting snow and ice in Northern Ontario and Ontario's large land mass.

2.1.1 The Impacts of Climate Change

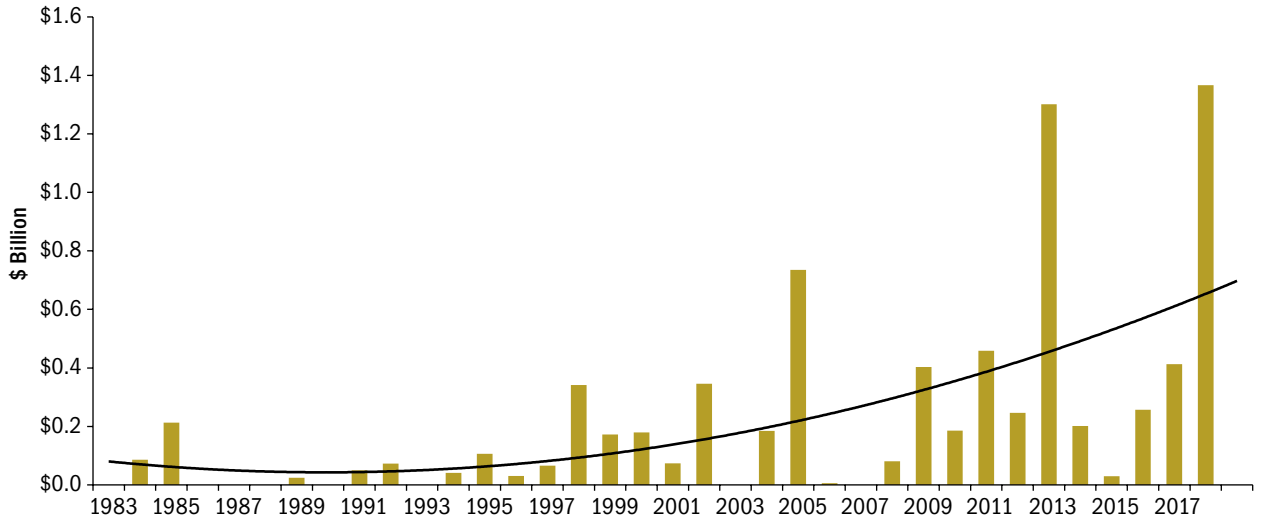
Warmer global temperatures contribute to melting glaciers and sea ice, rising sea levels, increased acidity and decreased oxygen in the ocean, extended heat waves and droughts, and an increased severity and frequency of storms, flooding and wildfires. Significant impacts on biodiversity and ecosystems, infrastructure, agriculture, food and water supply and security, human and wildlife health, transportation systems and tourism have been attributed to climate change.

Climate change impacts have already been observed in Ontario, and will continue contributing to wide-ranging negative effects that could include:

- More intense, more frequent, and longer heat waves that can adversely affect human health. According to Public Health Ontario, between 2003, the first full year data was collected, and 2018, the rate of heat-related emergency department visits in Ontario more than tripled from 4.6 visits per year per 100,000 Ontarians to 14.6 visits.
- Warmer temperatures that can limit water availability, affect crop production, damage vineyards and distress livestock.
- Milder winters that can increase winter floods, shorten the winter ice road season in Northern Ontario, and affect recreational activities like skiing, skating and ice fishing.

Figure 5: Total Insured Losses in Ontario Due to Large Catastrophic Events

Source of data: Insurance Bureau of Canada Facts Book, CatIQ, PCS, Swiss Re, Munich Re, and Deloitte



Note: Each bar represents costs due to the damage of personal and commercial property, and automobiles, excluding adjustment expenses. Large catastrophic losses include damage due to wind, water, ice, snow, hail, fire, lightning and earthquakes. Only events where total insured losses were greater than $25 million are included. Values in 2018 $ Cdn. The line is the estimated trend line.

- Milder winters that can facilitate the spread of invasive species like the Emerald Ash Borer, which feeds on Ash trees. Milder winters can also facilitate the spread of diseases, such as West Nile virus spread by infected mosquitos and Lyme disease spread by blacklegged ticks. According to Public Health Ontario, Lyme disease rates have increased more than 1,600%, from 0.4 reported cases per 100,000 Ontarians in 2005 to 7.0 in 2017.
- Changes in weather patterns, including heat waves, rainfall and freeze-thaw cycles, can affect infrastructure like wastewater treatment plants, bridges and roads, public transit and electricity distribution, and cause flooding of farms and homes. According to the Insurance Bureau of Canada, large catastrophic events in 2018 caused almost $1.4 billion in insured damage across Ontario (see **Figure 5**).

Ontario is also expected to be affected by the indirect effects of climate change, including impacts on the availability and delivery of food from other parts of the world. In its Plan, the Ministry of the Environment, Conservation and Parks stated that "people across the province—especially Northern communities—and all sectors of the economy are feeling the impacts of climate change and paying more for the costs associated with those impacts."

2.1.2 Ontario's Greenhouse Gas Emissions

In Canada, national reporting on greenhouse gas emissions began in 1992 with emissions estimates for 1990. Greenhouse gas emissions, which are estimated in tonnes (t) and megatonnes (Mt), are generally not measured directly but are estimated from data and calculations, such as how much fuel is burned or how much organic waste is sent to landfills. When quantifying and studying greenhouse gases, the global warming impacts of different gases (e.g., methane, nitrous oxide) are compared in terms of their carbon dioxide equivalent—that is, the amount of carbon dioxide that would create the same amount of warming over a specified period of time.

Greenhouse gas emissions in Ontario reached a historical peak of 208 Mt in 2000 (see **Figure 1**). Since then, Ontario's emissions have decreased. According to Environment and Climate Change Canada, Ontario's greenhouse gas emissions in 2017 were 159 Mt, 12% below the 1990 level of

Figure 6: Greenhouse Gas Emissions Produced by Provinces in 1990, 2005 and 2017 (Mt)

Source of data: Environment and Climate Change Canada (2019)

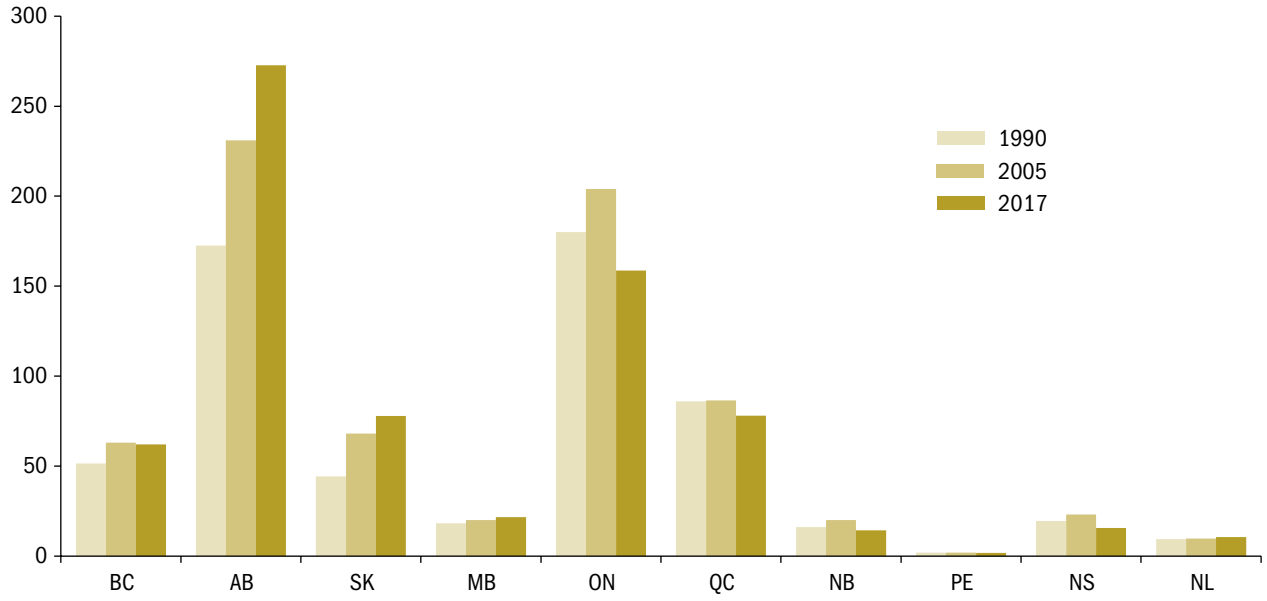
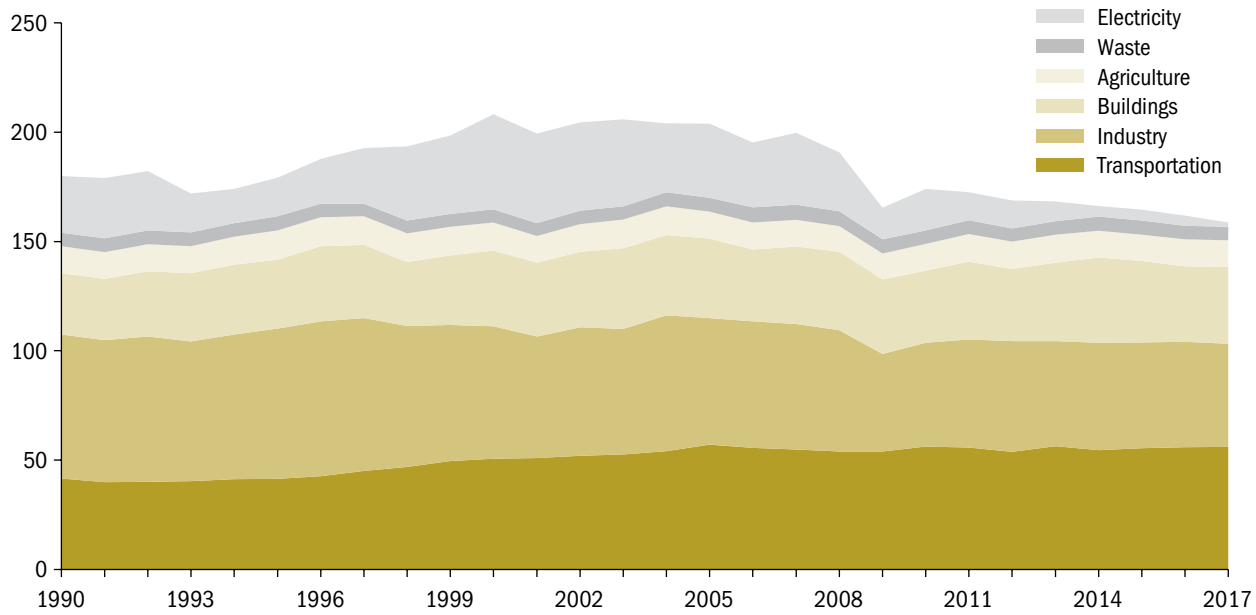


Figure 7: Ontario's Greenhouse Gas Emissions by Sector, 1990–2017 (Mt)

Source of data: Environment and Climate Change Canada (2019)



180 Mt. Ontario is not the only province to have reduced its emissions below 1990 levels. **Figure 6** shows the change in greenhouse gas emissions produced by Ontario and other Canadian provinces.

Ontario's decreasing greenhouse gas emissions have resulted mostly from changes in how we produce electricity. Between 2005 and 2014, Ontario phased out burning coal to generate electricity. However, while emissions decreased by 24 Mt in Ontario's electricity sector between 1990 and 2017, the combined emissions from all other sectors increased by 2 Mt (**Figure 7**).

Other, non-electricity greenhouse gas emissions come from transportation, industry, buildings,

Figure 8: Ontario Greenhouse Gas Emissions Sources and Ways to Reduce Them, by Economic Sector

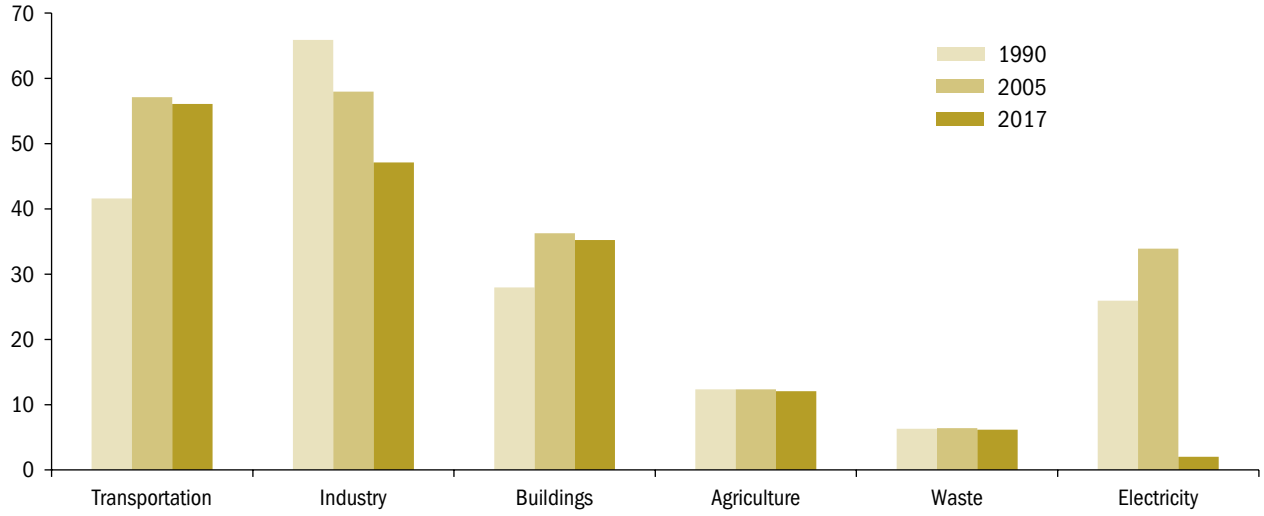
Source of data: Environment and Climate Change Canada (2019)

Economic Sector and 2017 Emissions	Most Common Sources of Emissions	Primary Actions to Reduce Emissions	Examples of Means of Implementing these Actions
Transportation 56 Mt (35% of total)	Gasoline cars and trucks, diesel trucks	• Reduce the travel distances required • Switch to low- or zero-carbon modes of transport	• Design walkable communities • Work from home • Walk, bicycle, use public transit, rideshare, or drive an electric vehicle
Industry 47 Mt (30% of total)	Natural gas and coke boilers, industrial processes	• Minimize energy use and material waste • Switch to low- or zero-carbon industrial inputs • Use carbon capture and storage (CCS) technology	• Use renewable energy in industrial processes • Use materials for producing low-carbon cement and steel • Install CCS at facilities that produce highly concentrated carbon dioxide emissions
Buildings 35 Mt (22% of total)	Natural gas furnaces and hot water tanks and refrigerants	• Minimize building heating requirements • Switch to passive or high-efficiency heating and ventilation technologies that use low- or zero-carbon energy sources • Reduce leakage of refrigerants	• Insulate and improve air tightness • Install heat pumps, and energy/heat recovery ventilators • Use air conditioners with refrigerants that have a low global warming potential, and collect waste refrigerants
Agriculture 12 Mt (8% of total)	Fertilizer, livestock, manure, on-farm fuel use	• Build up farm soils to increase carbon storage • Optimize use of fertilizers/manure	• Practise no-till agriculture • Use precision agriculture techniques
Waste 6 Mt (4% of total)	Organic waste decomposition, waste water treatment, incineration	• Reduce waste generation • Divert waste from landfills • Capture landfill gas	• Design products for easy repair, reuse and/or recycling • Compost organic waste • Install landfill gas capture systems
Electricity 2 Mt (1% of total)	Natural gas power plants	• Reduce electricity consumption at times of peak demand • Phase out greenhouse gas-intensive power	• Behaviour change • Use hydro, nuclear, wind, solar, and biomass power while enhancing energy storage
Ontario Total – 159 Mt			

agriculture and waste. In 2017, transportation was the largest contributor to Ontario's greenhouse gas emissions (35%), followed by industry (30%), buildings (22%), agriculture (8%) and waste (4%). Electricity generation contributed 2 Mt, or 1% of Ontario's total emissions (**Figure 8**). See **Figure 9** for the changes in Ontario's emissions by sector since 1990. See **Appendix 2** for a detailed breakdown of greenhouse gas emissions from economic sectors and subsectors. See **Appendix 3** for a list of the 25 highest greenhouse gas emissions reporters in 2017.

Despite decreases in Ontario's greenhouse gas emissions overall since 1990, the average emissions per person, per year, in Ontario are higher than in many developed countries, and almost twice the world average. However, the Ontario average of 11 tonnes is less than the Canadian average of 20 tonnes per person (**Figure 10**). In Canada, Saskatchewan and Alberta's per capita emissions

Figure 9: Ontario's Greenhouse Gas Emissions by Economic Sector in 1990, 2005 and 2017 (Mt)
Source of data: Environment and Climate Change Canada (2019)



are more than three times higher than any other province, mainly due to emissions from the oil and gas sector, and coal-fired electricity generation. Canada produces 1.5% of global emissions. Ontario produces 22.2% of the Canadian total, and 0.3% of global emissions.

2.2 Reducing Greenhouse Gas Emissions

There are two types of strategies for addressing climate change: *mitigation* focuses on slowing down global warming by reducing greenhouse gas emissions, and *adaptation* focuses on reducing the harm caused by the effects of climate change. Typically, mitigation efforts include:

- limiting or reducing the amount of greenhouse gas emissions from burning fossil fuels by conserving energy or using renewable fuels, for example; and
- capturing and storing carbon dioxide. This can be done by capturing carbon from industrial and energy-related sources, such as coal-fired power plants, and storing it long term in geological formations, such as oil and gas fields, coal beds, and oceans. These approaches can be very expensive on a per-tonne basis. Carbon can also be stored by preserving or creating carbon sinks, which include natural environments like forests and peatlands, as well as soils. Land use development, mining, forestry and agriculture can negatively impact natural carbon sinks.

