



Lawrence National Centre  
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# BY THE NUMBERS: CANADIAN GHG EMISSIONS

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# EXECUTIVE SUMMARY

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- Canada's greenhouse gas (GHG) emissions currently represent about 1.6 percent of the global total. Canada is among the top 10 global emitters and one of the largest developed world per capita emitter of GHGs.
- Canadian federal governments have committed to reduce annual GHG emissions from the current level of 726 megatonnes (Mt) to 622 Mt in 2020 and 525 Mt in 2030.
- Within Canada, GHG emissions vary widely across provinces ranging from 267 Mt in Alberta to 1.8 Mt in PEI in 2013.
- In per capita terms, Saskatchewan and Alberta are among the developed world's largest emitters at 68 and 67 tonnes respectively. Per capita emissions in BC, Ontario, and Quebec are in the 10-14 tonne range, comparable to best performers in Western Europe.
- For provinces with announced GHG emission targets, the level of ambition varies widely. Alberta plans to increase emissions towards 2020, and then return to today's levels by 2030, while Ontario Quebec and Manitoba plan to reduce emissions by 56, 27 and 8 Mt respectively.
- Even if all provincial targets were fully achieved, Canada would still need to reduce GHG emissions by an additional 45 Mt in 2020 and 55 Mt in 2030 to meet its international commitments.

## INTRODUCTION

A lot has changed recently in the world of Canadian climate change policy. With the election of new governments in Alberta and Ottawa, there is a sense that reducing greenhouse gas emissions (GHGs) is back on the policy agenda. The previous federal government's approach of ambitious targets plus policy inaction is, if one is to believe the pronouncements of federal and provincial political leaders, about to be replaced by one of ambitious targets plus vigorous policy action. Even provinces that have relatively low emissions by Canadian standards have pledged to do more. The previous government's ambitious 2030 target submitted to the United Nations Framework Convention on Climate Change (UNFCCC), the UN body responsible for climate change negotiations, has been characterized by the new government as 'a floor rather than a ceiling.' Federal and provincial officials have begun to meet to work out how they will coordinate their actions to achieve Canada's targets.

Yet, despite this flurry of activity and the promise of concrete action to reduce GHGs, citizens have relatively little understanding of the simple arithmetic of climate change targets. Given the magnitude of the challenge facing Canada and the delicate negotiations that are yet to come, it is important that everyone share a clear understanding of what will be required by individual provinces and industries if Canada is to match its new rhetoric with action.

In this paper, we lay out the simple arithmetic of GHG emissions. We begin by comparing Canada to a selection of other countries. We then disaggregate Canadian emissions by province and look at the targets that different provinces have set for 2020 and 2030. We hope that this analysis will help provide both a common understanding of the current situation and a firm foundation for tackling the challenge we face as a society.

## CANADA IN THE WORLD

According to the latest statistics, Canada emits about 1.6 percent of the world's GHG emissions.<sup>1</sup> Despite this relatively low share, Canada is among the top 10 global emitters on an absolute basis, and stands firmly in the top 3 for emissions per capita. By way of comparison, Canada's population makes up about 0.5 percent of the world total so that our emissions' share is about 3 times our population share.<sup>2</sup>

Canada played an active role in December 2015 at the Paris COP21 (21st Conference of the Parties) which led to a global agreement on mitigation, adaptation and financing of climate change action. The new Liberal government indicated that 'Canada is back' and wants to do its part in reducing GHGs at home, and helping developing countries that are already facing hardship because of climate change.

In May 2015, the former Conservative government submitted its Intended Nationally Determined Contribution (INDC)<sup>3</sup> to the UNFCCC indicating an economy-wide target of reducing GHG emissions by 30 percent below 2005 levels by 2030. Following the fall 2015 election, the Liberal Government indicated that it considered the target to be a 'floor', suggesting that a consultation process with provinces would be launched to design a credible plan for Canada that might lead to an even more ambitious reduction target.

In order to assess the cumulative effect of all INDCs received before the Paris Conference, the United Nations Framework Convention on Climate Change commissioned a synthesis Report.<sup>4</sup> It concludes that "aggregate global emission levels resulting from the implementation of INDCs will not fall within the 2°C scenario", let alone the 1.5°C scenario that some countries, including Canada, were advocating. Some have estimated that emissions in 2025 will be 11-13 gigatonnes (Gt) higher than the 2°C scenario, and as much as 15-17 Gt higher by 2030 (see Figure 1). To put the gap in perspective, China emitted approximately 11 Gt in 2012 and 16 Gt is the equivalent of the total emissions by China and the United States for 2012.

