An Optimal Pathway Towards a Low Carbon Future for Canada

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1.0 INTRODUCTION

As one of the highest emitters of Greenhouse Gases (GHGs) on a per capita basis, Canada has both a significant responsibility and a significant opportunity to take a leadership role in reducing emissions and driving a transition towards a low carbon future. Canada and the world face a significant challenge of decoupling economic and societal activity from climate forcing emissions on a sufficiently short timeframe to ensure that damages from climate change are minimized. As defined in recent IPCC reporting and modelling, devastating climate impacts can be avoided by strict adherence to a global carbon budget, necessitating substantial reductions in emissions by 2030 and a complete transition to net-zero emissions by mid- to late-century. This pathway is defined in part by country-specific targets agreed upon in the 2016 Paris Agreement. This report summarizes the methodology, structure, and expected outcomes of a proposed optimized policy package for achieving Canada's Paris Agreement target by 2030 and for catalyzing the broader shift to a low-emissions future.

2.0 POLICY PILLARS AND ASSUMPTIONS

2.1 DRIVERS FOR POLICY SELECTION

Due to the massive scope of the underlying issues, climate policy occupies a challenging space at the intersection of numerous interests related to energy, environment, economy, health, and social wellbeing. As a result, defining what it means for a policy or set of policies to be "optimal" is highly subjective. An economically optimal policy, for example, might seek to minimize the overall costs to society, while an exercize in engineering optimization could aim to achieve maximum utilization of energy resources or an absolute minimzation of emissions. Similar analogies exist for optimums defined by social issues or other values such as equity. However, optimizing for a single desired outcome can often result in other valuable outcomes being neglected, resulting in the potential for a worst-case situation where the cure is worse than the disease. Given that policies must be applied in the real world, any optimum must be discounted against its likelihood of actually being politically and socially accepted. The approach proposed in this report is deliberatly multi-faceted in order to mirror the wide-ranging scope of climate impacts and to avoid false optima dictated by only a single desired outcome. In short, this report considers the optimum climate policy package to be the one that statisfies the following three axioms:

1. The policy package must achieve significant and rapid decarbonization on a trajectory consistent with mitigating severe climate impacts;
2. The policy package must deliver an appropriate mix of economic, social/health, and environmental benefits without compromising equality; and
3. The policy package must have a reasonable level of viability in the political and legal realm.

With the above in mind, policies were reviewed according to the following criteria:

- **Technically feasibility:** Policies should be highly evidence-based and must not rely on nonexistant technologies or unrealistic assumptions.
- **Political Palatability:** Policies should be transparent in their methods and targeted outcomes. Benefits must be easily communicated to the general public and should avoid the perception (if not the reality) of excessive interventionism. It is critically important that the policy package be supported by a robust communications and marketing strategy to communicate the value and benefits of the program while dispelling myths and miscontructions.
- **Rapid Decarbonization:** Annualized emissions reductions achieve greater impact the sooner they are realized given the limited remaining carbon budget. Prioritizing rapid

large scale reductions effectively extends the timeline before the carbon budget is breached, enabling slower policies to come into effect and new technologies to mature.

- **Economic and Social Benefits:** Policies should achieve synergy with economic benefits where possible. This provides additional funds for climate mitigation & adaptation and improves the political palatability. Regressiveness of policies should be mitigated to the largest extent possible. Policies with greater local benefits can increase political support and incentivise action.
- **Limited Prescriptivity:** Where possible, policies should be technology-agnostic with respect to all factors except for carbon intensity. This implies a reliance on market incentives as well as long-term goals that are outcome driven rather than means-driven.
- **Momentum towards deep decarbonization:** Achieving the 2030 targets is a critical objective (indeed, the primary objective of the policy package), however near-zero carbon emissions will be required by midcentury and so it is desirable for the emissions reduction trend to not significantly de-cellerate after meeting the 2030 objective.

2.2 Key Assumptions

The effeicacy and viability of the chosen policies are partially dependant upon the following underlying assumptions:

- It is assumed that Canada's efforts will be matched by decarbonization efforts around the world, reducing carbon leakage to other markets and ensuring robust research & investment ecosystems.
- It is assumed that technological improvement trends will be maintained or will be somewhat accelerated over the study period, driven by increased investment in R&D as well as significant economies of scale from widespread adoption of low carbon technologies.
- It is assumed that "moonshot" solutions such as gigatonne scale carbon capture or nuclear fusion will not become viable prior to 2040. In other words, it is assumed that the 2030 target will be met with existing or near-term technology options.

