TECHNICAL ANNEX

OPTIONS FOR CANADA'S 2035 EMISSIONS REDUCTION TARGET

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Context

The Net-Zero Advisory Body (NZAB) commissioned the Canadian Climate Institute to evaluate credible options for a 2035 greenhouse gas emissions reduction target for Canada. This target (or target range) should be an achievable next step after the current target—to reduce emissions by 40 to 45 per cent below 2005 levels by 2030—and should be in line with Canada's goal of net zero emissions by 2050. The Canadian Net-Zero Emissions Accountability Act stipulates that the Minister must set the emissions target for the 2035 milestone year no later than December 1, 2024.

Approach

NZAB specified the objectives and parameters guiding this analysis. Based on these criteria, the Institute, in partnership with Navius Research, estimated the environmental, economic, and social trade-offs over a range of potential reduction targets. We completed the following steps:

1. **Setting the baseline to compare target outcomes.** We assessed each target scenario relative to a baseline scenario, which is the "announced, less stringent" scenario from the Institute's Independent Assessment of the federal government's 2023 Progress Report of the 2030 Emissions Reduction Plan (ERP). This scenario, which we refer to as the ERP baseline, simulates Canada's legislated, developing, and announced climate policies, as currently designed. Our Independent Assessment projected this scenario could reduce net emissions by approximately 34 per cent below 2005 levels in 2030.

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For this analysis, NZAB requested that we simulate the same policy scenario as in our Independent Assessment but assume a lower level of net emissions reductions in 2030—excluding 13 Mt CO_2e of projected reductions from nature-based climate solutions and agricultural soils and 25 Mt of compliance flexibilities in the proposed oil and gas emissions cap. NZAB excluded these 38 Mt of potential emissions reductions due to their higher degree of uncertainty. Under these revised assumptions, we project net emissions[1] in the ERP baseline scenario to be 29 per cent below 2005 levels in 2030, as opposed to 34 per cent when we account for those additional net emissions. Under this revised ERP baseline scenario, we project emissions to decline 36 per cent below 2005 levels in 2035.

2. **Modelling 2035 targets and net zero by 2050.** We modelled six potential emissions reduction targets in 2035: 46, 49, 52, 55, 58, and 61 per cent below the 2005 level. To assess long-term economic implications, we extended the emissions path from each 2035 target, and for the ERP baseline, to a common net zero goal in 2050. Policy-agnostic modelling scenarios were used, meeting the emission reduction trajectories from 2035 to 2050 (Figure 1) at the lowest cost possible.[2]

   In total, 35 scenarios informed our assessment of an optimal target range. The analysis included sensitivities on global oil prices and the costs of low-carbon technologies. The technology cost sensitivities explored uncertainty in future costs of low-carbon technologies. By simulating three possible future technology costs (reference, high, and low), we accounted for potential over- or under-estimation of innovation and technology change in the reference cost scenarios.