1. <http://cait.wri.org/historical>, consulted January 2016.

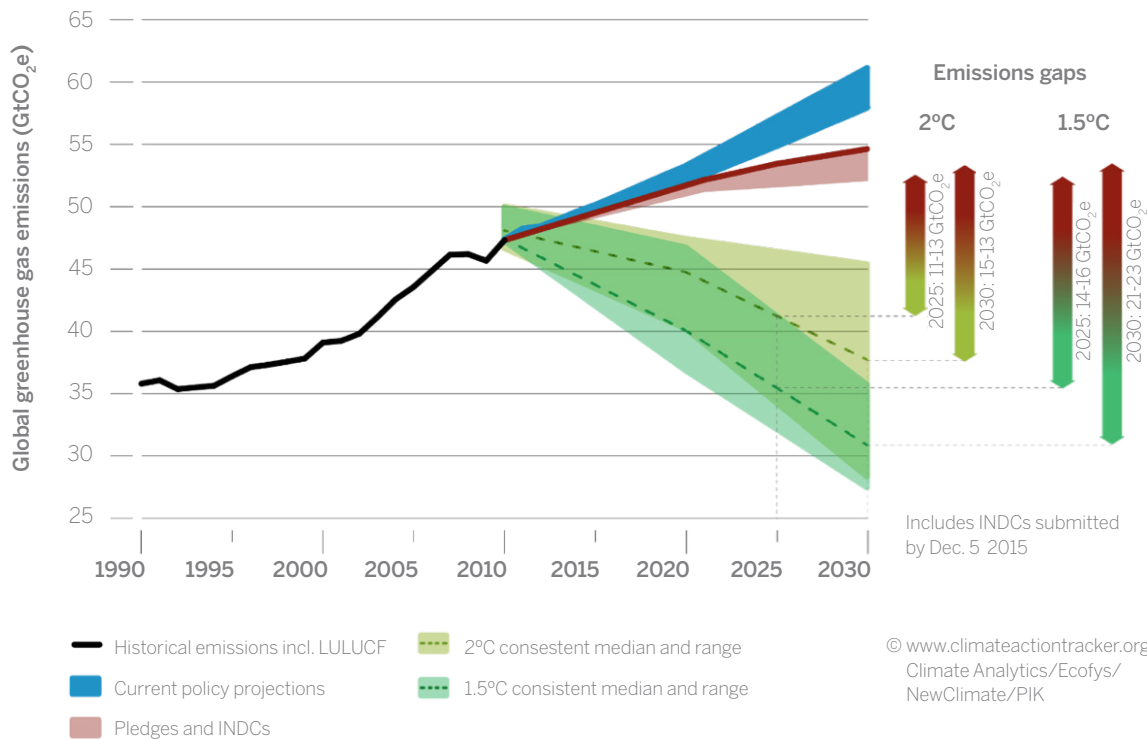
2. <http://data.worldbank.org/indicator/SP.POP.TOTL>, consulted January 2016.

3. <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Canada/1/INDC%20-%20Canada%20-%20English.pdf>, consulted January 2016

4. [http://unfccc.int/focus/indc\\_portal/items/9240.php](http://unfccc.int/focus/indc_portal/items/9240.php), consulted January 2016.

**FIGURE 1 – COMPARISON OF GLOBAL EMISSION LEVELS RESULTING FROM THE INTENDED NATIONALLY CONTRIBUTIONS IN 2025 AND 2030 WITH OTHER TRAJECTORIES**

(source: <http://climateactiontracker.org/global/173/CAT-Emissions-Gaps.html>)



In light of this gap, the international community agreed in Paris to revise their commitments every 5 years in order to close in on the level of GHG emissions that scientists say is required to limit warming to 2°C above pre-industrial levels.

Figure 2 presents total GHG emissions for selected countries for the period 1990 to 2012 (latest global emissions data) and their respective estimated 2020 and 2030 targets submitted as part of their Copenhagen commitment (for 2020) and INDCs (for 2030, except USA, who introduced a 2025 commitment). As expected, most developed countries reached their peak emissions sometime

in the past (between 1990 and 2005) whereas developing nations’ emissions have yet to peak.