Several options, each with benefits and challenges, are available to governments to get people and businesses to reduce their greenhouse gas emissions. These include:

- **legislation and regulations:** the government sets laws or rules that apply to businesses and/or consumers to limit emissions. This may require reducing emissions to a certain level, switching fuels or installing technologies. The costs of making such changes may be passed on to consumers.
- **pollution pricing:** the government applies a price to greenhouse gas emissions, which may be passed on to consumers. There are several ways this has been done, including:
  - Using a cap and trade approach. A limit is placed on the amount of greenhouse gases that may be emitted, but individual entities covered by the system are allowed to buy the right to produce additional emissions from those who have reduced theirs.
  - Using a carbon levy. A price is charged directly for emitting greenhouse gases.

Figure 10: Comparison of Greenhouse Gas Emissions by Jurisdiction

Sources of data: Potsdam Institute For Climate Impact Research, World Bank, Environment and Climate Change Canada, and Statistics Canada

	Population (000)	Emissions per Capita (t)	Total Emissions (Mt)
World	7,426,103	6	47,200
G20 Members			
China	1,378,665	9	12,700
United States	323,071	20	6,570
European Union	511,219	9	4,353
India	1,324,510	2	2,870
Russia	144,342	18	2,670
Japan	126,995	10	1,310
Brazil	206,163	5	1,050
Germany	82,349	11	918
South Korea	51,246	14	732
Mexico	123,333	6	718
Canada	**36,109**	**20**	**716**
Saudi Arabia	32,443	21	676
Indonesia	261,554	3	674
Australia	24,191	23	552
South Africa	56,204	9	531
Turkey	79,821	6	504
United Kingdom	65,596	8	494
France	66,860	7	468
Italy	60,627	7	433
Argentina	43,590	8	334
Canadian Provinces and Territories			
Alberta	4,244	64	273
Ontario	**14,071**	**11**	**159**
Quebec	8,298	9	78
Saskatchewan	1,151	68	78
British Columbia	4,922	13	62
Manitoba	1,335	16	22
Nova Scotia	951	16	16
New Brunswick	767	19	14
Newfoundland and Labrador	529	20	11
Prince Edward Island	151	12	2
Yukon	40	13	1
Nunavut	38	16	1
Northwest Territories	45	28	1

* Note: Per capita emissions are in tonnes per person. Data is from 2017 for Canadian jurisdictions, and from 2016 for G20 countries and the world.

The levy is usually applied to fossil-fuel purchases, such as gasoline. The government controls the price and may choose to charge the levy to individuals and/or businesses.

- **financial investments:** government funding, subsidies and rebates that encourage businesses and/or consumers to reduce their emissions.
- **information programs:** the government provides information that encourages voluntary actions to reduce emissions.

Appendix 4 presents examples of options used in Ontario to reduce greenhouse gas emissions. **Appendix 5** presents examples of best practice elements of an effective climate change plan.

2.2.1 International Actions to Reduce Emissions

In the last 30 years, countries around the world have worked to develop international agencies and agreements to address climate change (see **Appendix 6**).

In 1987, the international community agreed to the Montreal Protocol on Substances that Deplete the Ozone Layer. Under this global agreement, countries agreed to phase out the production and consumption of ozone depleting substances that are used in refrigeration, air conditioning, aerosols and other applications. Since many of these substances are also greenhouse gases, their elimination has significantly contributed to combatting climate change.

In 1988, the Intergovernmental Panel on Climate Change (Panel) was established by the United Nations Environment Programme and the World Meteorological Organization as an expert, international organization to assess the science of climate change, its impacts and future risks. The Panel does not conduct its own scientific research, but assesses the current scientific literature to provide advice to governments. Since 1988, the Panel has released five comprehensive assessment reports outlining the state of the science on climate change. The Fifth Assessment Report, released as separate volumes in 2013 and 2014, concludes that human activities are the main cause of climate change, and that the impacts will become much worse unless a significant reduction in global greenhouse gas emissions is achieved.

In addition to establishing the Panel, the global community has negotiated several agreements to establish an international approach to this challenge. For example, the United Nations Framework Convention on Climate Change (UN Framework Convention) is an international treaty negotiated at the United Nations Earth Summit in 1992. The UN Framework Convention requires that countries follow standardized guidelines for reporting greenhouse gas emissions released within their own boundaries to the UN Framework Convention Secretariat.

In 2015, the international community negotiated the Paris Agreement under the UN Framework Convention. It came into effect in 2016 and there are now 187 parties to the agreement. The Paris Agreement aims to keep the global average temperature increase well below 2°C compared to pre-industrial levels, and ideally below 1.5°C, to help avoid some of the more severe impacts associated with higher temperatures.

According to the Panel, an increase of global average temperature from 1.5°C to 2°C would increase the risk of extreme heat, floods, droughts, storms, and sea level rise, as well as negative impacts to ecosystems and fisheries. This could potentially affect the livelihoods of hundreds of millions of the most vulnerable people around the world by 2050.

The Panel determined that restricting the temperature increase to 1.5°C requires limiting total cumulative carbon emissions, also known as the global carbon budget. At current emission rates—about 42 gigatonnes per year—the 1.5°C carbon budget will be depleted in 10 to 14 years.

According to the Panel's 2018 special report on limiting global warming to 1.5°C, this goal can be

met by reducing net human-caused carbon dioxide emissions across the globe by 45% below 2010 levels by 2030, and reaching net-zero emissions by 2050. Net-zero, or carbon neutrality, means that there is an equal balance of carbon emissions and carbon sinks.

2.2.2 Federal Actions to Reduce Emissions

Canada has made several climate change commitments since joining the United Nations Framework Convention on Climate Change in 1992. Under the UN Framework Convention, Environment and Climate Change Canada produces an annual National Inventory Report. These reports contain detailed information for all provinces and territories on: greenhouse gas sources; the activities that produce emissions; and sinks—the natural reservoirs, like forests, that store carbon. National Inventory Reports provide the most recent greenhouse gas emissions data for each sector. These emissions data are often updated and restated, a result of continuous evaluation and improvements in how emissions are modelled and calculated.

The reports must be submitted to the UN Framework Convention's Secretariat each April, following the standard requirements for reporting emissions. Under the 2015 Paris Agreement, Canada committed to reducing its greenhouse gas emissions by 30% below 2005 levels by 2030. Based on the 2019 National Inventory Report data on greenhouse gas sources, this means a nation-wide reduction of 219 Mt, from 730 to 511 Mt.

Canada has regulated greenhouse gas emissions from light-duty vehicles since model year 2011 and from new heavy-duty vehicles since model year 2014. The regulations establish increasingly stringent greenhouse gas emissions requirements for the average of all new vehicle sales. Vehicle manufacturers comply by improving the efficiency of their vehicles, selling fewer high-emission vehicles and/or selling more low-emission vehicles.

In 2016, Canada and all provinces and territories, except for Saskatchewan and Manitoba, adopted the Pan-Canadian Framework on Clean Growth and Climate Change (Pan-Canadian Framework). The Pan-Canadian Framework has four main pillars: pricing carbon pollution; complementary measures to further reduce emissions; adapting and building resilience to climate change; and actions to accelerate innovation and support clean technology. Manitoba subsequently signed on to the Pan-Canadian Framework in 2018. Since the Pan-Canadian Framework was adopted, federal actions on climate change have focused on its implementation.

For example, Environment and Climate Change Canada has been consulting since 2017 on developing a Clean Fuel Standard to reduce greenhouse gas emissions. The proposed standard would require fuel suppliers to reduce the life-cycle carbon intensity of their fuels. This can be done, for example, by blending ethanol—a lower emissions fuel—with gasoline. These regulations are expected to come into effect for liquid fuels in 2022 and for gaseous and solid fuels in 2023.

In June 2018, Canada passed the *Greenhouse Gas Pollution Pricing Act*, implementing a federal carbon pricing system for provinces and territories that either do not have a carbon pricing system, or have a system that does not meet the federal benchmark requirements. The federal pricing system has two components: a charge on fossil fuels, and a carbon pricing system for industrial facilities based on their production levels. In October 2018, Canada announced how this carbon pricing system would apply in different provinces and territories across Canada (see **Appendix 7**). Because Ontario did not have its own carbon pricing system in place, the federal carbon pricing system took effect in Ontario in 2019; a carbon pricing system for industrial facilities took effect in January 2019, and a charge on fossil fuels took effect in April 2019.

In 2018, Canada projected that, without further action on climate change beyond the policies that were in place or that could be readily modelled at the time, Ontario's emissions in 2030 would be 160 Mt. Canada projected that further federal

Figure 11: Ontario's Actions to Reduce Greenhouse Gas Emissions

Prepared by the Office of the Auditor General of Ontario

Year	Event
2005	Ontario begins decommissioning five coal-fired generating stations to improve air quality.
2007	Ontario releases "Go Green: Ontario's Action Plan on Climate Change," establishing emission-reduction targets for 2014, 2020 and 2050. Enacts regulation that prohibits the use of coal to generate electricity after December 2014.
2008	Ontario joins the Western Climate Initiative, a group of US states and Canadian provinces collaborating on reducing emissions.
2009	Ontario passes the *Green Energy and Green Economy Act* to expand low-carbon energy generation (solar and wind power) and amends the *Environmental Protection Act* to enable the creation of an Ontario cap and trade system.
2014	Ontario closes the Thunder Bay Generating Station. This completes the phase-out of coal-fired electricity generation in Ontario. The closure of the five stations* is the single largest greenhouse gas reduction action in North America.
2015	Ontario announces it will create a cap and trade system to price carbon emissions, and sets a 2030 emission-reduction target of 37% below 1990 levels (to 113 Mt). Ministry releases Ontario's Climate Change Strategy.
2016	Ontario passes the *Climate Change Mitigation and Low-carbon Economy Act*. The Act establishes a legal framework for emissions reductions and reductions targets for 2020, 2030 and 2050. A cap and trade program is established by regulation under the Act. A five-year Climate Change Action Plan is released, with plans to reduce emissions across all sectors.
2017	Cap and trade program launched. In its 18-month duration, the program raises $2.9 billion, earmarked for programs to reduce emissions. The revenues were used mainly for energy efficiency retrofits for homes, businesses, hospitals and educational institutions, as well as electric vehicles, cycling infrastructure and transit.
2018	Ontario passes the *Cap and Trade Cancellation Act*, which repeals the *Climate Change Mitigation and Low-carbon Economy Act*. This cancels the cap and trade program and programs dependent on its revenues. Ontario also withdraws from the Western Climate Initiative. The Ministry of the Environment, Conservation and Parks releases an Environment Plan, outlining a proposed new path to meet a new 2030 greenhouse gas emissions target of 30% below 2005 levels by 2030 (143 Mt).

* Ontario's five coal-fired electricity generating stations included Nanticoke, Atikokan, Lambton, Lakeview and Thunder Bay. They were closed between 2005 and 2014. The Hearn Generating Station, also coal-fired, was closed in 1983.

government action, like the federal carbon pricing system, federal Clean Fuel Standard, and funding for private and public projects, would reduce Ontario's emissions 17 Mt down to 143 Mt in 2030.

For a chronology of Canada's climate change activities, see **Appendix 8**.

2.2.3 Ontario Actions to Reduce Emissions

Ontario's phase-out of coal-fired electricity generation was one of the most significant actions that improved Ontario's air quality, and had the added benefit of reducing greenhouse gas emissions. Between 2005 and 2014, five coal-fired generating stations at Nanticoke, Atikokan, Thunder Bay, Lambton and Lakeview were decommissioned, contributing to a 29 Mt decrease in greenhouse gas emissions by 2014. **Figure 11** outlines Ontario's actions to reduce greenhouse gas emissions since 2005, and **Figure 12** outlines Ontario's previous and proposed emission-reduction targets.

In 2007, the Ministry of the Environment, Conservation and Parks, then the Ministry of the Environment, released Go Green: Ontario's Action Plan on Climate Change, establishing greenhouse gas emission-reduction targets for 2014, 2020 and 2050. These targets were based on 1990 emission levels. Because 1990 is the first year reliable emissions inventories for industrialized countries were compiled, it is considered the most common international base year.

From 2008 to 2011, a Climate Change Secretariat operated out of Cabinet Office. The Secretariat's role was to co-ordinate and report on climate change initiatives. The Secretariat did not have the authority to require ministries to take specific

Figure 12: Ontario's Previous and Proposed Greenhouse Gas Reduction Targets

Prepared by the Office of the Auditor General of Ontario

Year	Source of Target	Target Year	Target Emission Reductions	Target Emissions (Mt)	Target Status
2007	Go Green: Ontario's Action Plan on Climate Change	2014	6% lower than in 1990[1]	169	Achieved
		2020	15% lower than in 1990[1]	153	Repealed in 2018
		2050	80% lower than in 1990[1]	36	Repealed in 2018
2016	*Climate Change Mitigation and Low-carbon Economy Act, 2016*	2030	37% lower than in 1990[1]	113	Repealed in 2018
2018	Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan	2030	30% lower than in 2005[2]	143	Current target

1. Ontario's 1990 emissions were 180 Mt.
2. Ontario's 2005 emissions were 204 Mt.

emission-reduction actions, but instead could only make suggestions. Ministries could choose to implement or ignore the suggestions made. According to former members, to be effective, the Secretariat needed more independence and cross-ministry influence, and should have reported directly to Cabinet to ensure climate change was given priority along with the goals of each ministry.

In 2014, the government established a Climate Change Directorate within the Ministry of the Environment and Climate Change. The role of this group was to co-ordinate, report on, and drive climate action across all ministries.

In 2015, the province set a 2030 emission-reduction target, and in 2016, legislated the 2020, 2030 and 2050 targets in the *Climate Change Mitigation and Low-carbon Economy Act, 2016*. Also in 2015, a Minister's Table on Climate Change was established to engage ministers from ten ministries on climate change-related issues. The Minister's Table was disbanded in 2018. In June 2016, the Ministry released a five-year Climate Change Action Plan.

In 2016, it was confirmed that the 2014 emission-reduction target set in 2007 had been met, mainly by closing Ontario's coal-fired power plants. Other policies and actions, like spending on public transit, renewable energy, and energy conservation, were planned to help meet Ontario's future greenhouse gas reduction targets. In 2017, the province launched a cap and trade program, requiring businesses that emit above a certain level of greenhouse gases to obtain allowances equal to their emissions. The program also permitted these allowances to be bought and sold between emitters. The *Climate Change Mitigation and Low-carbon Economy Act, 2016*, stipulated that the revenues generated by the cap and trade program were to be used to fund emission-reduction initiatives. A number of other existing programs and initiatives affect Ontario's greenhouse gas emissions in various sectors (see **Figure 13**).

In fall 2018, Ontario passed the *Cap and Trade Cancellation Act, 2018* and repealed the *Climate Change Mitigation and Low-carbon Economy Act*, 2016, cancelling Ontario's cap and trade program and its 2020, 2030 and 2050 reduction targets. The *Cap and Trade Cancellation Act, 2018*, administered by the Ministry of the Environment, Conservation and Parks, establishes a new legislative framework for reducing Ontario's greenhouse gas emissions and addressing climate change. The Act requires the government to establish and publicize greenhouse gas reduction targets. The Act also requires the Minister to prepare a climate change plan, regularly prepare reports on the climate change plan, and make the reports available to the public.

Figure 13: Examples of Current Ontario Programs and Initiatives that Affect Greenhouse Gas Emissions
Prepared by the Office of the Auditor General of Ontario

Sector of Emissions	Program or Legislation
Transportation	• Ethanol in gasoline – O. Reg. 535/05 under the *Environmental Protection Act* requires 5% of all gasoline to be comprised of ethanol biofuel • Greener diesel – O. Reg. 97/14 under the *Environmental Protection Act* requires 4% of diesel to be biofuel • 2041 Regional Transportation Plan – increase availability and use of public transit throughout the Greater Toronto and Hamilton Area • Speed-limiting systems for commercial motor vehicles – reduced truck speed results in reduced greenhouse gas emissions • Land use planning and approval of municipalities' official plans
Industry	• Emissions reporting – O. Reg. 390/18 under the *Environmental Protection Act* requires large emitters to report and verify their emissions data • Natural gas conservation programs (encourages reducing natural gas use)
Buildings	• Ontario Building Code – specifies levels of insulation and energy efficiency in buildings • Natural gas utility conservation programs (encourage reducing natural gas use) • Broader Public Sector energy reporting and conservation – O. Reg. 507/18 under the *Electricity Act* requires public agencies to have energy conservation and demand management plans
Waste	• Food and organic waste diversion (to minimize methane-producing organic waste in landfills) • Landfill gas – O. Reg. 232/98 under the *Environmental Protection Act* requires the collection, burning or use of methane gas at landfilling sites
Electricity	• Time-of-use energy pricing to reduce electricity use during peak times • Energy-efficiency standards for appliances and equipment (under *Electricity Act* regulations) • Electricity conservation programs through the Independent Electricity System Operator (under *Electricity Act* directives)

2.2.4 The Process and Timing for Drafting "Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan" (the Plan)

The Ministry's Climate Change Policy Branch (Branch) led the development of a climate change plan. In July 2018, Ministry staff began considering options, including the plan's vision, targets, principles, actions, structure, and process. The Branch proposed six pillars under which key actions in the climate change plan would focus, including:

- Building Resilience
- Making Polluters Pay
- Leveraging the Private Sector
- Leading by Example
- Using Energy Wisely, and
- Being Transparent.

In September 2018, the Minister of the Environment, Conservation and Parks announced that the Ministry would introduce a plan in fall 2018 that would fight climate change. With the objective of releasing a climate change framework in the fall, the Minister wrote to 14 other ministries in September 2018 outlining next steps and asking them to consider any existing or new initiatives under development that could be included. The ministries had a deadline of 20 days to provide ideas on what could be included in a climate change framework.