2.3 Policy Pillars and Descriptions

Pillar 1: Carbon Pricing

Assigning appropriate value to pollution is fundamental to any market-driven solution. By ensuring the real climate costs of all technologies and industries are captured in their pricing, carbon prices create the most economically optimal driver for emissions reductions. Carbon pricing achieves the greatest impact when proceeds are re-invested such as into R&D activities. To drive the desired outcomes, a portion of proceeds would also be used to eliminate regressive impacts on low-income consumers and small business (a similar approach to the current Alberta CLP). Importantly, another segment of carbon price revenue would be allocated to climate adaptation and resilience initiatives.
In the model, carbon price in all sectors is set to $50/tCO2e in 2022, rising to $150/tCO2e in 2030 and $200/tCO2e by 2050. The 2030 and 2050 values are based on the midpoint between the central and high estimates of social cost of carbon in those years. Ideally, the carbon price would be established in a flexible manner to adjust the emissions trajectory appropriately. Output based allocations would be used to alleviate competitiveness impacts,. while carbon tariffs would be applied to imports from noncompliant jurisdications. The carbon price would be partially revenue neutral via minor tac cuts and rebates, however a significant portion of proceeds would be used for investments in R&D, pilot projects, green loan

gaurantees, and other policies in the package. Critically, a growing portion of the revenuws would be allocated to climate adaptation and resilience activities. Not all of these actions or imapcts are captured in the model.

Pillar 2: Signpost Policies

These policies give consumers and firms clear guidance on the long term trajectory towards a low carbon future. They are necessary to drive change where carbon pricing provides a weaker incentive for complete decarbonization and/or where asset owners are more insulated from carbon costs: in particular, buildings & transportation. Although Canada already has a high proportion of renewable energy, a 100% clean energy by 2050 target is an important guiding objective. Note that the model setting is applicable only to specified renewable energy and thus is set to 34% to allow for other zero carbon options including existing hydroelectricity and nuclear to contribute. These policies also include substantial tightening of building efficiency standards to incentivise electrification and development and adoption of more efficient products.

Pillar 3: Best Practices & Enablers

This group of policies involves adopting best practices from other jurisdictions and improving the utilization of Canada's resources. These policies tend to be politically popular, drive economic & social benefits, and will ensure Canada maintains competitiveness. Examples include improved forest management, methane capture (which creates significant emissions and economic benefit), and reduction in soft costs for certain technologies. Policies with comaratively low emissions impact but significant other benefits include training, labelling, and eduction programs, some of which are included in the model.
Lastly, enablers for the assumed significant shift towards electrification were considered. These too have limited impact on the economic or emissions outputs of the model, but were included to show the need for complete solutions and to represent the expectation of supporting technologies and practices that would be needed to support the main thrust of the policy package. Not all of these impacts would be expected to be directly driven by government policy.

2.4 Innovative Features and Synergies

This policy package adopts many policy options recommended by leading climate experts. However, it also features multiple innovative features that distinguish it from current practice and most other proposals:

- The use of signal amplifying policy combinations is a key tenant. Examples include carbon pricing coupled with portfolio and efficiency standards, or the combination of contractor training with building code changes. These measures, when combined, create a significantly amplified incentive for action and can provide a stronger "nudge" for consumers, technology developers, firms, and investors to act more rapidly and with greater certainty.
- Policy synergy between rapidly expanding zero-emission electricity production and significant fuel switching to electiricty in buildings, transportation, and industry.
- Complementary policy handoffs that create immediate results while also leading to more significant steps over time. One example is the rapid implementation of a strict Clean Fuel Standard followed by gradual ramp up towards a 100% zero

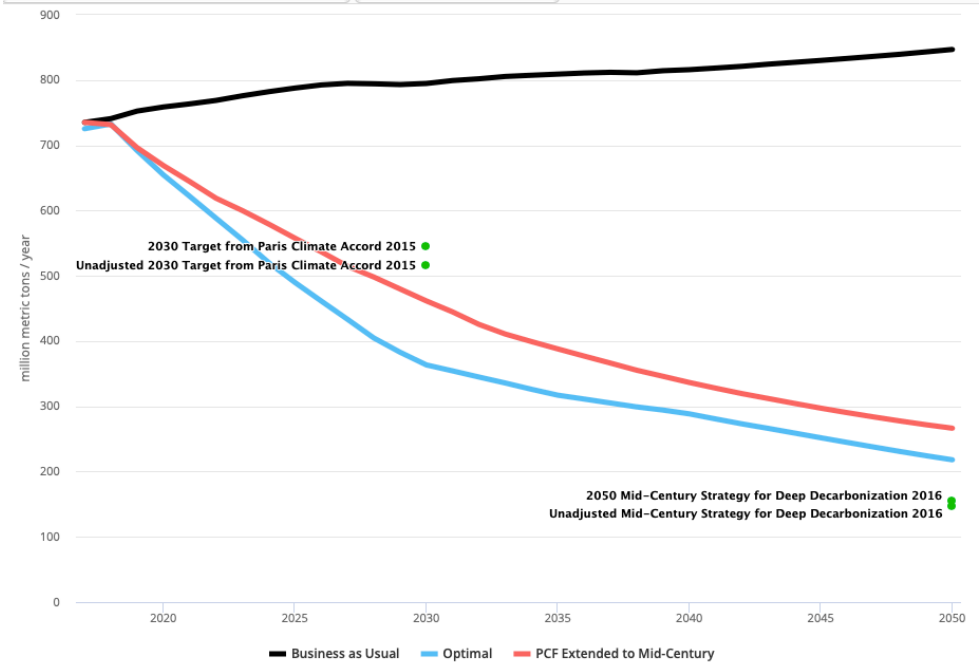
emissions vehicle mandate in the long run. A second handoff mechanism example is the implementation of coal-to-gas conversions and nuclear plant extensions in the short term giving way to a fully zero emissions grid in the long term.