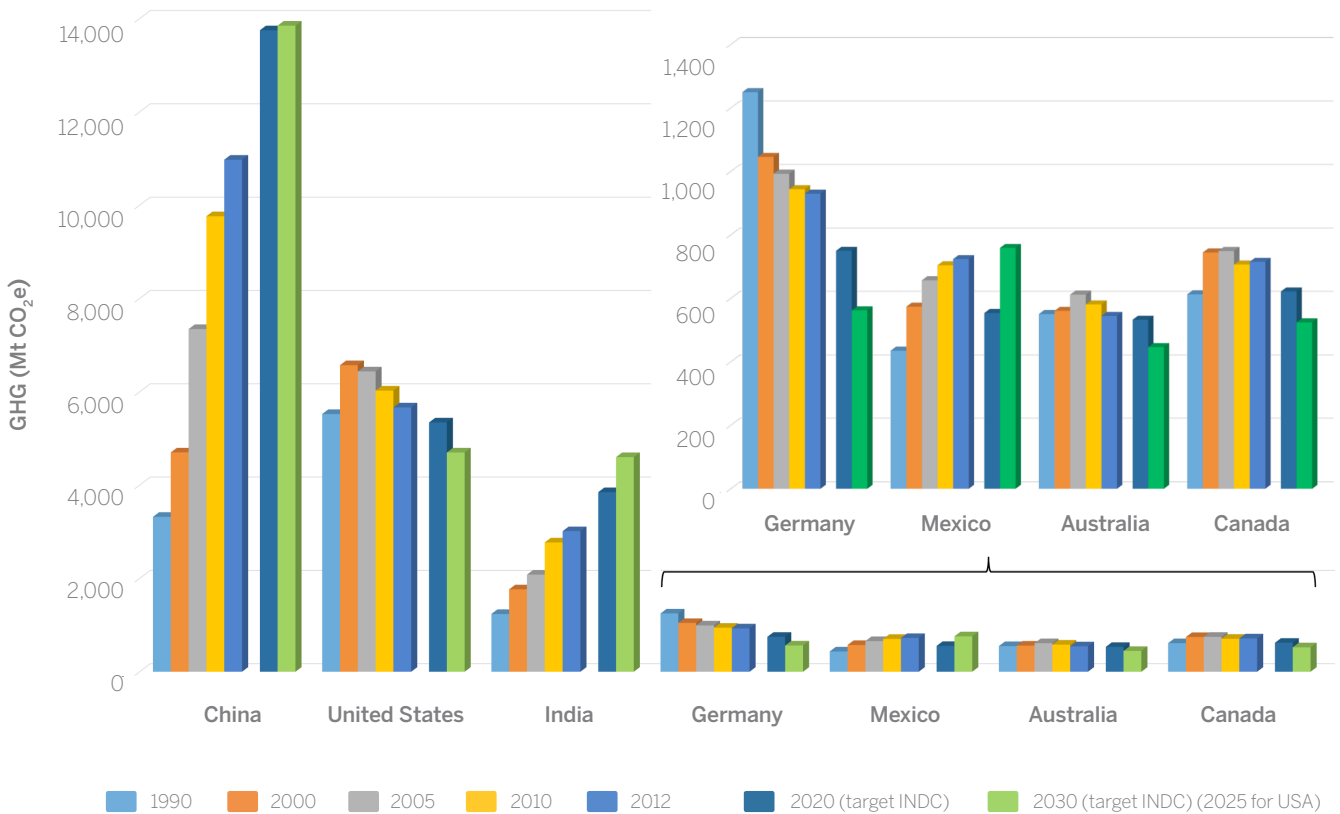
Simply comparing developed and developing countries’ reduction pledges can be misleading since national circumstances play an important role in determining the level of effort required by a country to reduce GHG emissions. Should developing nations be allowed to increase their emissions while they pull people out of extreme economic and energy poverty? Should countries that are responsible for most of the GHGs currently in the atmosphere pay for damages already incurred? These are some of the questions that bedevil international GHG reduction negotiations.

China's situation is of critical importance as they already represent a quarter of the world's emissions and would be expected to grow emissions substantially as they continue on the path to becoming the world's largest economy. Their commitment to "peak emissions by 2030 and making best efforts to peak earlier" is likely to be a very challenging goal while they simultaneously seek to raise average standards of living to developed country levels.

In contrast, India's INDC did not specify when emissions are forecast to peak. This is problematic for a country that saw its emissions triple between 1990 and 2012 and is currently the third largest global emitter. It is estimated that "if India's emissions were to peak when India reached the same per capita income as China is expected to have in 2030, the peak will not occur until about 2043".<sup>5</sup> Such a late peak in emissions is clearly inconsistent with moving global emissions to a downward path.