In October 2018, the Branch compiled a list and conducted a quantitative and qualitative assessment of initiatives proposed by other ministries, the Minister's Office, and other stakeholders (see **Appendix 9** for examples of ideas that were submitted but not included). The quantitative assessment used a points system to rank the proposals, and gave a point for each of the following criteria:

- new programs or new modifications to existing programs;
- programs that demonstrated ambition;
- projects that achieved significant greenhouse gas reductions (more than 1 Mt);
- programs that had little or no cost to government;
- programs that had demonstrated co-benefits; and
- projects that had reductions that can be quantified and verified.

The Ministry's qualitative assessment was based on: alignment with the six pillars and plan objectives; and whether it was a short- or long-term action. These assessments were compiled to help select emission-reduction initiatives for the plan.

From October 17, 2018, to November 16, 2018, the Ministry used an online portal to invite public input on key areas of focus for climate change. The Ministry received more than 8,000 comments.

In mid-October 2018, the Ministry expanded the climate change plan into a larger environment plan. Other divisions within the Ministry led the development of other sections of the environment plan. In November 2018, the Ministry held meetings and roundtables with industry, financial institutions and environmental organizations, asking for input on the climate change components of the environment plan.

On November 28, 2018, the government gave approval for the Ministry to release the environment plan for public consultation. As such, on November 29, 2018, the Ministry released "Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan" (Plan), and posted it on the Environmental Registry for a 60-day public consultation period.

As of September 25, 2019, the Ministry had not yet updated the Plan to factor in any changes that may have resulted from information or ideas garnered during the public consultation period, or posted a decision notice on the Environmental Registry.

Figure 14 provides a timeline of the development of the Plan and related events.

2.2.5 The Content of the Plan

The Plan outlines the province's proposed approach for achieving progress in four main environmental areas:

- protecting Ontario's air, lakes and rivers
- reducing litter and waste, and keeping land and soil clean;
- conserving land and greenspace; and
- addressing climate change.

According to the Ministry, the Plan's climate change chapter fulfils the commitment under the *Cap and Trade Cancellation Act, 2018* to prepare a climate change plan.

At the time the Plan was drafted, the Ministry estimated that if no further climate change actions are taken, Ontario's emissions will be 160.9 Mt in 2030—0.1 Mt higher than Ontario's estimated emissions for 2018 (see **Figure 1**). This is similar to Canada's 2018 estimate of Ontario's projected 2030 emissions (160 Mt). The Plan sets a target to reduce Ontario's greenhouse gas emissions by 30% below 2005 levels by 2030. Achieving this 30% reduction target would mean bringing Ontario's emissions down to 143.3 Mt by 2030. This would require a 17.6 Mt reduction below the Ministry's projected 2030 emissions for the province (160.9 Mt).

The Plan states that this target aligns Ontario with Canada's 2030 target under the Paris Agreement (30% below 2005 levels by 2030). However, if the global emission-reduction goal determined by the Intergovernmental Panel on Climate Change to limit the global temperature increase to 1.5°C was applied to Canada, this would mean reducing Canada's emissions by at least 39% below 2005 levels by 2030—more aggressive than Canada's target (30% below 2005 levels by 2030), to which Ontario's target is aligned.

To achieve Ontario's proposed 2030 target, the Plan outlines eight areas where the Ministry expects emissions reductions to occur (see

Figure 14: Timeline of Plan Development and Plan-Related Events

Prepared by the Office of the Auditor General of Ontario

Date	Event
Jul 2018	Ministry staff develop initial options for new climate change plan. Bill 4 *(Cap and Trade Cancellation Act, 2018)* introduced.
Aug 2018	Ministry staff develop internal briefings and produce research on key components of plan.
Sep 6–26, 2018	Minister asks other ministries to submit ideas to include in plan within 20 days.
Sep 11, 2018	Bill 4 posted on Environmental Registry for 30-day public consultation period.
Early Oct, 2018	Ministry reviews submissions of climate change plan ideas from other ministries.
Oct 17, 2018	Ontario launches online portal for public consultation on new climate change plan.
Oct 22, 2018	Ministry expands scope of plan beyond climate change to include broader environmental priorities.
Oct 31, 2018	Bill 4 receives Royal Assent.
Nov 13–22, 2018	Ministry consults stakeholders from industry, finance, energy and waste sectors on the climate change plan.
Nov 14, 2018	Ontario repeals *Climate Change Mitigation and Low-carbon Economy Act, 2016*.
Nov 27–28, 2018	Treasury Board and Cabinet approve posting plan for public consultation on the Environmental Registry.
Nov 29, 2018	**Ontario releases *Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan (Plan)* and posts it on the Environmental Registry for 60 days.**
Jan 1, 2019	Federal carbon pricing for industry takes effect in Ontario.
Jan 14, 2019	Climate Change Leadership Team established by Cabinet to "embed climate change considerations across government" and establish directions and guidance for ministries.
Jan 28, 2019	Public consultation period on Plan ends.*
Feb 12, 2019	Ontario posts two proposal notices on the Environmental Registry for public comment: Increasing Renewable Content in Fuels and Industrial Emission Performance Standards.
Mar 6, 2019	Ontario releases discussion paper on reducing litter and waste.
Apr 1, 2019	Federal carbon pricing for fossil fuels takes effect in Ontario.
Jun 2019	Ministry develops a draft reporting and implementation strategy for the Plan. Inter-ministry working group established to co-ordinate implementation of climate change initiatives.
Jul 5, 2019	Ontario finalizes the Industrial Emission Performance Standards as an alternative to federal carbon pricing for industry.

* As of October 1, 2019, no decision notice for the Environment Plan has been posted on the Environmental Registry.

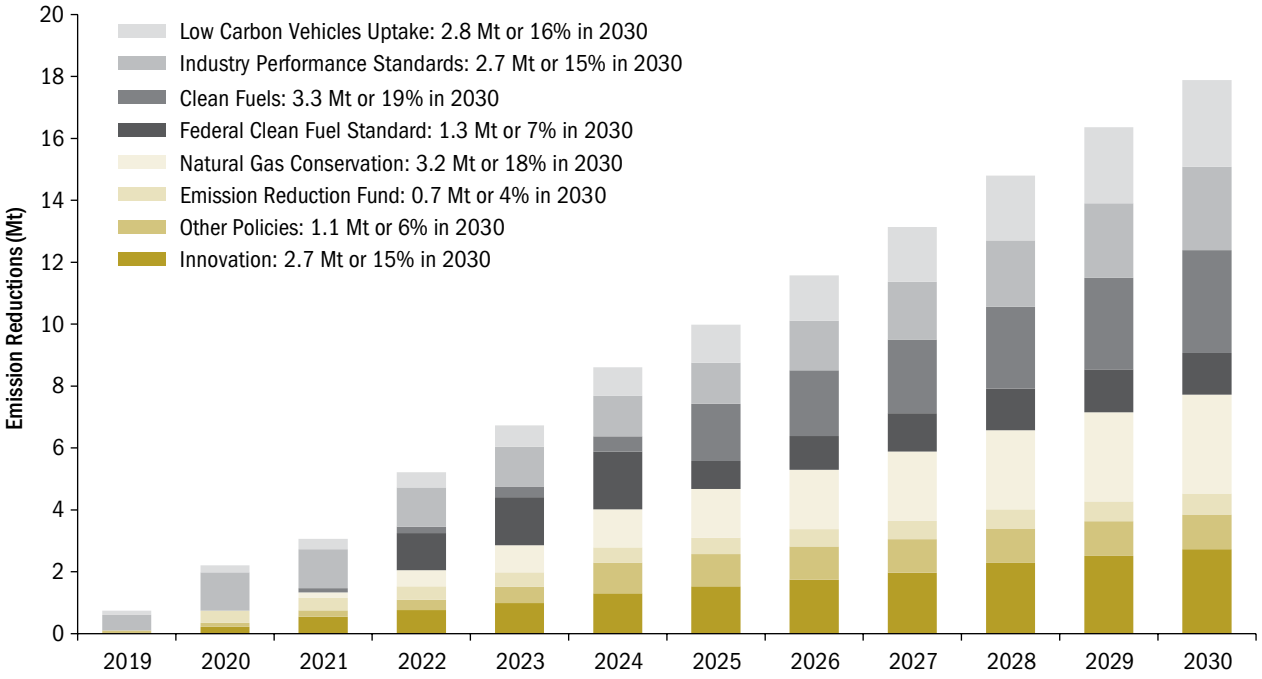
Figures 2 and **15**). The emissions reductions expected in each area are based on various assumptions and actions (see **Appendix 10**).

The Plan not only outlines how it expects Ontario's emissions to be reduced, but also contains a commitment to engage on international climate issues by providing Ontario's perspective to Canada's international climate negotiations. Ontario has the opportunity to both lead by example and to work with Canada to encourage other jurisdictions to collectively reduce global emissions. In working to reduce emissions both within Ontario and abroad, Ontario can leverage market changes to its economic benefit. On this, the Plan states that Ontario will encourage the federal government to ensure that international climate negotiations improve our cleantech sector's access to emerging global markets for low-carbon technologies, helping local companies create new green jobs.

The Plan also contains a commitment to establishing an advisory panel on climate change.

Figure 15: Estimated Emissions Reductions Associated with the Plan's Eight Areas, from Business-as-Usual Level

Source of data: Ministry of the Environment, Conservation and Parks



2.3 Ministry Organization and Key Climate Change Related Activities

The Ministry's Climate Change and Resiliency Division designs, develops and delivers policies and programs to help protect the environment, reduce greenhouse gas emissions and increase Ontario's resilience to climate change. For the 2019/20 fiscal year, this Division has an operating budget of $18.9 million, 6% of the Ministry's total budget, and 106 full-time staff. The five branches of this Division co-ordinate greenhouse gas mitigation and adaptation activities (see **Appendix 11**). They are the:

- **Climate Change Policy Branch**, responsible for the overall development, co-ordination and delivery of initiatives to address climate change, including the development of policy, key guidance and tools.
- **Climate Change Programs and Partnerships Branch**, responsible for the development of programs and regulations to increase access to clean fuels and reduce regulatory barriers to low-carbon solutions. The branch works with internal and external partners to deliver a range of government priorities.
- **Environmental Economics Branch**, responsible for using modelling and other analytical techniques to support policy development. The branch works with other branches to assess environmental and financial effects of proposed policies and programs.
- **Financial Instruments Branch**, responsible for leading the development and delivery of programs and initiatives to encourage the industrial sector to reduce greenhouse gas emissions.
- **Adaptation and Resilience Branch**, responsible for leading the development and delivery of Ontario's adaptation and resilience initiatives.

3.0 Audit Objective and Scope

Our audit objective was to assess whether the Ministry of the Environment, Conservation and Parks has effective systems and processes in place to ensure:

- credible information is used on an ongoing basis to assess, plan and undertake government initiatives to mitigate greenhouse gas emissions;
- initiatives to mitigate greenhouse gases are comprehensive, co-ordinated and cost-effective;
- initiatives to mitigate greenhouse gases are likely to achieve provincial greenhouse gas reduction targets, and are likely to contribute to global long-term mitigation goals; and
- the effectiveness of greenhouse gas mitigation initiatives is monitored, evaluated and reported to the public.

In planning for our work, we identified the audit criteria (see **Appendix 12**) we would use to address our audit objectives. These criteria were established based on a review of applicable legislation, policies and procedures, internal and external studies, and best practices. Senior management at the Ministry reviewed and agreed with the suitability of our objectives and associated criteria.

We conducted our audit from April to September 2019. We obtained written representation from Ministry management that, effective November 15, 2019, they had provided our Office with all the information they were aware of that could significantly affect the findings or the conclusion of this report.

Our audit work focused on the Plan's proposed path to reduce greenhouse gas emissions, examining: the process through which the Plan was developed; its underlying assumptions and supporting evidence used to estimate emissions reductions; the Ministry's evaluation and consideration of costs; and its approach to achieving the target. During our audit, we:

- reviewed documentation provided by the Ministry, other provincial ministries and agencies, Metrolinx and Public Health Ontario, for example, and other jurisdictions;
- met with and/or obtained information from staff to obtain an understanding of roles and responsibilities, the process of developing the Plan, and the methods and assumptions used to estimate expected emissions and emissions reductions;
- requested that the Ministry's Environmental Economics Branch run various scenarios in a greenhouse gas emissions model and reviewed the results;
- reviewed relevant reports from external parties; and
- interviewed and obtained information from external stakeholders, the non-profit organization Plug'n Drive, and consulting firms.

We conducted our work and reported on the results of our examination in accordance with the applicable Canadian Standards on Assurance Engagements—Direct Engagements issued by the Auditing and Assurance Standards Board of the Chartered Professional Accountants of Canada. This included obtaining a reasonable level of assurance.

The Office of the Auditor General of Ontario applies the Canadian Standards of Quality Control and, as a result, maintains a comprehensive quality control system that includes documented policies and procedures with respect to compliance with rules of professional conduct, professional standards and applicable legal and regulatory requirements.

We have complied with the independence and other ethical requirements of the Code of Professional Conduct of the Chartered Professional Accountants of Ontario, which are founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behaviour.

4.0 Detailed Audit Observations

4.1 Unclear If Plan Will Be Updated Based on Comments Received Through the Environmental Registry

Before the Plan was released, Ministry staff expressed concern that the Ministry may receive criticism for releasing a Plan for public comment that appeared to already be finalized. Unlike other proposed policies posted on the Environmental Registry for comment, the Plan itself is not marked as a draft. By contrast, the supporting materials for all other 10 policy proposals posted on the Environmental Registry by the Ministry between June 2018 and September 2019 are marked with a label indicating that the policies are either proposed, a draft for consultation or a discussion paper.

During our discussion with the Ministry, we were told that the Plan was always considered an initial plan, and that it would be updated in the future. As of September 25, 2019, the Ministry had not yet posted a decision notice for the Plan on the Environmental Registry, or specified a date as to when it expects to update the Plan after receiving public comments through the Environmental Registry.

RECOMMENDATION 1

To help ensure that the public is aware that plans, strategies and policies, when posted for review and public comment on the Environmental Registry are draft, we recommend that, in the future, the Ministry of the Environment, Conservation and Parks label such documents as draft.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation for future postings on the Environmental Registry. Going forward, the Ministry commits to labeling draft plans, strategies and policies that are posted on the Environmental Registry as draft.

4.2 No External Advisory Panel Yet Established to Provide Advice on Climate Change Plan

Under the *Cap and Trade Cancellation Act, 2018*, the Minister may, for the purpose of taking any steps with respect to the climate change plan, appoint panels to perform advisory functions. In addition, the Plan commits to establishing such a panel to provide advice to the Minister on implementation and further development of actions and activities in the Plan specific to climate change.

In July 2018, Ministry staff proposed establishing an advisory group to advise the Minister on potential elements of a new climate change plan, and on the establishment of a long-term approach to support plan implementation. In October 2018, the Ministry drafted Terms of Reference for the Climate Change Advisory Panel and developed a list of 28 potential Panel members. In November 2018, the government approved the creation of this panel and its Terms of Reference. The Panel's mandate is to provide advice to the Minister on "programs and initiatives sufficient to achieve deep greenhouse gas reductions." This includes advising the Minister on implementing the climate change plan, and providing specific advice on key areas such as activating the private sector, government leadership, using energy and resources wisely, as well as ongoing reporting, review, implementation, partnerships and engagement.

As of September 25, 2019, no appointments had yet been made to the Climate Change Advisory Panel. The Ministry advised our Office that, as of that date, the current Minister had not yet been briefed by the Ministry, and no specific briefing date was scheduled.

Establishing a Climate Change Advisory Panel would allow the Minister to benefit from the advice

of experts in a variety of fields, and help ensure that the Plan is better supported by sound evidence and includes the most effective and innovative emission-reduction initiatives to reach the 2030 target. Other jurisdictions, including the United Kingdom and Sweden, have used the best practice of an independent body to provide non-partisan, science-based analysis and advice on reducing greenhouse gas emissions.

RECOMMENDATION 2

So that Ontario's climate change planning can benefit from external expert advice, we recommend that members be appointed to the Climate Change Advisory Panel to review and provide advice on climate change planning and further refine the Ministry's Plan as needed.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General on the importance of gathering expertise and advice to support the refinement and implementation of its climate change plan. The Ministry will continue to support the Minister in establishing the Advisory Panel on Climate Change.

4.3 Better Methods to Estimate Emissions Reductions Needed Going Forward

The Ministry began by identifying the proposed 2030 emissions reduction target—30% below 2005 levels by 2030. Based on the emissions data available to the Ministry at the time, this represents a reduction to 143.3 Mt by 2030. The Ministry then projected what Ontario's 2030 emissions would be if no new initiatives were undertaken. In November 2018, the Ministry used a model to estimate this amount would be 160.9 Mt in 2030. The Ministry then subtracted 143.3 Mt from this estimate to arrive at the 17.6 Mt in emissions reductions needed to achieve the 2030 target.

4.3.1 Emission Projections and Reduction Estimates Need Robust and Ongoing Modelling

Using an integrated model to project greenhouse gas emissions and emissions reductions can allow the user to consider and account for contributing factors, such as economic and demographic factors that influence energy use and greenhouse gas emissions across sectors. Integrated models can also take into account the overlapping, interacting and competing effects of emission-reduction programs, and assist with evidence-based decision making.

To project the 160.9 Mt emissions estimate, the Ministry used an integrated energy-emissions-economy model. A combination of three models, some of which were developed over several decades, this model is a series of mathematical equations. It integrates information, including on government policies, the economy, technologies, and energy use and costs, to simulate policy impacts on energy and emissions trends, the adoption of technologies, and the economy. The model is calibrated regularly with data from sources that include the National Inventory Report, Natural Resources Canada's Comprehensive Energy Use Database, and Statistics Canada. Model simulations are also backcasted, a process by which model results are compared with historical data to ensure that they are reasonable.