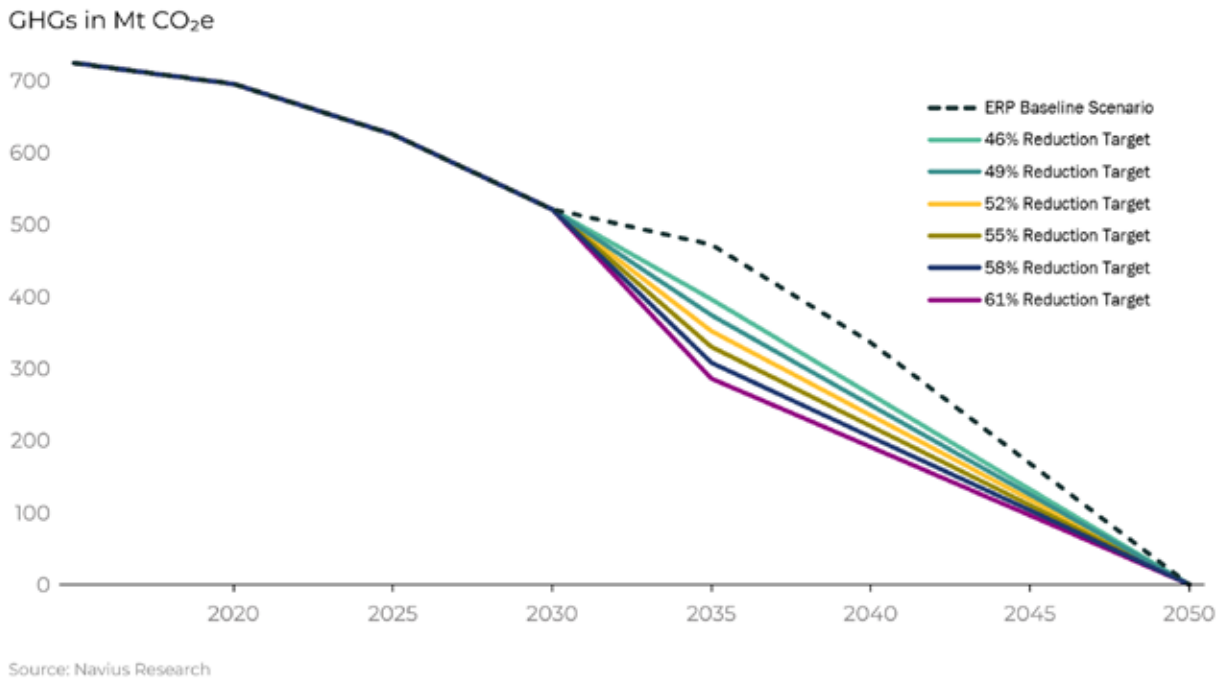
3. **Assessing pathways and comparing trade-offs.** We assessed six indicators to evaluate the 2035 targets. These indicators were measured over the short- and long-term and included cumulative emissions reductions, affordability, competitiveness, economic growth, benefit-cost comparison, and ease of policy implementation.

1 Net emissions include LULUCF (land use, land-use change and forestry) accounting contribution, 32 Mt reduction in 2030.

2 The modelling used an economy-wide cap and trade system, designed to be as policy-agnostic as possible, but required assumptions on implementation such as revenue recycling and free allocations under the emissions cap.

Figure 1:

Net emissions reduction trajectories that define each scenario



Source: Navius Research

Note: The chart shows net emissions from all economic activity, including carbon removal from the land-use, land-use change, and forestry category, which is assumed to capture 32 Mt CO_2e in 2035 and 67 Mt CO_2e in 2050. Potential greenhouse gas emissions reductions from nature-based climate solutions and agricultural soils and reductions from compliance flexibilities in the proposed oil and gas emissions cap are excluded.

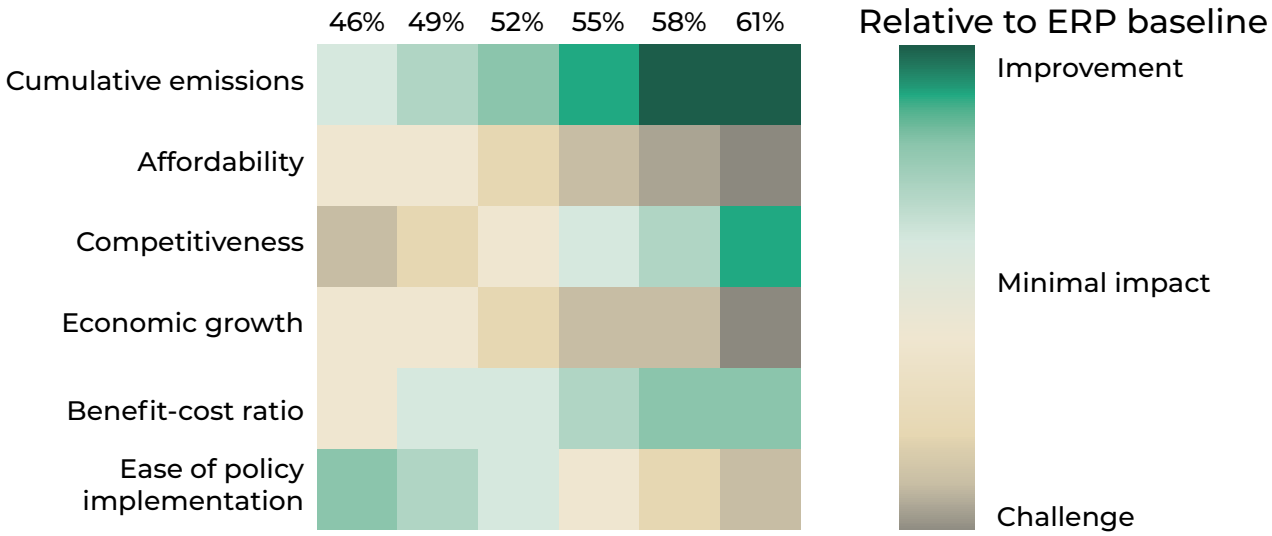
Evaluating 2035 emissions reduction targets