**FIGURE 2 – TOTAL GHG EMISSIONS – SELECTED COUNTRIES**

(source: <http://cait.wri.org/historical> and Environment Canada)



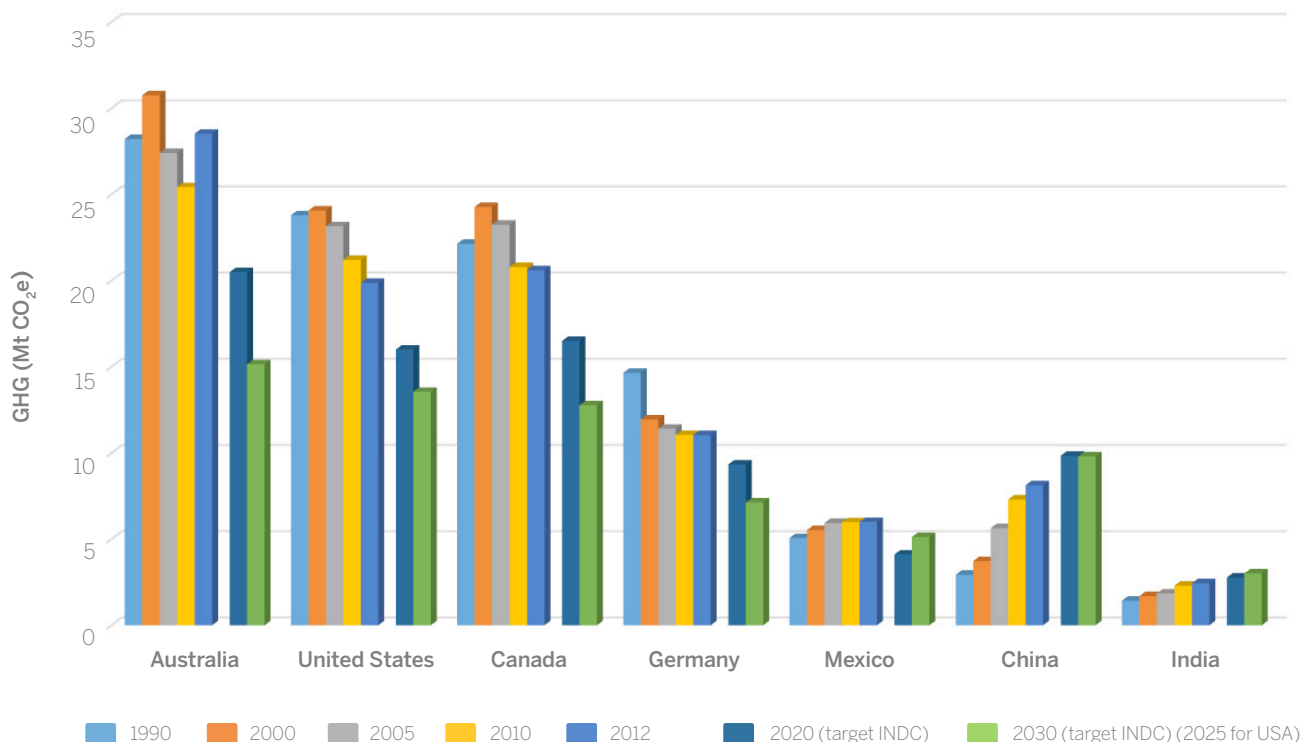
5. <http://www.brookings.edu/blogs/planetpolicy/posts/2015/12/11-india-greater-emissions-reductions-dhar>, consulted January 2016.

Comparing absolute GHG emissions between countries does not take into account differences in population. In Figure 3 we present per capita emissions for the same group of countries. At about 20.6 tonnes per capita in 2012, Canada is second behind Australia (28.5) as highest per capita emitter in this group of countries, slightly exceeding the US (20) and exceeding China (8.1) and India (2.4) by a wide margin. Turning to the INDC pledges for 2030, Canada has pledged to reduce annual emissions to 12.8 tonnes per capita, slightly lower than the US (13.4 in 2025), but well above China (9.8) and India (3.0).