Included in this model are assumptions around technological improvements that are expected to occur without new government initiatives. For example, the model assumes that in 2030, 250,000 (3%) of Ontario's 7.7 million on-road vehicles will be primarily or fully powered by electricity rather than by gasoline, a result of lower electric vehicle battery prices and natural market uptake. Also included in the model are assumptions around oil and natural gas prices, as well as economic growth.

The Ministry did not include the emission-reduction impacts of the federal carbon price when estimating the projected emissions for 2030 because the Plan is framed as an alternative to the federal carbon pricing system.

Since November 2018, new emissions data from the National Inventory Report has been released and incorporated into the model. In August 2019, our Office requested that the Ministry re-run the model to estimate the 2030 projection again. This time, the model estimated that Ontario's greenhouse gas emissions in 2030 would be 163.6 Mt if no further climate change actions are taken, 2.7 Mt higher than the estimate presented in the Plan.

In addition to estimating the 2030 emissions projection, the Ministry also used the integrated model to estimate emissions reductions expected from the implementation of Industry Performance Standards. However, the Ministry did not use the integrated model to estimate emissions reductions for the other areas in the Plan, or to help inform and determine the most effective programs for achieving the overall emission-reduction target.

The Ministry used an ad hoc approach to estimate all other emission estimates. The emission-reduction estimate for expanding GO Transit was taken from a Metrolinx technical memorandum. Emission-reduction estimates for energy storage, compressed natural gas and renewable natural gas were either based on, or taken from a submission to the Ministry from the Ontario Energy Association, an industry association that represents Ontario's electricity and natural gas utilities, among other companies. The emission-reduction estimates for Low Carbon Vehicles Uptake, cost-effective fuel switching, renewable content in gasoline, the federal Clean Fuel Standard, Natural Gas Conservation, the Emission Reduction Fund and organic waste diversion were estimated using spreadsheet calculations that did not account for the complex interactions between energy and economic factors and policies that a fully integrated model can provide. The remaining emissions reductions needed to reach the 2030 target were then assigned to Future Innovation. The Ministry informed our Office that it was unable to use the integrated model to estimate emissions reductions from these areas because the program design details needed for modelling were not available at the time.

4.3.2 Ministry's 160.9 Mt Estimate of Projected 2030 Emissions Incorrectly Includes the Emissions Reduction Impact from Now-Cancelled Climate Change Programs

When modelling the 2030 business-as-usual estimate in November 2018, the Ministry included electricity sector policies factored into Ontario's 2017 Long-Term Energy Plan (LTEP). The 2017 LTEP included Ontario initiatives, such as electricity conservation programs, renewable energy contracts, and the cap and trade program. These initiatives were later cancelled. In August 2019, our Office requested that the Ministry model a new 2030 projection that includes, among other updates, changes in the electricity sector since the 2017 LTEP was released. The modelling underlying the Plan projects that baseline electricity sector emissions in 2030 would be 0.5 Mt, whereas the updated projection received by our Office projects emissions for this sector would be 4.6 Mt—an increase of 4.1 Mt. This demonstrates that projected emissions will change due to a number of factors, and should be regularly re-estimated to account for changes in policy and programs.

RECOMMENDATION 3

So that complex interactions between energy, economics and emissions are taken into account when selecting and designing emission-reduction initiatives, and to provide more reliable emissions estimates, we recommend that the Ministry of the Environment, Conservation and Parks:

- use integrated modelling, where appropriate, to better estimate the impact of planned and future initiatives when updating its Plan to meet the 2030 target; and
- annually update its estimates to reflect new information and changes to proposed initiatives, and assess whether it is on track to achieve the targeted reductions.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation about using integrated modelling. The Ministry will make better use of integrated modelling, where appropriate, and up-to-date information as it becomes available when forecasting emissions in the province.

4.4 Emissions Estimates Underlying Plan Not Supported by Sound Evidence

The Plan projects that Ontario's greenhouse gas emissions will be 160.9 Mt in 2030 if no further climate initiatives are taken. To reduce Ontario's emissions by 17.6 Mt to meet the 2030 target, the Plan outlines eight areas where the Ministry expects emissions reductions to occur (**Figure 15**). We reviewed the evidence and assumptions the Ministry used to estimate the emissions projected for 2030, as well as the reductions for each area. Based on our review, several of the estimates are not supported by sound evidence (see **Appendix 10**). Our assessment of the assumptions and double counting of initiatives found that the Plan overestimates the emissions reductions expected. Overall, our analysis found that the initiatives in the Plan have the potential to achieve between 6.3 Mt to 13.0 Mt of the 17.6 Mt emission-reduction goal (see **Figure 2**). We outline our findings for specific emission-reduction areas below.

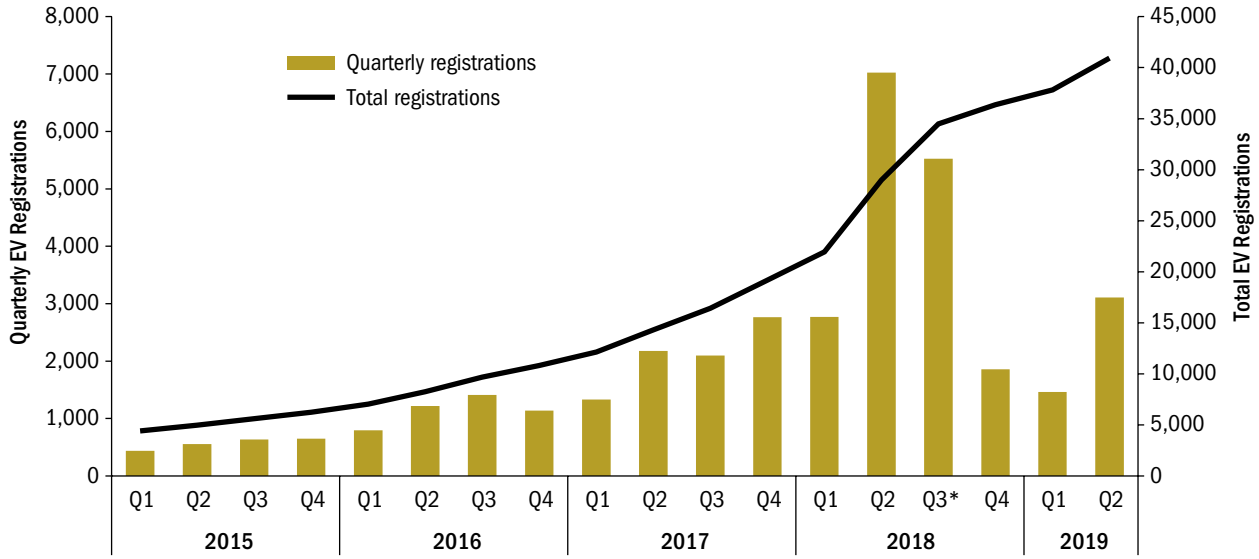
4.4.1 Low Carbon Vehicles Uptake: Ministry Overestimates Emissions Reductions Expected from Electric Vehicle Uptake by 2.6 Mt

In developing the Plan, the Ministry estimated that 2.6 Mt in emissions reductions in 2030 will come from the increased uptake of low-carbon vehicles. This estimate assumes that 1.3 million vehicles on the road in 2030 will be powered by electricity rather than gasoline. The Plan overestimates the emissions reductions associated with this assumed uptake of electric vehicles for several reasons:

- *Emissions reductions resulting from the uptake of low-carbon vehicles are already included in the projected 2030 estimate.* The increasingly stringent federal vehicle emissions standards require vehicle manufacturers to reduce the average emissions across the fleet of all vehicles they sell each model year. Manufacturers can meet these standards by selling fewer high-carbon vehicles and more low-carbon ones, such as electric vehicles. The emissions reductions attributed to the federal vehicle emissions standards, and thus the uptake of low-carbon vehicles, are already accounted for in the Ministry's projected 2030 estimate.
- *The Ministry's projection of 1.3 million electric vehicles on the road by 2030 is based on a number of factors, including cancelled programs.* To support the development of Ontario's 2017 Long-Term Energy Plan, the Independent Electricity System Operator (IESO) released a technical report in September 2016 on the adequacy and reliability of Ontario's electricity resources. This technical report forecasted several potential scenarios for the demand of Ontario's electricity through to 2035. These scenarios were based on assumptions for various levels of electricity demand in different sectors. The Ministry's estimate of 1.3 million electric vehicles on Ontario's roads by 2030 is based on the IESO's highest demand scenarios, and represents a more than 3,000% increase from approximately 41,000 electric vehicles in 2019. However, these scenarios included actions and programs identified in Ontario's now-cancelled 2016 Climate Change Action Plan, such as incentives for leasing or buying electric vehicles, and purchasing and installing charging stations in workplaces and residential buildings. Electric vehicle registrations had been increasing in Ontario under these incentive programs (registrations increased 1,168%,

Figure 16: Electric Vehicle (EV) Registrations in Ontario, 2015–2019

Source of data: Ministry of Transportation



* Electric vehicle purchase subsidies cancelled.

from 554 to 7,026 between the second quarter of 2015 and 2018). However, these programs were cancelled in summer 2018, and sales have subsequently declined; 4,574 electric vehicles were registered in the first half of 2019, 53% fewer than in the same period in 2018 (9,796 vehicles). (See **Figure 16** for registration data of electric vehicles since 2015).

- *The Ministry was unable to provide any details of planned initiatives that would result in 1.3 million electric vehicles on the road by 2030.* In its emissions projections for 2030, the Ministry based its calculations on the assumption that natural market uptake would result in 250,000 electric vehicles on the road by 2030. The Ministry was unable to provide details of any planned provincial initiatives that could increase the uptake of electric vehicles in Ontario to 1.3 million and achieve the greenhouse gas reductions forecasted for this area. The Ministry was unable to provide any evidence to support its expectation that the sales of electric vehicles in Ontario would exceed the projected natural market uptake.

RECOMMENDATION 4

To better assess whether Ontario will achieve 2.6 Mt in emissions reductions from the uptake of electric vehicles, we recommend that the Ministry of the Environment, Conservation and Parks, together with key partner ministries, base its estimates on sound evidence.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation on the importance of electric vehicle adoption in Ontario. The Ministry is in the process of refining its emissions forecast and will make better use of integrated modelling and up-to-date information as it becomes available when forecasting emissions in the province.

4.4.2 Low Carbon Vehicles Uptake: Estimate of 0.2 Mt in Emissions Reductions from Compressed Natural Gas Based on Illustrative Estimate

Most freight trucking in Ontario relies on diesel fuel. The Plan expects to achieve 0.2 Mt in

greenhouse gas emissions reductions by 2030 by displacing the use of diesel with compressed natural gas, which consists mainly of methane compressed and stored at high pressure. In 2016, freight trucks in Ontario used 0.1 petajoules of natural gas energy. To achieve the expected emissions reductions, the Ministry estimated an increase in the use of compressed natural gas by 55 petajoules in 2030. This estimate, which assumes that compressed natural gas generates fewer greenhouse gas emissions than diesel, is based on a scenario in a submission from the Ontario Energy Association to the Ministry to help inform the development of the Plan.

However, the Ontario Energy Association described this scenario as an assumed one. Our review found that the Ministry did not assess whether this level of compressed natural gas uptake is feasible or cost effective.

Moreover, while natural gas produces lower carbon dioxide emissions than diesel when burned, natural gas can leak into the atmosphere during fuel production and transportation. Because natural gas consists primarily of methane, a greenhouse gas that is more potent than carbon dioxide, studies that account for this leakage along the supply chain have found that the use of compressed natural gas can result in higher emissions compared with diesel.

RECOMMENDATION 5

To help reach Ontario's emission-reduction target by 2030, we recommend that the Ministry of the Environment, Conservation and Parks analyze the feasibility and emissions impact of increasing the use of compressed natural gas, taking into consideration the life-cycle emissions associated with compressed natural gas.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation. The Ministry will analyze the feasibility and emissions impact of increasing the use of compressed natural gas, taking into consideration the life-cycle emissions associated with compressed natural gas.

4.4.3 Clean Fuels: Internal Ministry Analysis Estimates 2.3 Mt Less Emissions Reductions Than the Plan Projects

The Plan overstates the Ministry's own internal projection for reductions from proposed clean fuel initiatives. The Plan projects that 19% (3.3 Mt) of reductions in 2030 will result from the increased use of clean fuels, such as ethanol and renewable natural gas. Ethanol is typically made by fermenting organic material like corn and sugar cane, while renewable natural gas is made from decomposing organic material such as green bin and farm waste. Renewable natural gas is almost chemically identical to conventional natural gas, which is a fossil fuel.

Of the total reductions from Clean Fuels, 2.3 Mt (13% of the targeted reductions in the Plan) are projected from renewable natural gas use. To achieve these reductions, the Plan proposes that Ontario require utilities to offer a voluntary renewable natural gas option for customers and consult on the appropriateness of clean content requirements. However, evidence from Ontario and British Columbia shows that few natural gas utility customers purchase renewable natural gas. For example, data from a company that sells renewable natural gas in Ontario indicates that only 6.6 petajoules of renewable natural gas has been sold to Ontarians since 2005, compared to a total of 1,051 petajoules of natural gas sold in 2018 alone. Evidence from the electricity and natural gas distribution utility in British Columbia is similar. Of the 292 petajoules of natural gas used in 2018 in the province, only about 0.3 petajoules was renewable natural gas, provided by FortisBC.

During the Plan's development, internal Ministry staff calculations estimated there would be "negligible" emissions reductions (0.0049 Mt) by 2030 associated with a voluntary renewable natural

gas requirement, due to the higher costs to the consumer, and therefore lower sales, of renewable natural gas. The Ministry estimated that costs for non-renewable natural gas would be less than $3 per gigajoule, whereas the cost estimates for renewable natural gas would be $18 per gigajoule.

Instead of using the internal staff analysis, the Plan based emissions reductions in this area on an Ontario Energy Association submission to the Ministry. In its submission, the Ontario Energy Association described the potential to achieve 2.3 Mt of emissions reductions through renewable natural gas supply as "illustrative and [indicated that] more pilot programs are required to demonstrate provincial and regional potential."

RECOMMENDATION 6

To help reach Ontario's 2030 emission-reduction target, we recommend that the Ministry of the Environment, Conservation and Parks work with the Ministry of Energy, Northern Development and Mines to assess the feasibility of increasing renewable natural gas supply in Ontario.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation. The Ministry will continue to engage with the Ministry of Energy, Northern Development and Mines and key stakeholders on the feasibility of increasing renewable natural gas in Ontario.

4.4.4 Federal Clean Fuel Standard: Plan Relies on Proposed Standard to Reduce Provincial Emissions by 1.3 Mt

Since 2017, Environment and Climate Change Canada has been consulting the public and stakeholders on developing a Clean Fuel Standard to reduce Canada's greenhouse gas emissions. By setting regulatory performance standards for liquid, solid and gaseous fossil fuels, the proposed standard would require fuel suppliers to reduce the life-cycle carbon intensity of their fuels. This is intended to encourage innovation and adoption of clean technologies in the oil and gas sector, and the development and use of low-carbon fuels.

The Plan expects 7% (1.3 Mt) of the province's emission-reduction target to come from the 2022 implementation of proposed federal fuel standards. However, based on information our Office received from Ministry staff, emissions reductions from the federal Clean Fuel Standard could be as high as 6.5 Mt, as emissions reductions attributed in the Plan to Low Carbon Vehicles Uptake (2.8 Mt) and Renewable Natural Gas (2.3 Mt) are expected to instead result from the Clean Fuel Standard.

In June 2019, as part of its ongoing consultations, Environment and Climate Change Canada released a Proposed Regulatory Approach for the Clean Fuel Standard, building upon input received on discussion papers and through consultation sessions. Environment and Climate Change Canada plans to continue consulting on these regulations over the next few years, with liquid fuel regulations planned to come into effect in January 2022, and gaseous and solid fuel regulations planned to come into effect in January 2023.

Because the Plan counts on reductions from the implementation of these proposed federal regulations to meet its 2030 target, there would be an emission-reduction shortfall if the federal regulations are not implemented. However, if the federal Clean Fuel Standard is implemented, the emission-reduction impacts of these standards will overlap with those of the provincial Industry Performance Standards (see **Section 4.4.6**).

4.4.5 Natural Gas Conservation: Ministry Estimate of 3.2 Mt in Emissions Reductions Assumes an Incremental Cost of $6.6 Billion Over Ten Years

The Plan estimates 18% (3.2 Mt) of emissions reductions will come from natural gas conservation programs. These programs provide incentives to

industrial, commercial, and residential customers to reduce their natural gas use. In estimating reductions from natural gas conservation efforts, the Ministry based its calculations on a 2016 study submitted by a consulting firm to the Ontario Energy Board. This study modelled various future potential scenarios for natural gas conservation in Ontario. Of several potential scenarios, the Ministry selected a scenario that assumed unlimited funding for all cost-effective natural gas conservation measures. (Cost-effective means that benefits, such as energy cost savings, are greater than the incremental installed cost of the measure. In 2016, every dollar spent on natural gas conservation programs resulted in energy bill savings of about $2.40). Internally, the Ministry estimated the additional required funding for this scenario from 2021 to 2030 would be $6.6 billion.

4.4.6 Industry Performance Standards: Emissions Reductions Overstated in Plan Because of Double Counting and Weaker Finalized Standards

The Plan estimates that 15% (2.7 Mt) of the emissions reductions will come from Industry Performance Standards. This is an overestimate.

Industry Performance Standards are sector- or facility-specific benchmarks. Such standards require that industry pay a carbon price for emissions that exceed pre-established levels. To avoid paying the carbon price, industry can reduce its emissions. One way to meet the Industry Performance Standards is for industry to reduce its natural gas use, by replacing less-efficient furnaces with more efficient ones, for example. As described in **Section 4.4.5**, the scenario chosen for Natural Gas Conservation and the emissions reductions associated with such programs assumes unlimited funding would be made available to undertake all cost-effective natural gas conservation measures. Under such a scenario, industry would be able to reduce its emissions beyond the levels required to comply with Industry Performance Standards. The Plan overestimates the emissions reductions associated with this area, as it does not account for overlap of the Industry Performance Standards and Natural Gas Conservation, and attributes emissions reductions achieved through industrial natural gas conservation to both areas.