We assessed six indicators for evaluating the trade-offs of potential 2035 emissions reduction targets. The findings by target and indicator are shown in Figure 2, showing a relative outcome, from significant improvement (green) to significant challenge (yellow), relative to the ERP baseline scenario.

Cumulative emissions, competitiveness, and the benefit-cost ratio each show improving outcomes with more stringent targets. Affordability, economic growth, and ease of policy implementation show increased challenges with more stringent targets.

Figure 2:

Impacts on indicators, relative to the ERP baseline, by 2035 target scenario



Cumulative emissions

FINDING: More stringent 2035 targets have better emissions outcomes.

This indicator is the cumulative annual emissions from 2023 to 2050. Since the modelled scenarios are designed to exactly meet the reduction trajectories in Figure 1, the result is unsurprising. The higher targets achieve the lowest cumulative emissions from 2023 to 2050.

Affordability

FINDING: Lower targets deliver better outcomes for affordability.

This indicator is the net present value[3] of the consumption portion of Gross Domestic Product (GDP), from 2023 to 2050. Higher levels of consumption GDP reflect greater affordability for households since they are able to purchase more desired goods and services.

Deeper emissions reductions require households to invest in low-carbon technologies like electric vehicles and heat pumps. While these technologies have higher up-front costs, previous Institute analysis finds that they will save households money over time. However, these actions are generally more accessible to higher income groups who have better access to lower borrowing rates and can more easily spread the capital costs over time as the benefits of lower operating costs play a larger role. Higher targets will require households to adopt these technologies at an accelerated rate.

3 Future monetary values are discounted to 2023 with a 2 per cent annual rate.

Competitiveness

FINDING: With a focus on longer-term impacts, targets above 55 per cent deliver better outcomes for competitiveness.

This indicator measures the net present value of the investment portion of GDP, from 2023 to 2050.

In the short-term (now through 2035), investment is lower for all targets compared to the ERP baseline scenario for most provinces. Alberta, however, sees increased investment driven mostly by the construction and utilities sectors.

More long-term investment reflects greater competitiveness of industry. Higher targets generally incentivize more investment in the longer-term to 2050. Nationally, investment improves relative to the ERP baseline scenario at targets above 55 per cent. While investment GDP in many provinces is lower than the ERP baseline for all targets, the higher investment in Alberta and Saskatchewan's decarbonizing industries leads to overall positive impacts at the national level with the higher reduction targets.

Economic growth

FINDING: Lower targets, below 50 per cent, are less challenging to economic growth for most provinces.

This indicator is the net present value of total GDP, from 2023 to 2050, *excluding any potential impacts on GDP from climate-related damages in this time period.*[4] Total GDP grows for each province and the territories across even the most stringent targets. Economic growth is slightly lower for the target scenarios than for the ERP baseline. The emissions reductions to meet the targets result in less consumption and lower net exports as we get closer to 2050. An increase in construction, especially in Alberta helps offset declines elsewhere in the economy.

Jobs generally follow the same trend as GDP: higher targets are associated with smaller growth in the number of jobs.

Benefit-cost ratio

FINDING: Higher targets, above 49 per cent, deliver better outcomes for benefit-cost ratios.

This indicator is the ratio of societal benefits to costs of reaching the target and focuses on longer-term costs and benefits. We define the societal benefits of emissions reductions as the change in greenhouse gas emissions relative to the ERP baseline multiplied by Canada's social cost of carbon in each year. The costs are the economic impact of implementing mitigation measures, measured as the difference in total net GDP. Note that because we use Canada's social cost of carbon, the benefits estimate national-scale impacts and it is inappropriate to differentiate by region.

4 See analyses such as the Canadian Climate Institute's Damage Control, for more on economic challenges of the impacts of climate change.