To put these per capita emissions levels in context, the Deep Decarbonization Pathways Project,<sup>6</sup> an initiative of the United Nations Sustainable Development Solutions Network (UNSDSN) and Institute for Sustainable Development and International Relations (IDDRI), determined that in order to limit global warming to 2°C above pre-industrial levels, the target for all countries should be to reduce global GHG emissions to 1.7 tonnes per capita by 2050 from the 2012 level of about 6.2 tonnes per capita.<sup>7</sup> With per capita emissions in developed countries being substantially above this level and developing nations' emissions projected to increase in both absolute and per capita terms as they raise living standards, the global challenge ahead is significant.

**FIGURE 3 – CPER CAPITA EMISSIONS – SELECTED COUNTRIES**

(source: <http://cait.wri.org/historical>, Environment Canada and World Bank Population data)



6. <http://deepdecarbonization.org>, consulted January 2016

7. [http://cait.wri.org/profile/World%20\(sum%20of%20all%20CAIT%20countries\)](http://cait.wri.org/profile/World%20(sum%20of%20all%20CAIT%20countries)), consulted January 2016

## CANADA AT HOME

The data presented in the previous section shows that while Canada contributes only about 1.6 percent of global emissions, it is one of the world's top ten emitters and also one of the its highest per capita emitters. However, these aggregate statistics mask a good deal of diversity with respect to both emissions and climate policy across the country. In this section we delve more deeply into Canadian results by province.

In the last few years, much of the action to combat climate change has come through provincial government policies. Such policies include a carbon tax in British Columbia, a newly-announced hybrid of a carbon tax and emissions trading scheme in Alberta, a cap-and-trade system in Quebec that will shortly be joined by Ontario and Manitoba, and stringent electricity regulations in Ontario to phase out coal and incentivize renewable energy. Table 1 summarizes provincial plans and commitments as of January 2016.

TABLE 1 – PROVINCIAL PLANS AND TARGETS AS JANUARY 2016

PROVINCE	2013 EMISSIONS PER CAPITA	POLICY MEASURES	2020 TARGET	2030 TARGET
<b>Newfoundland and Labrador</b>	8.6 Mt (16.4 t/capita)	<i>Climate Change Action Plan (2011)</i> <sup>8</sup> introduces progressive action on climate change into its policy, planning and programs. Focus on hydroelectricity with support of Lower Churchill Hydroelectric project.	10% below 1990	NA
<b>Prince Edward Island</b>	1.8 Mt (12.4 t/capita)	<i>Strategy for Reducing the Impacts of Global Warming (2008)</i> <sup>9</sup> outlines 49 actions to mitigate and adapt to climate change.	10% below 1990	NA
<b>Nova Scotia</b>	18.3 Mt (19.4 t/capita)	<i>Toward a Greener Future (2009)</i> <sup>10</sup> presents Nova Scotia's plan to address climate change by introducing the Environmental Goals and Sustainable Prosperity Act, notably establishing a cap on Nova Scotia Power Inc.'s emissions by 2010.	10% below 1990	NA
<b>New Brunswick</b>	15.7 Mt (20.8 t/capita)	<i>Climate Change Action Plan 2014–2020</i> includes actions in various areas, including renewable energy, transportation, industrial sources, etc. mainly through voluntary measures. <sup>11</sup>	10% below 1990	NA

(CONTINUED ON FOLLOWING PAGE)

8. <https://www.exec.gov.nl.ca/exec/ccee/index.html>, consulted January 2016

9. <http://www.gov.pe.ca/environment/climatechange>, consulted January 2016

10. <https://climatechange.novascotia.ca>, consulted January 2016

11. [http://www2.gnb.ca/content/gnb/en/departments/elg/environment/content/climate\\_change.html](http://www2.gnb.ca/content/gnb/en/departments/elg/environment/content/climate_change.html), consulted January 2016



TABLE 1 – PROVINCIAL PLANS AND TARGETS AS JANUARY 2016 (CONTINUED)