Another way for industry to meet Industry Performance Standards is to switch from higher emission fuel, like petroleum coke, to lower emission fuel, like natural gas. This is what Ministry staff modelling indicated would happen in the absence of other Plan initiatives. Because fuel switching would also help industry comply with the federal Clean Fuel Standard, emissions reductions from both of these initiatives would overlap. The Plan overestimates emissions reductions because it does not account for the overlap of the Industry Performance Standards and the federal Clean Fuel Standard, and attributes emissions reductions achieved by shifting to lower emitting fuels to both areas.

Furthermore, since the release of the Plan, the Ministry filed the finalized standards. These standards, now called the Emissions Performance Standards, are in O. Reg. 241/19 under the *Environmental Protection Act*. These finalized standards are weaker than the standards modelled during the development of the Plan. The Ministry now estimates that instead of 2.7 Mt (15%), only 1.0 Mt (6%) of the emissions reductions to be achieved in 2030 would come from the finalized standards.

RECOMMENDATION 7

To better assess the contribution that Industry Performance Standards would make toward Ontario's 2030 emission-reduction target, we recommend that the Ministry of the Environment, Conservation and Parks use best practices, such as integrated modelling, that account for the interactions and overlap with other initiatives.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation on using integrated modelling to account for the interactions and potential overlap between initiatives. The Plan was developed using the best available information and modelling at the time. The Ministry did not model the federal standards as it is unknown what they will be after 2022. The province will continually evolve the Plan with updated modelling, information and actions.

4.4.7 Emission Reduction Fund: Estimated 0.5 Mt Emissions Reductions Are Likely Less Than Projected Due to Funding Assumptions

The Plan overstates the reductions to be achieved from an Emission Reduction Fund (named in the Plan as the Ontario Carbon Trust). The Plan estimates 4% (0.5 Mt) of reductions in 2030 will result from providing $350 million for energy efficiency loans. These loans would help pay the upfront capital costs of energy-efficiency projects for buildings. The loans would be paid back over time by energy savings. The Ministry estimates that the reductions would result from funding air sealing, as well as wall, attic and basement insulation projects. Half of the 0.5 Mt in emissions reductions are estimated to come from reduced natural gas use.

As described in **Section 4.4.5**, the scenario chosen for Natural Gas Conservation assumes funding would be made available for all cost-effective natural gas conservation measures. According to Ministry staff, this includes funding for 100% of incremental capital costs. For example, a homeowner could receive funding to insulate their attic or basement, minimizing heat loss and reducing their natural gas use. However, if funding is provided to homeowners through a natural gas conservation program for these types of projects, homeowners would not require loans through the Emission Reduction Fund, and the fund would not result in emissions reductions for these projects.

The Plan overestimates the emissions reductions associated with the Emission Reduction Fund, as it does not account for the overlap of the fund and Natural Gas Conservation, and attributes emissions reductions achieved through residential natural gas conservation to both programs.

RECOMMENDATION 8

To better assess the contribution that the Emission Reduction Fund would make toward Ontario's emission-reduction target, we recommend that the Ministry of the Environment, Conservation and Parks use best practices, such as integrated modelling, that account for the interactions and overlap with other initiatives.

MINISTRY RESPONSE

The Ministry agrees with this recommendation and the importance of integrated modelling to accurately forecast anticipated emissions reductions from the Emission Reduction Fund. This iteration of the Plan is one of many that will help us work towards our 2030 target. The Ministry is in the process of updating its estimates and will incorporate the Auditor General's feedback in its work.

4.4.8 Emission Reduction Fund: Plan Estimates 0.1 Mt in Reductions From Projects That May Occur Anyway

A further $50 million of the Emission Reduction Fund would be designated for an Ontario Reverse Auction, which the Ministry has estimated would result in 0.1 Mt of emissions reductions. A reverse auction allows bidders to compete for funding to finance projects with the lowest cost reductions. Research on reverse auctions, including the program used in Australia, suggests that lowest cost auction bids are often for projects that would have happened regardless of government funding. Unless Ontario's reverse auction is designed to prevent it, government funding could be provided

to projects that would have happened anyway. This funding, therefore, would be unnecessary and the Plan would be overestimating the expected emissions reductions in this area by up to 0.1 Mt.

RECOMMENDATION 9

To help achieve a reverse auction that contributes toward reaching Ontario's 2030 emission-reduction target, we recommend that the Ministry of the Environment, Conservation and Parks design its reverse auction to achieve additional emissions reductions that would not have happened without government funding.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation about the potential outcomes of the reverse auction as proposed in the draft Plan. This iteration of the Plan is one of many that will help us work towards our 2030 target. The Ministry will take this into consideration as it updates the Plan.

4.4.9 Organic Waste: Ministry Improperly Counts 0.3 Mt in Emissions Reductions from Decreasing the Amount of Exported Waste

Food and organic waste that is sent to landfill decomposes and creates methane, a potent greenhouse gas. Approximately 40% of Ontario's municipal solid waste for disposal is exported and landfilled in the United States. The emissions associated with this exported waste are counted in the United States' National Inventory Report—rather than Canada's National Inventory Report—as the emissions occur in the United States, not Ontario.

The Ministry expects 1.0 Mt of Ontario's 2030 emission-reduction target to come from programs that increase the diversion of food and organic waste from landfills. Based on the Ministry's modelling, about 0.3 Mt (30%) of these reductions are expected to come from diverting waste that would otherwise be exported and landfilled in the United States.

However, the Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories requires emissions generated by waste that is exported and landfilled in the United States to be counted in the United States' inventory—not Ontario's inventory. Therefore, any reduction in those emissions that are a result of waste diversion in Ontario would be accounted for in the United States' inventory. Reductions in emissions that are not counted in Ontario should not be counted toward meeting Ontario's target.

RECOMMENDATION 10

To improve the reliability of estimated emissions reductions associated with organic waste diversion, we recommend that the Ministry of the Environment, Conservation and Parks follow the Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories and transparently account for actions that occur outside Ontario's borders, consistent with international rules.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation. The Ministry agrees that transparent reporting of emissions reductions is critical, including where the emissions reductions occurred and how they relate to the IPCC inventory categories. The Ministry agrees to follow international best practices, including the Paris Agreement rules and IPCC guidelines, where applicable.

4.4.10 Innovation: Plan Assumes 0.5 Mt Emissions Reductions from Energy Storage and Cost-Effective Fuel Switching with No Planned Initiatives

Batteries and other forms of energy storage can be used to store surplus low-carbon energy generated

during times of low electricity demand. This surplus energy can then be released at times of high electricity demand to displace fossil-fuel fired generation from natural gas that would otherwise be needed.

The Ministry's modelling underlying the Plan projects that 0.3 Mt of emissions reductions in 2030 will come from increased energy storage. This assumed reduction was taken directly from a submission from the Ontario Energy Association to the Ministry to inform the development of the Ministry's climate change plan. However, the associated 750 MW of additional energy storage by 2030 was a hypothetical example of the potential for growth, and was presented as illustrative only. The Ministry did not assess the feasibility or cost of this proposed level of energy storage.

The Plan also expects 0.2 Mt of emissions reductions by 2030 through changing heating in buildings from high-carbon fuels to low-carbon fuels, such as electricity, where cost effective. The Plan does not include government actions to achieve the emissions reductions estimated from energy storage or changing building heating to low-carbon fuels.

RECOMMENDATION 11

So that an increase in Ontario's electricity storage capacity contributes to achieving Ontario's overall 2030 emissions reduction target, we recommend that the Ministry of the Environment, Conservation and Parks work with the Ministry of Energy, Northern Development and Mines to identify and assess the feasibility of energy storage initiatives that are supported by sound evidence.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation on assessing the potential of energy storage to contribute to emissions reductions in Ontario. The Ministry acknowledges that its emission forecast in this area represents the potential Ontario has to enhance actions in the future. Actual reductions achieved will depend on how actions identified in our Plan are finalized based on feedback we get from businesses and communities. We will work with the Ministry of Energy, Northern Development and Mines to identify and assess the feasibility, including cost-benefit analysis, of energy storage initiatives that are supported by sound evidence.

4.4.11 Innovation: No Evidence to Support 2.2 Mt Emissions Reductions from Future Innovation

The Plan expects 15% (2.7 Mt) of emissions reductions to come from the area of Innovation. According to the Ministry, Innovation includes potential advancements and expansion in energy storage, switching some buildings from high-carbon heating to electricity, and Future Innovation.

The Ministry estimates that 2.2 Mt of the 2.7 Mt in emissions reductions under Innovation will come from Future Innovation. However, the Ministry was unable to provide any evidence to support this emission-reduction estimate, indicating that the reduction estimate represents the remaining emissions needed to reach the 2030 target after all other reductions in the Plan are counted. There are currently no planned initiatives or staff assigned to develop initiatives to achieve emissions reductions in this area.

Further, Future Innovation in the form of technological improvements and price reductions expected to occur in the absence of new government initiatives is already taken into account in the 160.9 Mt projected forecast for 2030.

RECOMMENDATION 12

To help achieve emissions reductions from technological improvements beyond those already accounted for in the 2030 emissions projection, we recommend that the Ministry of the Environment, Conservation and Parks

work with key partner ministries to identify and assess the feasibility of initiatives to support the adoption of new and innovative emission-reduction technologies in Ontario.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation about the need to support new and innovative emission-reducing technologies. The Ministry will work across government to support the adoption of new and innovative emission-reducing technology in the province.

4.5 Public Transit Spending in the Plan Not Likely to Result in Significant Emissions Reductions

The Plan includes a commitment to spend an additional $5 billion on public transit, including GO Transit expansion, subways and relief lines. The Ministry estimates this spending will reduce emissions by 0.1 Mt in 2030. This number is based on an internal Metrolinx memorandum from December 2015, which estimated the potential emissions reductions by 2031 from expanding and electrifying the GO transit system of commuter trains. The reductions are from replacing diesel trains with electric trains, and shifting commuters from cars to trains. The Ministry did not update the Metrolinx analysis to account for recent changes to the GO Rail Expansion program. As well, the Ministry did not estimate the emissions reductions from other public transit spending on subways and relief lines.

Estimating emissions reductions from spending on public transit is complex and uncertain. The outcomes depend on interacting programs and policies, including land use planning, competing and/or complementary transportation planning, fuel prices and commuter choices. Initial estimates from Metrolinx indicate that additional capital spending of $45 billion for public transit across the Greater Toronto and Hamilton Area will lead to, at best, a minor increase in the share of trips taken by transit from 14.2% in 2011 to 14.7% in 2041. Independent analysis suggests that this is in part due to a lack of co-ordination between transit investments and land use planning.

Ontario does not require transit spending to align with decisions around land use and growth, and much spending falls short of its potential to shift riders away from personal vehicles and onto transit. At the same time, regional and local land use plans have largely failed to direct future urban growth to areas that would support such a shift. As our Office reported in two chapters that focused on Metrolinx in our 2018 Annual Report, regional interests to maximize transit ridership and emissions reductions can also be overridden by local and stakeholder interests. Frequent changes to transit planning over the past decade have resulted in delays that not only waste money, but also allow car-dominated commuting patterns to continue. As discussed in Recommendation 18 in Section 4.10.3, Treasury Board submissions on decisions that may have an impact on greenhouse gas emissions, including transit-related decisions, should include an evaluation of the greenhouse gas emissions impacts.

4.6 Ministry Analysis Estimates That Current Initiatives in the Plan Will Achieve Less Than 17.6 Mt of Emissions Reductions

In developing the Plan and estimating the emissions reductions expected from different initiatives, Ministry staff estimated emissions based on three scenarios or cases:

- **The Reference Case:** Also known as "business-as-usual," the greenhouse gas emissions forecasted if no new climate policies are pursued;
- **The Climate Change Plan Case:** The emissions expected if initiatives in the Plan are put in place; and
- **The Extended Policy Case:** The emissions expected if additional or enhanced policies

are pursued. The purpose of the Extended Policy Case was to illustrate how expanding key policies could achieve deeper emissions reductions than those outlined by the Climate Change Plan Case. Staff noted that no policy mechanisms have been identified to achieve the reductions described.

Internal staff analysis estimated that the Climate Change Plan Case would achieve 10.9 Mt in emissions reductions by 2030, and that the Extended Policy Case would achieve an additional 7.0 Mt, which would reach the 17.6 Mt target for 2030. The Ministry's internal estimate that the Climate Change Plan Case would only achieve 10.9 Mt of the Plan's 17.6 Mt target is within the range of our Office's analysis. We found that the initiatives in the Plan have the potential to achieve between 6.3 Mt and 13.0 Mt of emissions reductions in 2030.

Ministry staff advised internally that, because the actions in the Plan are not enough to achieve the 2030 target, the Plan must differentiate between the Climate Change Plan Case and the Extended Policy Case.

On November 19, 2018, the graphics in the version of the Plan to be shared with the public were simplified, and the emissions reductions expected from the Climate Change Plan Case and the Extended Policy Case were merged.

The Plan states that graphs in the Plan show that the "2030 target is achievable," and that the "policies within this plan will put us on the path to meet our 2030 target." As a result of the decision to simplify graphics in the Plan, the Plan in fact depicts the emissions reductions expected from implementing initiatives in the Plan, as well as reductions from additional policies that are not in the Plan.

RECOMMENDATION 13

To support Ontario in achieving the 2030 emission-reduction target, we recommend that the Ministry of the Environment, Conservation and Parks work with partner ministries to update its climate change plan to include detailed actions, with all estimated emissions reductions based on sound evidence and supported by a comprehensive and transparent feasibility and cost analysis.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation on the importance of sound estimates, feasibility and cost analysis of initiatives in the Plan. The Ministry will conduct such analysis as it refines its proposed policies and programs in future iterations of the climate change plan.

4.7 Ministry Did Not Request or Receive Assurance on IT Controls of Integrated Model Used to Estimate Emissions

The Ministry used an integrated model to estimate the projected emissions for Ontario with no new climate change initiatives, and the emissions reductions expected from Industry Performance Standards. Ministry users access the integrated model's information technology (IT) system using an online connection. The IT system and data are hosted and stored on servers in Vancouver. Because this system is outside of the Ministry's IT environment, the Ministry has no oversight of the system's technology controls, such as security of the stored information, the integrity of the information and reliable access.

The Ministry's October 1, 2018 to September 30, 2019 contract with the consulting firm that owns and maintains the integrated model included terms related to expected deliverables, performance warranty, performance by specified individuals and security clearance. However, the Ministry obtained no assurance on the vendor's technology controls. Although an assurance report is not available on the IT system itself, our Office requested and received from the vendor the System

and Organization Controls reports on the system and operating effectiveness of controls related to the data centre that hosts the model. These reports provide independent assurance regarding the organization's system, suitability of the design and operating effectiveness of controls, and the security and availability of the system throughout the period of October 1, 2017, to September 30, 2018. Based on our review of the reports for the data centre, we did not identify significant IT findings.

RECOMMENDATION 14

To obtain assurance over a vendor's information technology system used for emissions modelling, we recommend that the Ministry of the Environment, Conservation and Parks obtain and review independent assurance reports annually for information technology weaknesses.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation. The Ministry will take steps to obtain and review independent assurance reports for information technology weaknesses in the emissions modelling system the ministry uses.

4.8 Plan Leaves Agricultural Emissions Largely Unaddressed

As shown in **Figure 8**, Ontario's greenhouse gas emissions come from several sectors—transportation (35%), industry (30%) and buildings (22%). (See **Appendix 2** for Ontario's emissions in various economic sectors and subsectors). The eight areas in the Plan to reduce greenhouse gas emissions target many sectors, but do not explicitly address emissions from the agricultural sector, such as those from raising livestock (6.2 Mt) and producing crops (3.6 Mt). Nevertheless, initiatives in the Clean Fuels area may help reduce the emissions produced by on-farm fuel use and livestock manure management, through the production of renewable natural gas, for example. The reverse auction component of the Emission Reduction Fund may also result in funding for new agricultural emissions reduction projects, as was the case in Australia's reverse auction process. The Ontario Ministry of Agriculture, Food and Rural Affairs has a number of initiatives in place to support improved agricultural management practices that can reduce greenhouse emissions, like the joint Canadian Agricultural Partnership with the federal government. In response to the Ministry's request for ideas to include in a climate change plan, the Ministry of Agriculture, Food and Rural Affairs proposed scaling up existing programs to further reduce emissions from the sector. This option is not yet included in the Plan.

RECOMMENDATION 15

So that all major economic sectors are taken into account when designing emission-reduction initiatives, we recommend that the Ministry of the Environment, Conservation and Parks work with the Ministry of Agriculture, Food and Rural Affairs to include agriculture-specific initiatives in an updated Plan to reduce emissions to meet the 2030 target.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation. The Ministry will work with the Ministry of Agriculture, Food and Rural Affairs to include approved agricultural initiatives in future iterations of the climate change plan.

4.9 Costs of Emission-Reduction Initiatives Were Not Fully Evaluated or Considered

Emission-reduction initiatives, regardless of type, have associated financial costs—costs to the government, businesses and the public. Estimating and considering these costs is a best practice to account

for economic impacts, and are an important factor to consider when deciding which initiatives to undertake.

During the development of the Plan, the financial criterion used to evaluate initiatives was whether or not there were implementation costs. The Ministry's assessment awarded points to proposed ideas with little or no assumed provincial costs. The Ministry did not consider indirect costs to the public and businesses, or to the economy as a whole.