- Resource stewardship is a key issue for Canada given our abundant natural resources. The deliberate focus on best practices for forests, agriculture, hydrocarbon, and renewable enrergy resources builds upon this legacy and provides signifcant local benefits.
- Partial revenue neutrality ensures that the negative impacts of carbon pricing are mitigated while also providing funds for more aggressive action. Local investments in infrastructure and capacity building have significant benefits beyon the immediate emissions reductions and can be used to build support and acceptence of carbon pricing.

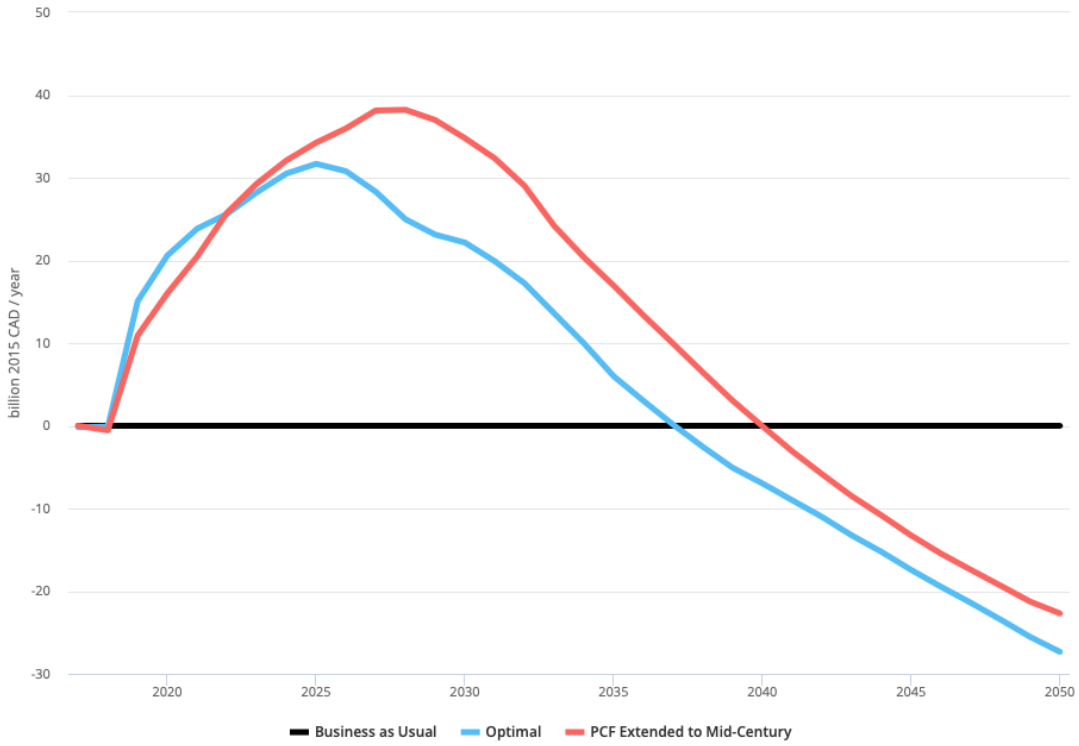
3.0 Impacts and Outcomes

Implementing the proposed policy package in the Canada Energy Policy Simulator and comparing to the PCF-Extended and BAU scenarios indicates the following results:

- The proposed package reduces emissions faster than the BCF-Extended package and exceeds the 2030 target by roughly 110Mt/yr. It also provides significant momentum towards the 2050 target (despite many measures maxing out in 2040.) This means that less technology advancement and additional policy will be needed to meet targets in 2050 and beyond.



- Cumulatively, the proposed package saves significant more emissions over the study period compared to the BCF-Extended case.
- The proposed solution achieves lower costs/greater benefits in each year and achieves “breakeven” roughly 3-5 years earlier than PCF-Extended.



- The proposed solution has a lower "sticker price" for carbon in later years despite achieving greater impact, due to a more rapid ramp up of carbon pricing and adoption of complementary measures that will enhance political viability.
- It is expected that the proposed solution will enhance competitiveness of Canadian industries while providing a strong incentive for innovation and investment.

4.0 Model Options and Next Steps

Using the open source nature of the model, additional policies could be contemplated, including:

- Bioenergy with CCS
- Hydrogen/Synthetic fuels
- Supply-side measures including emissions caps
- Education programs
- Additional agricultural and transportation measures
- More specific industrial measures

References

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