PROVINCE	2013 EMISSIONS PER CAPITA	POLICY MEASURES	2020 TARGET	2030 TARGET
<b>Quebec</b>	82.6 Mt (10.1 t/capita)	<i>Climate Change Action Plan and Adaptation Strategy (2013-2020)</i> reaffirmed Quebec's vision to operate a Cap-and-trade system for GHG emission allowances aimed at all large emitters, which was legislated in 2013. In 2014, Quebec linked up with California's carbon market. In 2015, Ontario and Manitoba announced their intention to join in the near future.	20% below 1990	37.5% below 1990
<b>Ontario</b>	171.0 Mt (12.6 t/capita)	<i>Ontario's Climate Change Strategy (2015)</i> <sup>12</sup> provides an update on the 2007 Action Plan. It highlights the results of the Green Energy Act of 2009 that effectively phased out the use of coal and introduced a feed-in-tariff program to promote renewable energy. In 2015, Ontario announced its intention to join the cap-and-trade system along with Quebec and California.	15% below 1990	37% below 1990
<b>Manitoba</b>	21.4 Mt (16.9 t/capita)	<i>Climate Change and Green Economy Action Plan (2015)</i> <sup>13</sup> introduced a number of policy measures in the transportation, agriculture and energy efficiency sectors. It also indicates to Manitobans the government's plan to join the cap-and-trade system established by Quebec.	No 2020 target but had a 2012 target of 6% below 1990	33% below 2005
<b>Saskatchewan</b>	74.8 Mt (67.6 t/capita)	In December 2009, the government introduced a climate change legislation setting out the province's plan to meet its target. However, the legislation was never enacted due to delays of federal plan and elections. <sup>14</sup>	20% below 2006	NA

(CONTINUED ON FOLLOWING PAGE)

12. <https://www.ontario.ca/page/climate-change-strategy>, consulted January 201613. <http://www.gov.mb.ca/conservation/climate>, consulted January 201614. <http://environment.gov.sk.ca/climatechange>, consulted January 201615. <http://www.alberta.ca/climate-leadership-plan.cfm>, consulted January 2016

TABLE 1 – PROVINCIAL PLANS AND TARGETS AS JANUARY 2016 (CONTINUED)

PROVINCE	2013 EMISSIONS PER CAPITA	POLICY MEASURES	2020 TARGET	2030 TARGET
<b>Alberta</b>	267.0 Mt (66.6 t/capita)	<i>Alberta's Climate Leadership Plan (2015)</i> <sup>15</sup> presents the new strategy on climate change based on recommendations put forward by the Climate Change Advisory Panel. Details of the final strategy are being developed, but the plan covers 4 key areas: Phasing out coal-generated electricity and developing more renewable energy, implementing a new carbon price, legislated oilsands emission limit, and implementing a new methane emission reduction plan.	Implementation of the plan is expected to reduce emissions by 20Mt from business-as-usual scenario (297Mt).	Implementation of the plan is expected to reduce emissions by 50Mt from business-as-usual scenario (320Mt).
<b>British Columbia</b>	62.8 Mt (13.7 t/capita)	<i>Climate Action Plan (2008)</i> <sup>16</sup> introduces short, medium and long-term targets as well as a number of provincial legislations, including the Carbon Tax Act.	33% below 2007	40% below 2007 (target has been proposed but not adopted)
<b>Territories</b>	2.0 Mt (17.6 t/capita)	<i>Yukon Government Climate Change Action Plan (2009)</i> , <sup>17</sup> <i>NWT's A Greenhouse Gas Strategy 2011-2015 (2011)</i> <sup>18</sup> and <i>Nunavut's Climate Change Strategy (2003)</i> <sup>19</sup> all introduce a number of measures to mitigate but also adapt to climate change.	Yukon: Carbon neutral Government related emissions NWT: limit to +66% from 2005	NWT: Return to 2005 levels
<b>CANADA</b>	726.1 Mt (20.7 t/capita)	Federal measures to date include sectoral regulations (light and heavy vehicles, electricity standards for coal-fired generation, energy efficiency measures, etc.)	17% below 2005	30% below 2005

Different measures have different impacts. For example, it has been estimated that Ontario's phase out of coal-fired electricity generation helped reduce GHGs by about 30 Mt, while British Columbia's carbon tax-related reductions resulted in a reduction of about 3 Mt.<sup>20</sup>

Almost every Canadian province has made 2020 commitments (the exception being Manitoba). Quebec, Ontario and Manitoba have announced formal targets for 2030 while Alberta has modeled the 2030 reductions implied by its recently-announced plan. Together, these provinces represent about 75 percent of Canadian emissions.

16. <http://www2.gov.bc.ca/gov/content/environment/climate-change/policy-legislation-programs>, consulted January 2016.

17. <http://www.env.gov.yk.ca/air-water-waste/ccactionplan.php>, consulted January 2016.

18. <https://www.enr.gov.nt.ca/programs/nwt-climate-change>, consulted January 2016.

19. <http://climatechangenunavut.ca>, consulted January 2016.