In soliciting proposals to include in the Plan, the Ministry requested that other ministries provide the estimated costs of implementing proposed actions. Of the 147 proposals that the Ministry received, compiled and considered, 69 were identified as having the potential for measurable emissions reductions. Of these, the costs of implementation were estimated for 28 (41%).

When the Plan was released, the Ministry had not yet evaluated the full financial costs of the following emission-reduction areas included in the Plan: Low Carbon Vehicles Uptake, Clean Fuels, the federal Clean Fuel Standard, Industry Performance Standards, or Innovation.

RECOMMENDATION 16

To support the selection of emission-reduction initiatives, we recommend that the Ministry of the Environment, Conservation and Parks accurately assess and compare all costs and net emissions reductions associated with all initiatives under consideration for inclusion in the final Plan.

MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation on the importance of assessing and comparing all costs and net emissions reductions from initiatives in the Plan. The Ministry will consider this feedback as it refines its proposed policies and programs and updates the climate change plan. When drafting the Plan, we used the latest research and models to estimate costs of actions and the impacts of policies on greenhouse gas emissions. These estimates will continue to evolve as policies and commitments in the Plan are finalized and implemented.

4.10 Decisions Made Separately by Provincial Ministries and Agencies Can Undermine Efforts to Reduce Emissions

4.10.1 Ministry Does Not Have Direct Control over Most Plan Reductions

The Ministry co-ordinates Ontario's actions on climate change, and its Climate Change and Resiliency Division leads the Ministry's efforts to address climate change in support of the Plan. The Division is responsible for the design, development and delivery of policies and programs to help reduce emissions and increase Ontario's resilience to climate change.

Within the Division, the Ministry's Climate Change Policy Branch is currently developing an implementation strategy to facilitate co-ordination within the Ministry and between ministries, set roles and responsibilities, support timely results, and enable public reporting. The Climate Change Plan Implementation Directors' Working Group is responsible for co-ordinating these efforts across ministries. A co-ordinated implementation strategy is important because many emission-reduction initiatives outlined in the Plan are outside the Ministry's control. The Ministry is the lead for five initiatives: Industry Performance Standards, the Emission Reduction Fund, increasing the renewable content of gasoline, organic waste diversion, and cost-effective fuel switching. Together, these initiatives account for 5.6 Mt (31%) of the Plan's estimated 17.6 Mt in emissions reductions by 2030.

4.10.2 Some Recent Decisions by Other Ministries Are Inconsistent With Government Climate Change Goals

Provincial government programs and activities have the potential to increase or decrease emissions. However, provincial ministries and agencies responsible for those programs and activities do not consistently consider this. For example, several recent decisions by other ministries and agencies have the potential to increase greenhouse gas emissions, or make it harder to achieve the emission-reduction goals of the Plan.

- *Changes that undermine electric vehicle uptake:* The Plan states that Ontario will "remove regulatory barriers that block private investors from deploying low-carbon refueling infrastructure that will help increase the uptake of electric…vehicles without government subsidies." In November 2018, Metrolinx removed 24 electric vehicle charging stations from its GO station parking lots, citing low demand and costs exceeding revenue. However, the majority of parking spaces in Metrolinx's GO station network have costs that exceed revenue. As of July 2019, Metrolinx had 75,106 parking spaces in its GO station network. Metrolinx did not derive revenue from 69,788 (93%) of these spaces. The total capital cost for each parking space in 2019 was $42,475.

  In May 2019, the Ministry of Municipal Affairs and Housing amended the Ontario Building Code, removing requirements that workplaces provide electric vehicle charging in at least 20% of their parking spaces, and that new homes be built to include supply equipment to permit future installation of electric vehicle chargers. The Ministry of Municipal Affairs and Housing states that these changes were made to reduce costs associated with home construction. Internally, staff at the Ministry of the Environment, Conservation and Parks recommended against the proposed Building Code changes, indicating that the changes would impact Ontario's ability to meet its greenhouse gas reduction target. Staff advised that the changes would likely act as a deterrent to electric vehicle uptake. The lack of home charging equipment is a key barrier to the uptake of electric vehicles. Studies from other jurisdictions have found that the costs of retrofitting buildings to install charging equipment can be up to 80% higher than installation at time of construction.
- *Decisions that increase personal vehicle use:* In August 2018, the Ministry highlighted the importance of the Growth Plan for the Greater Golden Horseshoe (Growth Plan) in addressing climate change, and indicated that any changes made to it should support emission-reduction goals by "decreas[ing] deforestation/conversion of lands between settlement and forest land." In fall 2018, the Ministry of Municipal Affairs and Housing began consulting stakeholders to update the Growth Plan. In December, the Ministry provided input to the Ministry of Municipal Affairs and Housing on draft versions of the Growth Plan. The Ministry expressed concerns that a number of the proposed changes would negatively impact the Growth Plan's ability to address climate change, by removing limits on urban boundary expansions, for example. The Ministry made suggestions to keep some of the climate change goals and language intact. While the final updated Growth Plan addressed some of the Ministry's concerns, it included a number of changes that could increase the total area of agricultural and natural land converted to urban development by 2041. By removing limits on urban boundary expansions, among other changes, the updates to the Growth Plan allow development to expand, requiring people to drive more and may contribute

more greenhouse gas emissions through increased vehicle use.

- *Expansion of natural gas infrastructure:* In December 2018, Ontario passed legislation to expand natural gas distribution infrastructure. Natural gas expansion may increase reliance on fossil fuels, leading to a long-term increase in greenhouse gas emissions. Preliminary analysis by the Ministry estimated that for every $10 million in natural gas infrastructure capital investment, emissions will increase by 0.01 Mt per year.

4.10.3 More Work Needed to Embed Climate Change into Government Decision Making

To ensure that future decisions consider climate change, the Plan includes a commitment to "make climate change a cross-government priority," by developing a Climate Change Governance Framework to establish clear responsibilities and requirements for ministries to track and report on climate change measures and consider climate change in certain government procurement decisions. The Plan also commits to developing tools to help decision makers understand the climate impacts of government activities and updating ministries' Statements of Environmental Values to reflect the Plan. A Statement of Environmental Values is a document, required under the *Environmental Bill of Rights, 1993*, that describes how a ministry views its environmental values, priorities and responsibilities. It guides ministry staff in integrating environmental values with social, economic and scientific considerations when making environmentally significant decisions. As discussed in **Chapter 2** of this volume, Statements of Environmental Values are outdated for 10 of the 15 ministries that are required to have one, and therefore these ministries may not be considering climate change each time they make a decision that affects the environment.

Fulfilling the above commitments would be a step toward addressing recommendations made previously by our Office to support climate-change mitigation efforts government-wide. A number of other jurisdictions have embedded climate change across government decision making. For example, British Columbia has established an independent Climate Solutions and Clean Growth Advisory Council to provide advice to government and report every two years on progress in meeting emissions targets. British Columbia ministries are also required to develop annual service plans that demonstrate how they will implement and measure progress on climate change initiatives.

Best practices used by other jurisdictions to embed climate change in government decisions and operations include:

- integrating climate change goals in key planning documents (energy, infrastructure, land use, annual budgets);
- considering climate change in all submissions to Cabinet and Treasury Board and in regulatory impact analyses; and
- holding specific ministries and agencies accountable for climate change through regular reporting, greater transparency on spending and implementation plans, and clear responsibilities in mandate letters.

Ontario has made progress toward embedding climate change considerations across government, but does not yet use these best practices.

In January 2019, a Climate Change Leadership Team (CCLT) was established. The CCLT is a cross-ministry group responsible for embedding climate change in government procurement, building understanding and capacity within government, and creating a process to update internal directives and guidance to help ensure climate change is considered. The CCLT includes representation from a number of key ministries, including Treasury Board Secretariat, which co-chairs the group with the Ministry, Cabinet Office, the Ministry of Infrastructure, and the Ministry of Finance. The group includes directors who report to senior management within their ministries. The CCLT itself reports to the Assistant Deputy Minister of the

Climate Change and Resiliency Division, and will update Cabinet on progress on the broader Environment Plan.

The CCLT is still at an early stage of development, and has not yet demonstrated whether it is an effective model to meet the commitment of making climate change a cross-government priority. Our Office pointed out in our 2016 report that reporting directly to Cabinet would give such a group greater authority to ensure that other ministries adopt its recommendations. The CCLT has no direct authority over whether other ministries decide to adopt its recommendations. Instead, it must rely on working collaboratively and making suggestions.

Currently, the CCLT is working on several pilot projects to support other ministries when considering climate change in key policy and procurement decisions. Several tools are being developed for the Ontario Public Service. These include a decision tree to identify points where climate could be considered, a carbon emissions inventory to outline the emissions associated with government assets, and a resource guide on using life-cycle assessment for carbon emissions. However, there are no existing concrete plans for ensuring that the results of these pilots are adopted across government. The current approach to incorporating climate change into ministries' decision making is largely ad hoc, with ministries consulting the Ministry on some decisions. Often, the Ministry is involved only toward the end of the policy development process. This process risks making climate change an afterthought in government decisions, rather than an integral factor to consider.

For more than a decade, Ontario has introduced various climate change governance and advisory bodies. These have included a Climate Change Secretariat, an external advisory panel on climate change, and a Minister's Table on Climate Change. To date, these have resulted in little success. Because climate change is a complex problem that affects every aspect of Ontario's economy and society, it requires a transformational, cross-cutting focus across sectors, ministries and agencies. Climate change must be embedded into all government decision making to ensure progress is made in reducing provincial emissions.

In 2012, the Commission on the Reform of Ontario's Public Services advised that "any transformational process … must be led from the top. In the case of the Ontario government, this means that the centre of government—the Premier's Office and Cabinet Office—must be directly involved and provide strong leadership to the process for as long as it takes … A steering committee should be established, with representation from the Premier's Office, Cabinet Office and Ministry of Finance. This committee, supported by a secretariat within Cabinet Office, would be the focal point for the government-wide work necessary to develop implementation proposals for specific reforms and for cross-cutting measures addressing themes that touch on multiple sectors." Although referring to fiscal management, the challenges described apply equally to climate change.

RECOMMENDATION 17

So that actions and decisions made by ministries support Ontario's ability to meet its greenhouse gas reduction target, we recommend that the Secretary of Cabinet, in conjunction with the Ontario Deputy Ministers' Council, require ministries to use the guidance tools developed by the Climate Change Leadership Team.

MINISTRY RESPONSE

The Climate Change Leadership Team (CCLT), comprised of representatives from across government ministries, will be developing tools and guidance to support the consideration of climate change in government decision making and operations. In this respect, we will ask the CCLT to report into Deputy Ministers' Council, from time to time, as the guidance and tools are developed, so that Deputy Ministers have an awareness of the guidance and are able to promote its adoption in their respective ministries.

RECOMMENDATION 18

So that ministries consider the impact that their decisions may have on greenhouse gas emissions, we recommend that the impact of decisions that affect emissions be evaluated and highlighted in all Treasury Board submissions.

MINISTRY RESPONSE

We recognize the importance of taking action on climate change, including climate informed decisions in government. In this respect, Cabinet Office will work with ministries to include considerations and impacts relating to greenhouse gas emissions, where relevant, in submissions that are brought forward for decision making by Cabinet and its committees.

4.11 Public Reporting on Environment Plan Under Development

The *Cap and Trade Cancellation Act, 2018* requires the Ministry of the Environment, Conservation and Parks to regularly prepare and release progress reports on the Ministry's climate change plan. The Plan states that, to ensure progress toward the 2030 target, the Ministry is committed to updating and reporting on estimated greenhouse gas reductions once program details are finalized. The Plan also states that the Ministry is committed to reporting regularly on progress, developing key indicators and reviewing the Plan every four years.

Ministry staff are preparing advice to government on how to meet the Ministry's reporting obligations. This may include releasing two progress reports on climate change:

- *A High-Level Environment Plan Summary Report*—an annual, public-facing web report with progress on all Plan initiatives, statistics on outcomes achieved to date, and a focus on the social and economic benefits of initiatives.
- *A Climate Change Update*—a more detailed, web-based report that will be regularly updated with quantitative results, including modelling and analysis of progress toward targets, as well as timing and performance metrics.

With respect to monitoring and evaluating progress, Ministry staff plan to consult with partner ministries to develop specific performance metrics and align them with best practices. Our review of other jurisdictions found that it is a best practice to provide timely and useful information about progress in specific sectors to complement regular economy-wide reporting (see **Appendix 5**).

For example, the United Kingdom's Committee on Climate Change, an independent body established by legislation that reports to Parliament, produces annual progress reports that not only include sector-wide emissions statistics, including preliminary estimates of the previous year's emissions, but also track 24 separate indicators across eight sectors. The indicators, such as the number of electric car registrations or number of heat pumps installed, help to measure progress in reducing emissions. This provides a more comprehensive picture of where progress is being made, as well as more up-to-date reporting than national emissions inventory reports. Other jurisdictions, including British Columbia, have also committed to reporting more regularly on results from specific climate programs, as well as emissions from the previous year.

Our Office will audit and report on the Ministry's monitoring, evaluation and reporting of progress once the implementation of initiatives is further along.

RECOMMENDATION 19

To help keep Ontarians updated on the status of efforts to reduce emissions, we recommend that the Ministry of the Environment, Conservation and Parks:

- develop and implement a set of performance metrics that are measurable and cover all key sectors;

- report at least annually to the public on the government's performance metrics and overall cumulative progress toward meeting its 2030 emissions target; and
- explain the outcomes of all initiatives to reduce emissions in the annual report.

MINISTRY RESPONSE

The Ministry recognizes the importance of public reporting and has committed to reporting on progress against its Plan and target on a regular basis. The Ministry agrees with the Auditor General's recommendation about the importance of performance metrics and outcome-based reporting, and will consider this advice as it finalizes its approach to public reporting, monitoring and evaluating progress against the commitments in its Plan.

Appendix 1: Glossary of Terms

Prepared by the Office of the Auditor General of Ontario

Adaptation: Actions taken to reduce the potential damage caused by climate change and prepare for its impacts (e.g., higher temperatures, extreme weather, flooding).

Business-as-usual (BAU) forecast: The expected future level of greenhouse gas emissions if no new government actions are taken beyond those already in place. Also known as the baseline or reference scenario.

***Cap and Trade Cancellation Act, 2018*:** The Act that ended Ontario's cap and trade system, and requires the Minister of the Environment, Conservation and Parks to prepare a climate change plan.

Carbon dioxide (CO_2): The principal greenhouse gas responsible for human-caused climate change. Carbon dioxide occurs naturally in the atmosphere, and is also produced by human activities, including the burning of fossil fuels and biomass (e.g., forests), land use changes, and industrial processes (e.g., cement production).

Carbon pricing backstop: The federal backstop consists of two parts (a carbon levy on fossil fuels, and an output-based pricing system for industrial emitters), and was applied to any province or territory that did not have its own equivalent system in place by 2018. As of April 2019, the backstop applied, in full or partially, to Manitoba, New Brunswick, Ontario, Prince Edward Island and Saskatchewan.

Carbon pricing: A policy that captures the external costs of greenhouse gas emissions by attaching a price to the associated carbon dioxide emissions. This generally takes one of two forms: a carbon tax or levy, which attaches a fixed price to each tonne of carbon dioxide emitted; or cap and trade, which sets an overall limit and creates a market for tradeable carbon allowances.

Carbon sinks: Natural reservoirs (like forests, oceans and soils) that store carbon.

Clean Fuel Standard: Proposed federal regulations to encourage the production and adoption of low-carbon fuels through setting performance standards.

Climate Change Action Plan: Ontario's previous five-year plan to address climate change, which was to run from 2016 to 2020. It was replaced in 2018 with *Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan*.

Compressed natural gas (CNG): A substitute for transportation fuels such as gasoline and diesel, consisting of methane (natural gas) compressed and stored at high pressure. CNG can be used in modified internal combustion engine vehicles, or vehicles manufactured to run on CNG.

Electric vehicle (EV): A vehicle that runs entirely or in part on electricity, as opposed to gasoline and other fossil fuels. Can include battery electric vehicles (BEV), which are 100% electric, and plug-in hybrid electric vehicles (PHEV), which can also be recharged by an on-board engine.

Energy storage: The capture of energy (usually electricity) for use at a later time, commonly through a battery or hydroelectric dam. Surplus electricity can be captured and stored until it is needed, usually at times of high demand.

Environment and Climate Change Canada (ECCC): The lead federal department responsible for a wide range of environmental issues and programs, including climate change.

Environmental Registry: The Environmental Registry is an on-line database that allows the public to comment on any proposed new or amended environmental law, regulation, policy or instrument (i.e., permit, approval or order) in Ontario.

Fossil fuel: Fuels such as oil, coal and natural gas, formed from the fossilized remains of dead organisms buried for millions of years. When burned, these fuels release carbon dioxide and other greenhouse gases into the atmosphere, leading to higher temperatures and other climatic impacts.

Gigajoule (GJ): A unit of energy equivalent to 1 billion joules (10^9), and a standard measure of natural gas use.

Global warming potential: Greenhouse gases differ in the time they remain in the atmosphere and their ability to trap heat. Global warming potential represents the ability of each gas to trap heat compared to carbon dioxide and is measured over a specified time period. The global warming potential for methane is 28, which means it is 28 times more potent than carbon dioxide over a 100-year time period.

Greenhouse gas (GHG): Water vapour, carbon dioxide, methane, nitrous oxide, ozone and other gases that absorb and emit infrared radiation in Earth's atmosphere, causing the greenhouse effect (i.e., letting the sun's energy in, but blocking its heat from escaping). Increasing greenhouse gas emissions from human activities since the industrial revolution are the primary cause of climate change.