Most targets have equal or positive benefit-cost ratios due to large cost-effective emissions reductions in power generation, oil and gas, and heavy industry.

A 2 per cent discount rate is used to calculate the net present value of future monetary values post-modelling, which is consistent with best practices for social discounting and aligns with Canada's social cost of carbon approach, but leads to significant reduction of future costs.

Ease of policy implementation

FINDING: An ambitious policy agenda could achieve the lower targets. Realizing higher targets will require implementing significantly more stringent policies and possibly relying on international carbon offsetting mechanisms.

This indicator is a qualitative assessment of Canada's experience with the types of additional policy effort needed to reach the potential targets. We compared the Institute's previous policy-based modelling of the ERP to the economy-wide target scenarios and found that additional policy effort will be needed in the following sectors for all targets:

- Industrial large emitters (chemicals, fertilizers, iron and steel, cement)
- Heavy-duty vehicles
- Oil and gas

Emissions reductions in these sectors could be achieved by revising existing policies such as strengthening large-emitter trading systems, strengthening the Clean Fuel Regulations' intensity benchmarks, and increasing methane reduction requirements for the oil and gas sector. To reach higher targets, new policies will likely be needed.

When considering ease of policy implementation, we also considered annual rates of change in total emissions, both historically and projected. Canada's total gross greenhouse gas emissions decreased at a compound annual rate of 0.8 per cent between 2015 and 2022.[5] To reach the ERP baseline scenario, emissions would need to decrease at an annual rate of 2.6 per cent from 2022 to 2030. To reach the targets in 2035, emissions reduction rates would need to be between 5.0 per cent and 10.5 per cent each year from 2030. This is two to four times the annual decrease required to meet the ERP baseline for the 2022 to 2030 period.

We considered a scenario where Canada adopts a package of policies that could meet the 2030 emissions reductions target. In that scenario, assuming no additional policy action beyond 2030, national emissions decline to 47 per cent below 2005 levels by 2035—the lower end of the six 2035 target scenarios we examined. To achieve the more stringent targets we examined, governments may need to contemplate the use of offsetting mechanisms, like internationally transferred mitigation outcomes.

5 The estimate of greenhouse gas emissions in 2022 is from the Institute's Early Estimate of National Emissions.

Findings

Our assessment identified two important implications for policy makers in selecting a 2035 target:

1. **Delay is costly**. Setting a relatively less ambitious 2035 target may delay action, which could create challenges in meeting emissions reductions goals after 2035, increase mitigation costs, or result in stranded assets. Delayed investments in emission-reducing technologies also risks Canada missing key opportunities to accelerate innovation and export Canadian low-carbon technologies and expertise.
2. **Avoid doing too much, too fast.** An overly aggressive 2035 target may require premature retirement of capital and high short-term costs, leading to sharp price increases that erode affordability for consumers. Short- and long-term cost trade-offs should account for plausible current policy trajectories and investment certainty desired by businesses and households.

Our multi-criteria assessment indicates an optimal target in the range of 47 to 50 per cent for 2035.

We reviewed the modelling results across the six indicators, with particular attention on trade-offs for households and businesses in the short- and long-term. No single target indicated a significant inflection point in any of the indicators. However, by looking across all indicators, we conclude that a 47 to 50 per cent target balances the challenges faced at higher target levels on affordability, economic growth, and policy implementation with the benefits of greater emissions reductions, increased competitiveness through business investment, and higher social benefit to cost ratios. Our multi-criteria assessment creates space for NZAB to prioritize some of the criteria reported here, or consider additional criteria alongside this analysis and reach different conclusions for the 2035 target.

As outlined above, our analysis excludes possible emissions reductions from nature-based solutions (such as restoring wetlands and reforestation) and agricultural measures (such as increased use of cover crops and nitrification inhibitors) due to the higher uncertainty of these reduction or credit opportunities. Our Independent Assessment of the ERP identified reductions from those actions of up to 13 Mt in 2030, or 2 per cent of 2005 emissions. Including these reductions in 2035 would increase the target range up to 49 to 52 per cent.

Recommended citation: Griffin, Bradford, Alison Bailie, Dave Sawyer, and Anna Kanduth. 2024. *Options for Canada's 2035 emissions reduction target. Canadian Climate Institute.*