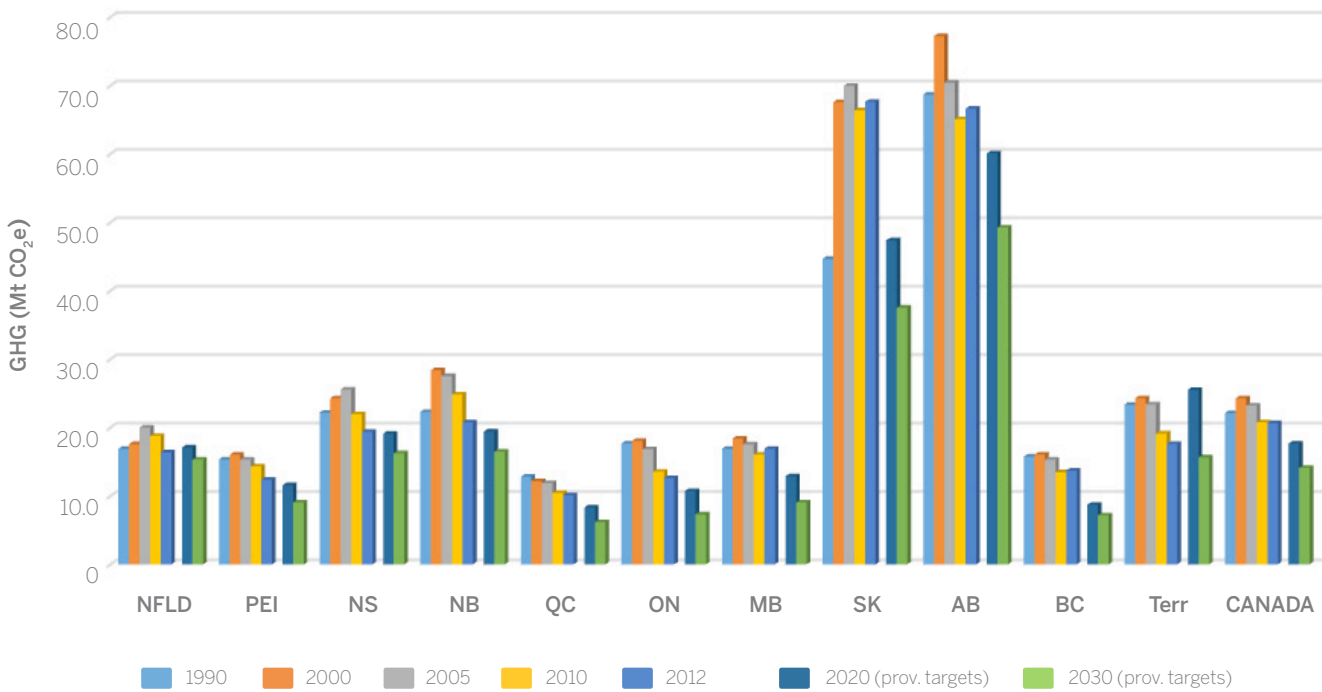
20. [http://www.iisd.org/pdf/2012/bc\\_carbon\\_tax.pdf](http://www.iisd.org/pdf/2012/bc_carbon_tax.pdf), consulted January 2016.



Figure 5 normalizes emissions by population to account for the different sizes of provinces. Saskatchewan and Alberta have some of the largest per capita emissions in the world at 68 and 67 tonnes respectively. BC, Ontario and Quebec weigh in at 14, 13 and 10 tonnes per person respectively, in line with best performers in Western Europe.

Saskatchewan and Alberta's high levels of per capita emissions come from their reliance on coal-fired electricity generation as well as oil sands and heavy oil production. In contrast, BC, Ontario and Quebec rely on hydro-electric or nuclear electricity generation and have relatively few large industrial emitters.

**FIGURE 5 – PER CAPITA EMISSIONS PER PROVINCE FOR 1990-2013 AND PROJECTED LEVELS FOR 2020 AND 2030 TARGETS**



We can also use Figures 4 and 5 to compare the 2020 and 2030 targets for the provinces. In cases where no provincial targets have been announced, either the most recent target is used (e.g. Manitoba's 2012 target is used as a proxy for 2020) or an estimate is determined based on the increased stringency (e.g. for provinces that have not announced a 2030 target, targeted emissions in 2030 have been estimated to be 15 percent lower than in 2020, which is the average stringency increase from provinces that have announced 2030 targets).