Greenhouse Gas Pollution Pricing Act: This federal act creates a system to price greenhouse gas emissions, and was passed by the Canadian parliament in June 2018. The system consists of two parts: a charge on fossil fuels (i.e., the carbon levy), and a pricing system for industrial facilities based on production levels (i.e., Output-Based Pricing System).
Hydrofluorocarbons (HFCs): Compounds containing only hydrogen, fluorine and carbon atoms. They were introduced as alternatives to ozone-depleting substances in serving many industrial, commercial and personal needs.
Independent Electricity Systems Operator (IESO): Administrator of Ontario's wholesale electricity market, which matches electricity supply with demand. Also responsible for long-term planning and procurement to meet Ontario's electricity needs.
Industry Performance Standard: A policy to reduce greenhouse gas emissions from the industrial sector by setting performance standards (i.e., annual emissions limits). Facilities can comply by either paying a fee, or reducing their emissions.
Intergovernmental Panel on Climate Change (IPCC): A United Nations body that provides policymakers with regular scientific assessments on climate change, its implications and potential future risks.
Life-cycle assessment: A method of evaluating the full impacts of a product or technology over its lifetime. For fossil fuels, this includes upstream (extraction, processing, distribution) and downstream (combustion) impacts.
Megatonne (Mt): One million metric tonnes (often in reference to the amount of greenhouse gases emitted by human activities).
Megawatt (MW): A unit of power equivalent to 1 million joules per second.
Methane: A potent greenhouse gas that is the main constituent of natural gas.
Metrolinx: The provincial agency responsible for managing and planning regional transit, including GO Transit, in the Greater Toronto and Hamilton Area.
Mitigation: Actions taken to reduce the quantity of greenhouse gases released (e.g., by switching from fossil fuels to renewable fuels), or absorb emissions from the atmosphere (e.g., through expanding forests).
National Inventory Report (NIR): The annual inventory of Canada's greenhouse gas emissions by sources, and removals by sinks. The NIR is produced by Environment and Climate Change Canada and submitted to the UN Framework Convention on Climate Change.
Natural gas conservation: Refers to a suite of measures and incentives to encourage homeowners, businesses and industry to reduce their use of natural gas.
Ontario Energy Association (OEA): An energy industry group in Ontario that undertakes advocacy, research and education on behalf of its members.
Paris Agreement: A 2015 United Nations agreement at which the international community agreed to limit the global warming increase to well below 2°C, ideally below 1.5°C, compared to pre-industrial levels. Canada is one of 187 states and territories that have ratified the Agreement.
Parts per million (ppm): The standard measure of carbon dioxide concentration in the atmosphere.
Peatlands: Areas of land with a naturally accumulated area of dead plant material (peat) formed under waterlogged conditions.
Petajoule: A unit of energy equal to a quadrillion joules (10^{15} joules).
Pre-industrial: Before the start of large-scale industrial activity (around 1750).
Renewable energy: A source of energy that is naturally replenished on a human timescale. Examples include solar, wind, tidal, and geothermal energy.
Renewable natural gas (RNG): Natural gas produced as a by-product of the decomposition of organic material (e.g., food waste, biomass) that can be substituted for fossil natural gas and distributed through the existing energy grid.
Statistics Canada: Canada's national statistics office, which produces information for citizens and decision makers on the economy, society and environment.
United Nations Environment Programme: A body that co-ordinates the United Nations' environmental activities and supports developing countries to implement environmental and sustainable development projects.
United Nations Framework Convention on Climate Change (UNFCCC): An international treaty negotiated in 1992 at the United Nations Earth Summit. The UNFCCC sets non-binding limits on greenhouse gas emissions and outlines how countries can negotiate international treaties to prevent climate change. It came into force in March 1994.
World Meteorological Organization: An intergovernmental agency with a membership of 193 states and territories, which has a mandate to promote the standardization of meteorological observations.

Appendix 2: Ontario's Greenhouse Gas Emissions from Economic Sectors and Subsectors in 1990, 2005 and 2017

Source of data: Environment and Climate Change Canada (2019)

	Megatonnes				
	1990	2005	2017	1990–2017 Change[1]	Share of Total in 2017 (%)
Transportation	**42**	**57**	**56**	**14**	**35**
Cars, Light Trucks and Motorcycles	24	33	32	8	20
Bus, Rail and Domestic Aviation	2	2	3	0	2
Heavy Duty Trucks, Rail	7	16	17	10[2]	11
Domestic Aviation and Marine	1	1	1	0	1
Recreational, Commercial and Residential	7	4	3	(4)	2
Industry	**66**	**58**	**47**	**(19)**	**30**
Mining	1	1	1	0	1
Smelting and Refining (Non Ferrous Metals)	1	2	1	0	1
Pulp and Paper	3	2	1	(2)	1
Iron and Steel	15	15	14	(1)	9
Cement	5	6	4	0	3
Lime and Gypsum	2	2	1	(1)	1
Chemicals and Fertilizers	16	7	5	(11)[3]	3
Oil and Gas	10	12	9	(1)	6
Light Manufacturing	10	8	6	(4)	4
Construction and Forest Resources	3	3	3	0	2
Buildings	**28**	**36**	**35**	**7**	**22**
Service Industry	10	15	16	7	10
Residential	18	21	19	1	12
Agriculture	**12**	**12**	**12**	**0**	**8**
On Farm Fuel Use	2	2	2	0	1
Crop Production	3	3	4	1	2
Animal Production	7	7	6	(1)	4
Waste	**6**	**6**	**6**	**0**	**4**
Electricity	**26**	**34**	**2**	**(24)[4]**	**1**
Total	**180**	**204**	**159**	**(21)**	**100**

1. Sums and differences may be affected by rounding.
2. Heavy duty truck emissions increased due to increased trade.
3. Chemical and fertilizer emissions decreased primarily due to closure of an adipic acid factory.
4. Electricity emissions decreased primarily due to closure of coal power plants.

Appendix 3: Ontario's 25 Highest Greenhouse Gas Emissions Reporters in 2017

Source of data: Ministry of the Environment, Conservation and Parks

Ontario Emissions Reporter[1]
Sector: Transportation[2]/Industry[3]/Buildings/Agriculture (On-Farm Fuel Use)
Imperial Oil Ontario Petroleum Product Supply
MacEwen Petroleum Inc. (Maxville)
Plains Midstream Canada (Sarnia Fractionation Plant)
Shell Canada Products – Supply
Suncor Energy Ontario Wholesale and Retail Marketing
Valero Energy Distribution
Sector: Industry[3]/Buildings
Enbridge Gas Distribution Inc.
Union Gas Ltd. – Natural Gas Transmission and Distribution
Sector: Transportation[2]/Agriculture (On-Farm Fuel Use)
Greenergy Fuels Canada Inc.
Sector: Heavy Industry (Iron and Steel)
ArcelorMittal Dofasco (Hamilton)
Essar Steel Algoma Inc.
Stelco (Lake Erie)
Sector: Heavy Industry (Cement)
CRH Canada Group (Mississauga)
Lafarge Canada (Bath)
Lehigh Hanson Materials (Picton)
St. Marys Cement (Bowmanville)
St. Marys Cement (St. Marys)
Sector: Heavy Industry (Chemicals and Fertilizers)
Air Products Canada Hydrogen Facility (Corunna)
CF Industries Courtright Nitrogen Complex
NOVA Chemicals (Canada) (Corunna)
Sector: Oil and Gas Industry (Petroleum Refining)
Imperial Oil (Nanticoke)
Imperial Oil (Sarnia Refinery Plant)
Shell Canada Products (Sarnia)
Suncor Energy Products Partnership (Sarnia)
Sector: Oil and Gas Industry (Oil and Natural Gas Transmission)
TransCanada Pipeline, Ontario

1. Reporters are those required to report their emissions under O. Reg. 390/18 (Greenhouse Gas Emissions: Quantification, Reporting and Verification) under the *Environmental Protection Act*. Reporters in the first three sectors include fuel distributors who report emissions that result from the use of fuel sold to their customers.
2. Includes all subsectors: passenger, freight and other transport (recreational, commercial and residential).
3. Includes all subsectors: heavy industry, oil and gas industry and other industry (light manufacturing, construction and forest resources).

Appendix 4: Options Used in Ontario to Reduce Greenhouse Gas Emissions*

Prepared by the Office of the Auditor General of Ontario

Policy Option and Current Examples	How it Works	Benefits	Challenges
Legislation and Regulation: • Ontario Ethanol in Gasoline (O. Reg. 535/05) • Ontario Cessation of Coal Use (O. Reg. 496/07) • Federal Vehicle Greenhouse Gas Emission Regulations (SOR/2010-201)	• **Government**: sets specific rules designed to reduce emissions. • **Emitters (businesses and/or consumers)**: must comply with rules and pay for associated costs.	• **Easier to communicate public benefits**: specific regulatory requirements can be easier to understand (e.g., ethanol has lower emissions than gasoline). • **Low public costs**: emitters bear cost of compliance (e.g., buying ethanol). • **No explicit emitter costs**: may help avoid some controversy (e.g., impact of ethanol on fuel price is unclear).	• **Inflexible**: government decides how emitters can comply (e.g., blend ethanol into gasoline). • **Capital cost barriers**: lack of capital could be obstacle to complying (e.g., ethanol infrastructure costs). • **Potentially high emitter costs**: options to comply could exclude more affordable options to reduce emissions (e.g., cannot comply with ethanol regulation by carpooling).
Pollution pricing: • Federal *Greenhouse Gas Pollution Pricing Act* (S.C. 2018, c 12, s. 186) • Ontario Greenhouse Gas Emissions Performance Standards (O. Reg. 241/19)	• **Government**: sets a pollution price or creates a pollution market that sets the price. • **Emitters (businesses and/or consumers)**: pay price for their emissions, which may be passed on to consumers. Emitters with lower emissions would pay less than those with higher emissions.	• **Flexibility**: emitters decide how to reduce their emissions (i.e., not limited by government options). • **Lower emitter costs**: emitters can choose most affordable options to reduce their emissions (e.g., carpooling or public transit). • **Public revenue**: funds available to address affordability issues (e.g., household rebates).	• **Visible emitter costs**: may increase controversy (e.g., pollution price is designed to increase gasoline price). • **Harder to communicate public benefits**: economics can be difficult to understand (e.g., how do people respond to higher gasoline prices?). • **Capital cost barriers**: lack of capital could prevent investments required to achieve deepest emission cuts (e.g., more public transit infrastructure), though pollution pricing revenue can be used to help.

Policy Option and Current Examples	How it Works	Benefits	Challenges
Financial investments: • Ontario natural gas conservation rebates (Demand-side Management Framework, 2015-2020) • Ontario electricity conservation rebates (Conservation First Framework, 2015-2020) • Federal Low Carbon Economy Fund (2017-)	• **Government**: directly or indirectly provides funding for activities that reduce emissions. • **Emitters (businesses and/or consumers)**: can choose to participate in activities to earn funding. However, emitters may directly or indirectly be required to pay for program costs regardless (e.g., program costs added to utility bill).	• **Easier to communicate public benefits**: narrow program focus can be easier to communicate (e.g., replacing inefficient furnace can reduce energy use and emissions). • **Visible emitter cost savings**: may help build support and avoid some controversy (e.g., reduced home renovation costs). • **Capital cost assistance**: can provide capital investment required for deepest emissions cuts (e.g., costly upgrade to zero-emission electric heat pumps).	• **Inflexible**: government decides how emitters can earn subsidy (e.g., no rebate for turning down thermostat at night). • **Visible public costs**: public bears cost so revenue source is required (e.g., program cost added to utility bill). • **High public costs**: funding also goes to activities that would have occurred regardless (e.g., rebates for home renovations that would have occurred without rebate) or that may not reduce emissions (e.g., rebate that helps reduce cost of home expansion).
Information programs: • Federal EnerGuide labels (1978-) • Ontario Green Button downloadable energy usage data (2013 Long-Term Energy Plan) • Ontario climate change website	• **Government**: provides information to encourage actions that can reduce emissions, but without any financial incentives. • **Emitters (businesses and/or consumers)**: can choose whether or not to take action.	• **Little or no costs**: may help avoid controversy. • **Complementary**: can help support businesses and/or consumers motivated to act by other policies (e.g., recommend paying less carbon price by taking public transit, carpooling or driving a fuel efficient vehicle).	• **Largely ineffective**: decades of empirical evidence show information programs, even with subsidies, have failed to reduce overall emissions. This includes technological innovation and awareness, which also does not reduce emissions on its own (e.g., more efficient engines are increasingly used to power bigger trucks and SUVs rather than to reduce gasoline use).

* The effectiveness of government programs at reducing greenhouse gas emissions depends primarily on the stringency of pollution pricing and/or regulatory requirements, though financial investments and information are also required. Some government programs can include a combination of these elements. For example, the Greenhouse Gas Emissions Performance Standards include pollution pricing, but also regulatory requirements, and financial subsidies.

Appendix 5: Examples of Best Practice Elements of a Climate Change Plan

Prepared by the Office of the Auditor General of Ontario

	Examples of Jurisdictions Where Element Has Been Applied
Government Processes	
• Co-ordinated development and implementation of climate policies and programs	**Alberta and New Brunswick** – Cabinet committees created to oversee/support implementation of climate change plans
• Independent bodies providing non-partisan, science-based advice and analysis	**UK** – Committee on Climate Change **Sweden** – Climate Policy Council
• Stakeholder engagement and public consultation	**France** – extensive stakeholder engagement prior to 2015 Energy Transition Law
• Oversight and accountability (e.g., regular reporting, monitoring and evaluation, setting and tracking performance metrics, transparency)	**UK** – Committee on Climate Change holds government to account through annual reports to Parliament where it tracks progress on 24 indicators across sectors **British Columbia** – government must report annually to legislature on spending, program results, interim and projected greenhouse gas emissions reductions
Greenhouse Gas Reduction Targets	
• Long-term target in line with Paris Agreement	**Sweden** – legally binding net-zero emissions target by 2045
• Legally binding near- and mid-term targets	**France** – legally binding targets for 2020, 2030 and 2050
• Sectoral targets	**New Brunswick** – Climate Change Action Plan assigns responsibility for emissions reductions to specific economic sectors and government departments
• Mechanisms to increase the stringency of initiatives in place	**UK** and **France** – set five-year carbon budgets to gradually increase ambition toward 2050 target **California** and **Germany** – set gradually increasing targets for renewable energy and vehicle efficiency
Laws and Policies	
• Broad-based policy framework using a range of evidence-based tools	**UK** – government uses a range of policy tools (including carbon pricing, regulations, investments in infrastructure and subsidies) to meet five-year carbon budgets
• Regulations and Standards	**Canada** – *Greenhouse Gas Pollution Pricing Act* (2018) sets minimum national standards for pricing carbon pollution **Mexico** – General Law on Climate Change (2012) embeds emissions trading and energy efficiency targets into law
• Integrate climate change into government planning and decision making	**France** – climate change targets integrated into planning documents across all key sectors **Sweden** – climate report must be presented with annual budget bill **New Brunswick** – climate change must be considered in Memorandums to Executive Council and all key government decisions
Funding	
• Sustainable/sufficient funding for implementation	**France** – government undertakes annual assessment of funding needs for implementation; public savings fund provides energy efficiency and low-carbon transport loans to municipalities and others **British Columbia** – Use carbon tax revenue to fund implementation of climate initiatives

Appendix 6: Events in Global Knowledge and Response to Climate Change

Prepared by the Office of the Auditor General of Ontario

Date	Event	Notes
1820s–1860s	Concept of the greenhouse effect first proposed	Joseph Fourier calculates Earth would be far colder without its atmosphere. John Tyndall's experiments confirm gases in Earth's atmosphere, especially carbon dioxide (CO_2) and water vapour, trap heat from the sun.
1896	Discovery of link between CO_2 concentrations in the atmosphere and global temperatures	Svante Arrhenius quantifies how changes in atmospheric CO_2 levels could impact Earth's surface temperature. The first to suggest that burning fossil fuels is a significant source of CO_2 and could lead to additional warming.
1909	The term "greenhouse effect" is officially introduced	John Henry Poynting uses term to explain how heat is transferred in Earth's atmosphere.
Late 1950s and early 1960s	Establishment of the first monitoring program for global atmospheric CO_2 concentrations	Charles David Keeling begins measuring atmospheric CO_2 concentrations. Results in the Keeling Curve, the longest-running measurement of atmospheric CO_2. The curve reveals a clear yearly increase in atmospheric CO_2 since 1958.
1957	Discovery that Earth's oceans have prevented the full impact of warming by absorbing vast quantities of atmospheric CO_2	Roger Revelle and Hans Suess show that the oceans have absorbed large amounts of CO_2 released by fuel combustion since the industrial revolution.
Late 1960s	Greater understanding of impacts	Scientists calculate that doubling CO_2 in the atmosphere will lead to warming of several degrees, causing polar ice sheet to collapse and sea levels to rise.
1970s–1980s	Creation of the first global climate models	A small group of scientists begin modeling atmospheric circulation and generating future climate projections.
1977	Industry awareness of climate change	Leading oil companies become aware, through their own research programs, of the impact that burning fossil fuels has on Earth's climate.
1979	Oil "energy crisis"	Second global oil crisis leads to upsurge in renewable energy and more efficient vehicles. US National Academy of Sciences releases its first report on the greenhouse effect, stating that doubling CO_2 levels could raise global temperatures by 1.5°C–4.5°C.
1987	Montreal Protocol on Substances that Deplete the Ozone Layer	Global agreement to curb emissions of substances that deplete the ozone layer. Often cited as an example of successful international collaboration on atmospheric pollution.
1988	Intergovernmental Panel on Climate Change (IPCC) established	The United Nations Environment Programme and World Meteorological Organization create the IPCC. In the same year, atmospheric CO_2 levels reach 350 parts per million, considered a safe threshold for global temperature rise.
1990	IPCC first global assessment report released	Intergovernmental Panel on Climate Change (IPCC) report concludes "emissions resulting from human activities are substantially increasing the atmospheric concentrations of greenhouse gases."
1992	Earth Summit	United Nations Framework Convention on Climate Change is adopted. Goal is to stabilize greenhouse gas concentrations at a level that would prevent dangerous human-related interference with the climate system.
1994	United Nations Framework Convention on Climate Change (UNFCCC) enters into force	UNFCCC comes into force. 197 countries, including Canada, are currently party to the convention.

Date	Event	Notes
2005	European Union launches carbon Emissions Trading Scheme	First and largest carbon trading system of its kind; operates in 31 countries and covers about 5% of global emissions.
2005	Kyoto Protocol comes into force	First agreement under the UNFCCC. Sets internationally binding targets for all Parties to collectively reduce global emissions from a group of six greenhouse gases by 5.2% below 1990 levels by 2012, with specific targets varying from country to country.
2009	Copenhagen Accord	Successor to the Kyoto Protocol, encouraged developed countries to set economy-wide emissions targets for 2020 and developing countries to implement mitigation actions.
2016	Paris Agreement	Negotiated in 2015, this is a global agreement to keep global temperature rise to well below 2°C above pre-industrial levels, and pursue efforts to limit increase to 1.5°C. Comes into force in November 2016 and 187 parties including Canada have ratified the agreement.
2017	One Planet Summit	Heads of State and non-state representatives gather to put forward concrete initiatives to meet Paris Agreement objectives.
2018	IPCC 1.5°C special report	IPCC report that presents evidence that 1.5°C of warming above pre-industrial levels will lead to significant and damaging impacts worldwide.
2019	Kigali Amendment to the Montreal Protocol comes into force	Global agreement to reduce the production and consumption of hydrofluorocarbons, which are potent greenhouse gases. If fully implemented, it could help avoid global warming by up to 0.4°C this century.

Appendix 7: Current Carbon Pricing in Canadian Provinces and Territories, as of October 2019

Source: Environment and Climate Change Canada

Province/Territory	Carbon Levy on Fuels	Industrial Output-Based Pricing System
Alberta	Federal system (beginning January 2020)	Provincial system
British Columbia	Provincial system	
Manitoba	Federal system	
New Brunswick	Federal system	
Newfoundland and Labrador	Provincial system	
Northwest Territories	Territorial system	
Nova Scotia	Provincial system	
Nunavut	Federal system	
Ontario	Federal system	
Prince Edward Island	Provincial system	Federal system
Quebec	Provincial system	
Saskatchewan	Federal system	Provincial-Federal hybrid system
Yukon	Federal system	

Appendix 8: Events in Canada's Response to Climate Change

Prepared by the Office of the Auditor General of Ontario

Date	Event	Notes
1988	Toronto Conference	Federal government (with United Nations Environment Programme and World Meteorological Organization) hold conference. Immediate action by governments, the UN, non-governmental organizations, industry and individuals is called for to "counter the ongoing deterioration of the atmosphere."
1990	Canada's Green Plan	Canada unveils plan for a healthy environment, expressing its commitment to stabilize greenhouse gas emissions at 1990 levels by the year 2000.
1992	United Nations Framework Convention on Climate Change	Canada signs United Nations Framework Convention on Climate Change (UNFCCC) at Earth Summit in Rio de Janeiro.
1995	National Action Program on Climate Change	Federal-provincial-territorial program is adopted with the goal of setting a strategic direction for pursuing the nation's objective of meeting the emission-reduction target outlined in the Green Plan.
1998	Kyoto Protocol	Canada signs the Kyoto Protocol.
2000	Action Plan 2000	Plan commits to reducing emissions by 65 Mt per year for the period 2008-2012 to achieve the Kyoto target.
2002	Kyoto Protocol ratified	Canada formally ratifies Protocol and submits a second, more elaborate plan to achieve the Kyoto target (the Climate Change Plan for Canada).
2005	Kyoto Protocol enters into force	Commits Canada to an emissions target of 563 Mt during the period 2008 to 2012 (6% below 1990 levels). In 2012, Canada's total emissions were 711 Mt. Canada submits a third plan to achieve the Kyoto target, entitled *Moving Forward on Climate Change: A Plan for Honouring Our Kyoto Commitment*, which included the creation of a nationwide cap-and-trade program with an intensity-based emission-reduction target for major emitters.
2007	*Kyoto Protocol Implementation Act*	Act passes. Canada announces a new climate plan, which includes intensity-based reduction targets for major emitters and a national target of an absolute emission-reduction target of 20% from 2006 levels by 2020.
2010	New commitment under Copenhagen Accord	Under the Accord, Canada commits to a new emissions target of 607 Mt in 2020 (17% below 2005 levels).
2011	Withdrawal from Kyoto Protocol	Canada withdraws to avoid paying penalties.
2016	Paris Agreement ratified Pan-Canadian Framework on Clean Growth and Climate Change (PCF) Developed	Canada ratifies Agreement and submits first Nationally Determined Contribution, which commits Canada to reducing emissions by 30% below 2005 levels by 2030. Develops PCF with provinces and territories. Federal government, provinces and territories adopt Vancouver Declaration on Clean Growth and Climate Change, which indicates Canada's international mitigation pledge is to be achieved through the PCF and a carbon pricing system.
2017	Canada and UK launch global alliance	Alliance launched to phase out coal-fired electricity generation. Canada commits to a new target to reduce greenhouse gas emissions 80% below 2005 levels by 2050. Canada signs the Kigali Amendment to the Montreal Protocol, proposing new regulations to substantially lower emissions of hydrofluorocarbons (a greenhouse gas).
2018	Electricity regulations announced *Greenhouse Gas Pollution Pricing Act* is passed	Canada announces regulations to phase out coal-fired electricity generation by 2030, and regulations limiting CO_2 emissions from natural gas-fired electricity.
2019	Federal carbon pricing system introduced	System introduced in provinces that either request it, or do not have a system that meets the federal requirements. Both of these were introduced in Ontario. There are two components: a charge on fossil fuels and a pricing system for industrial facilities based on their production levels. Both are in effect in Ontario.

Appendix 9: Examples of Emission-Reduction Ideas Submitted but Not Included in the Plan

Prepared by the Office of the Auditor General of Ontario

Sector	Regulations	Investments	Information
Transportation	Remove provincial sales tax on renewable fuels. Zero emission vehicle mandate.	Investments in municipal public transit systems (Ministry of Transportation).	Efficient driving campaign (Ministry of the Environment, Conservation and Parks).
Buildings	Reduce regulatory barriers to increase adoption of geothermal systems.	Social housing capital repair program (Ministry of Municipal Affairs and Housing). Hospital energy efficiency program (Ministry of Health and Long-Term Care/Ministry of Energy, Northern Development and Mines).	n/a
Industry	n/a	n/a	Low carbon transition office for industry (Ministry of the Environment, Conservation and Parks).
Waste	Improve landfill gas collection requirements (Ministry of the Environment, Conservation and Parks).	n/a	Incorporate food waste reduction in schools.
Agriculture/Forestry	Create carbon offset market to allow farmers to receive payment for reducing emissions.	Cost-share funding for agriculture efficiency and waste reduction projects (Ministry of Agriculture, Food and Rural Affairs).	n/a
Electricity	Net metering to support greenhouse gas reductions and net-zero buildings and communities (Ministry of Energy, Northern Development and Mines).	n/a	n/a

Appendix 10: OAGO Comment on Ministry Assumptions Associated with the Plan's Emissions Reductions

Prepared by the Office of the Auditor General of Ontario

Action Area	Description in Plan	Ministry Estimate of Emissions (or Reductions) (Mt in 2030)	Key Ministry Assumptions	OAGO Issues Noted*
"Business as usual" Emissions Forecast	Where we expect Ontario's emissions to be if we take no action	160.9	Technological improvements without new government initiatives	Overlaps with emissions reductions also attributed to Future Innovation (**Section 4.4.11**).
			Federal carbon pricing for fuel and industry not implemented	Federal carbon pricing for fuel and industry has already been implemented (**Section 4.3.1**).
			Federal vehicle emissions standards become more stringent	Overlaps with emissions reductions also attributed to Low Carbon Vehicles Uptake (**Section 4.4.1**).
			Electricity sector reflects 2017 Long-Term Energy Plan	Renewable energy contracts and cap-and-trade program have since been cancelled (**Section 4.3.2**).
Low Carbon Vehicles Uptake	Electric vehicle adoption in Ontario	(2.6)	Electric vehicles on road increase to 1.3 million in 2030	Estimate is based on electric vehicle incentives that have since been cancelled. There are no actions in Plan to achieve the emission-reduction estimate (**Section 4.4.1**).
			Reductions are above and beyond those achieved by federal vehicle emission standards.	Emissions reductions overlap with those from vehicle emission standards **(Section 4.4.1)**.
	Expansion of compressed natural gas in trucking	(0.2)	Compressed natural gas in trucking increases from 0 to 55 petajoules by 2030	Estimate is from document that describes the numbers as "assumed." There are no actions in Plan to achieve the emission-reduction estimate (**Section 4.4.2**).
			Compressed natural gas emissions 24% lower than diesel	Scientific studies have shown compressed natural gas can result in higher emissions than diesel (**Section 4.4.2**).
Clean Fuels	Increasing the ethanol content of gasoline	(1.0)	Renewable content requirement in gasoline increases from 5% to 15% as early as 2025	No issue noted.
			Renewable content has 45% less carbon than gasoline	No issue noted.
	Encouraging uptake of renewable natural gas	(2.3)	Renewable content in natural gas increases from 0 to 47 petajoules in 2030	Estimate is from document that describes the numbers as "illustrative." There are no actions in Plan to achieve the emission-reduction estimate (**Section 4.4.3**).
			Customers will voluntarily purchase renewable content for $18/gigajoule, instead of conventional natural gas for less than $3/gigajoule	Ministry staff estimate purchases will be "negligible" due to high costs. (**Section 4.4.3**).
Federal Clean Fuel Standard	Proposed federal standards	(1.3)	Federal government implements proposed regulation	Emissions reductions depend on proposed federal standard (**Section 4.4.4**).

Action Area	Description in Plan	Ministry Estimate of Emissions (or Reductions) (Mt in 2030)	Key Ministry Assumptions	OAGO Issues Noted*
Natural Gas Conservation	Gradual expansion of programs delivered by utilities	(3.2)	"Unconstrained" budget that "can fund up to 100% of capital cost" of cost-effective consumer programs	Potential emissions reductions overlap with other Plan initiatives (**Section 4.4.5**).
Industry Performance Standards	Proposed approach to regulate large emitters	(2.7)	Carbon price increases $10/t annually until 2022	No issue noted.
			Emissions exempt from price decrease by 1% to 5% annually until 2030	Finalized program has weaker requirements and Ministry staff estimate will only reduce 1.0 Mt (**Section 4.4.6**).
			Reductions are above and beyond those achieved by natural gas conservation programs for industry	Emissions reductions from Industry Performance Standards overlap with those from Natural Gas Conservation and the federal Clean Fuel Standard (**Section 4.4.6**).
			Reductions are above and beyond those achieved by Clean Fuel Standard	
Emission Reduction Fund	Use public funds to leverage private investment	(0.5)	$350 million committed to loans with 4:1 private to public funding leverage ratio	Plan already assumes "up to 100% of capital cost" will be funded for cost-effective natural gas conservation projects, thus overlapping with potential reductions from Emission Reduction Fund. (**Section 4.4.7**).
			$113/t emission-reduction cost for natural gas, oil and propane home retrofits	
			Reductions above and beyond Natural Gas Conservation	
	Reverse auction	(0.1)	$50 million committed to emission-reduction projects	Emissions reductions from lowest cost bids are likely to occur anyway (**Section 4.4.8**).
			$15/t emission-reduction cost paid to lowest cost bids	
Other Policies	Improve diversion of food and organic waste from landfills	(1.0)	1.3 Mt of additional organic waste diverted from landfills in 2030, with estimated net operational costs of $118 million per year.	Estimate includes some emissions reductions that are accounted for in the United States inventory (**Section 4.4.9**).
			Program being designed to target institutional, commercial, industrial, and residential organic waste	
	Investments in public transit	(0.1)	$5 billion committed to transit expansion	Emissions reductions with investments in GO Transit likely to be minimal (**Section 4.5**).

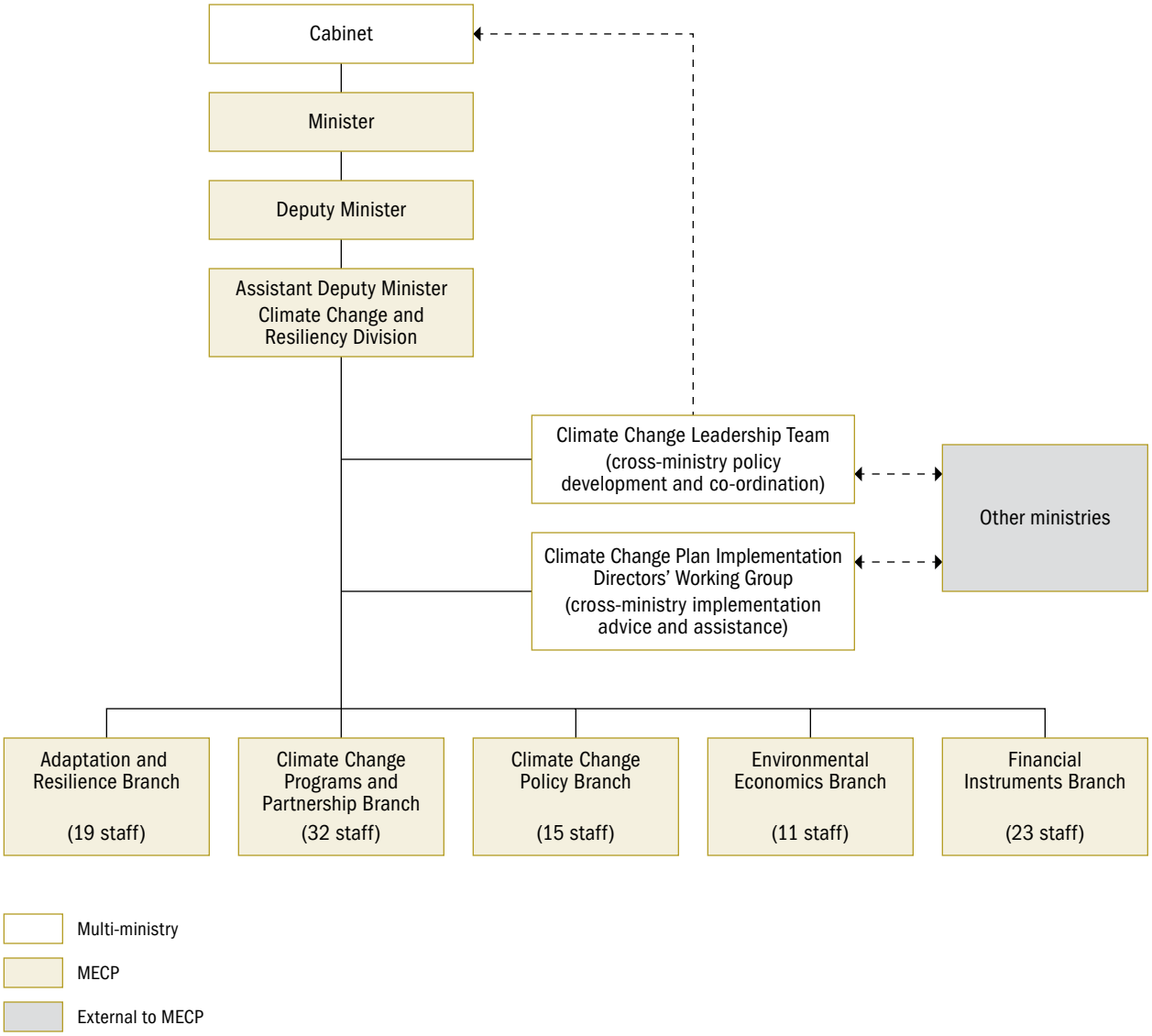
Action Area	Description in Plan	Ministry Estimate of Emissions (or Reductions) (Mt in 2030)	Key Ministry Assumptions	OAGO Issues Noted*
Innovation	Advancements in energy storage	(0.3)	750 MW of zero-emission electricity storage capacity in 2030	Estimate is from document that describes the numbers as "illustrative," and there are no actions in Plan to achieve estimate (**Section 4.4.10**).
	Cost-effective fuel switching	(0.2)	29 petajoules of oil or propane heating switches to electricity by 2030	Ministry staff estimate the cost to achieve these reductions to be $78 million. However, there are no actions in the Plan to achieve the emission-reduction estimate **(Section 4.4.10)**.
	Future innovation (not described in Plan)	(2.2)	Achieves all remaining emissions reductions to reach 2030 target	Estimate is not based on any evidence and there are no planned government initiatives to support the estimate. Emissions reductions from technological improvements and price reductions that will occur without government initiatives are also already incorporated in the business-as-usual emissions forecast (**Section 4.4.11**).
Net emissions reductions		**(17.6)**		
Net emissions (i.e., 2030 target)		**143.3**		

Note: Numbers may not add due to rounding.

* The section numbers refer to the section of this report that describe issues noted.

Appendix 11: Simplified Organizational Chart of the Ministry of the Environment, Conservation and Parks (MECP) and Key Climate Change Responsibilities

Prepared by the Office of the Auditor General of Ontario



Note: Branch descriptions can be found in the text of the report (**Section 2.3**).

Appendix 12: Audit Criteria

Prepared by the Office of the Auditor General of Ontario

1.	The Ministry's initiatives to reduce greenhouse gas emissions in the province are: • based on sound evidence and are in line with best practices; • planned with sufficient detail; and • supported by a sound feasibility analysis.
2.	The Ministry has sufficient authority to lead a co-ordinated approach across provincial ministries and agencies in their implementation of climate change mitigation initiatives.
3.	The Ministry regularly monitors, evaluates and reports to the public on the effectiveness of its greenhouse gas reduction initiatives and progress towards meeting emission-reduction goals.