Looking first at Figure 4, we see that BC's 2020 target calls for a decline of about 20 Mt from the current level of 63 Mt and then a further decline of 3 Mt over the decade to 2030.<sup>21</sup> The Alberta plan has 2020 emissions growing by about 10 Mt from current levels to 277 Mt and then declining by 7 Mt over the next decade to 2030. In Ontario, emissions will need to decline by about 16 Mt to 155 Mt to reach its 2020 goal and then an additional 40 Mt over the next decade to 2030. Finally, Quebec has pledged to reduce emissions by about 11 Mt to 72 Mt in 2020 and an additional 16 Mt over the decade to 2030. Thus, provincial targets reflect substantial differences in both absolute levels and ambition.

Figure 5 shows the contrast between the plans of the four largest provinces more sharply. Of course, translating pledges of future emissions into per capita terms requires a forecast of population. For this exercise, we used the medium-growth case of Population Projections for Canada, published by Statistic Canada.<sup>22</sup> For the 2015-2030 period, the population projections extend recent trends: Western provinces, led by Alberta, will see faster population growth than the national average. Quebec and Ontario' populations will grow steadily with the national average, while Atlantic Canada's population will remain flat.

BC's targets have per capita emissions declining from the current level of about 14 tonnes per person to 9 in 2020 and 7 in 2030. In Alberta, aided by projected strong population growth, targeted per capita emissions decline from about 67 in 2013 to 60 in 2020 and 49 in 2030. Ontario per capita emissions, currently at 13 tonnes are pledged to fall to 11 in 2020 and 7 in 2030, while in Quebec, emission per capita are targeted to fall from 10 tonnes in 2013 to 8 in 2020 and 6 in 2030. All of this arithmetic ignores the fact that provinces may well miss their 2020 targets, making the achievement of their 2030 goals all the more difficult.

As a final exercise, it is interesting to compare the known federal commitments for 2020 (622 Mt) and 2030 (525 Mt) with the aggregate of provincial targets, assuming they are achieved. As we noted above, for provinces that have not announced targets, we generally used the average level stringency of the announced targets to develop proxy 2030 targets. Since 75 percent of Canada's emissions are covered by announced 2030 provincial targets, these proxy targets for the remaining provinces probably have only marginal effects on the overall results.

Table 2 presents the announced and proxy 2020 and 2030 targets by province. In total, the provincial targets sum to about 667 Mt in 2020 and 580 Mt in 2030. Thus, even if all provinces achieved their announced or proxy targets, Canada would still face a gap of about 45 Mt in 2020 and 55 Mt in 2030.

21. BC's target has been recommended by a government panel but not yet officially adopted.

22. <http://www.statcan.gc.ca/pub/91-520-x/91-520-x2010001-eng.htm>, consulted January 2016

TABLE 2 – PROVINCIAL TARGETS AND ESTIMATED GAPS TO MEET CANADA'S 2020 AND 2030 TARGETS

PROVINCES	2020 TARGET		2030 TARGET	
	Mt	t/per capita	Mt	t/per capita
<b>NFLD</b>	8.5	17.1	7.5*	15.5
<b>PEI</b>	1.8	11.6	1.5*	9.0
<b>NS</b>	18.2	19.1	15.5*	16.3
<b>NB</b>	14.9	19.4	12.6*	16.5
<b>QC</b>	71.8	8.9	56.1	6.2
<b>ON</b>	154.7	10.7	114.7	7.3
<b>MB</b>	17.6*	12.9	13.7	9.1
<b>SK</b>	55.5	47.4	47.2*	37.5
<b>AB</b>	277.0	60.1	270.0	49.2
<b>BC</b>	43.5	8.7	39.5*	7.2
<b>TERRITORIES</b>	3.1	17.7	2.0*	15.6
<b>CANADA TOTAL</b>	<b>667</b>	<b>17.7</b>	<b>580</b>	<b>14.1</b>
<b>CANADA TARGET</b>	<b>622</b>	<b>16.5</b>	<b>525</b>	<b>12.8</b>

\* Estimated by authors

Parallels can be drawn between the Canadian and international situations. In both cases, economic, demographic and political circumstances that affect the distribution of emissions are at play. In Canada, natural resources are unevenly distributed among

provinces.<sup>23</sup> This leads to widely different absolute and per capita emissions across provinces. The same is true of countries, although differences in stages of national development are probably the most important driving factor.

# CONCLUSIONS

Significant challenges lie ahead for Canada as it works to meet its GHG emission targets, and those challenges parallel the ones faced by the international community. Finding ways to equitably share the burden of GHG emission reductions and practical mechanisms to allow regional and national economies to transition to a low-carbon world will test the ingenuity and will of political leaders at home and abroad.

