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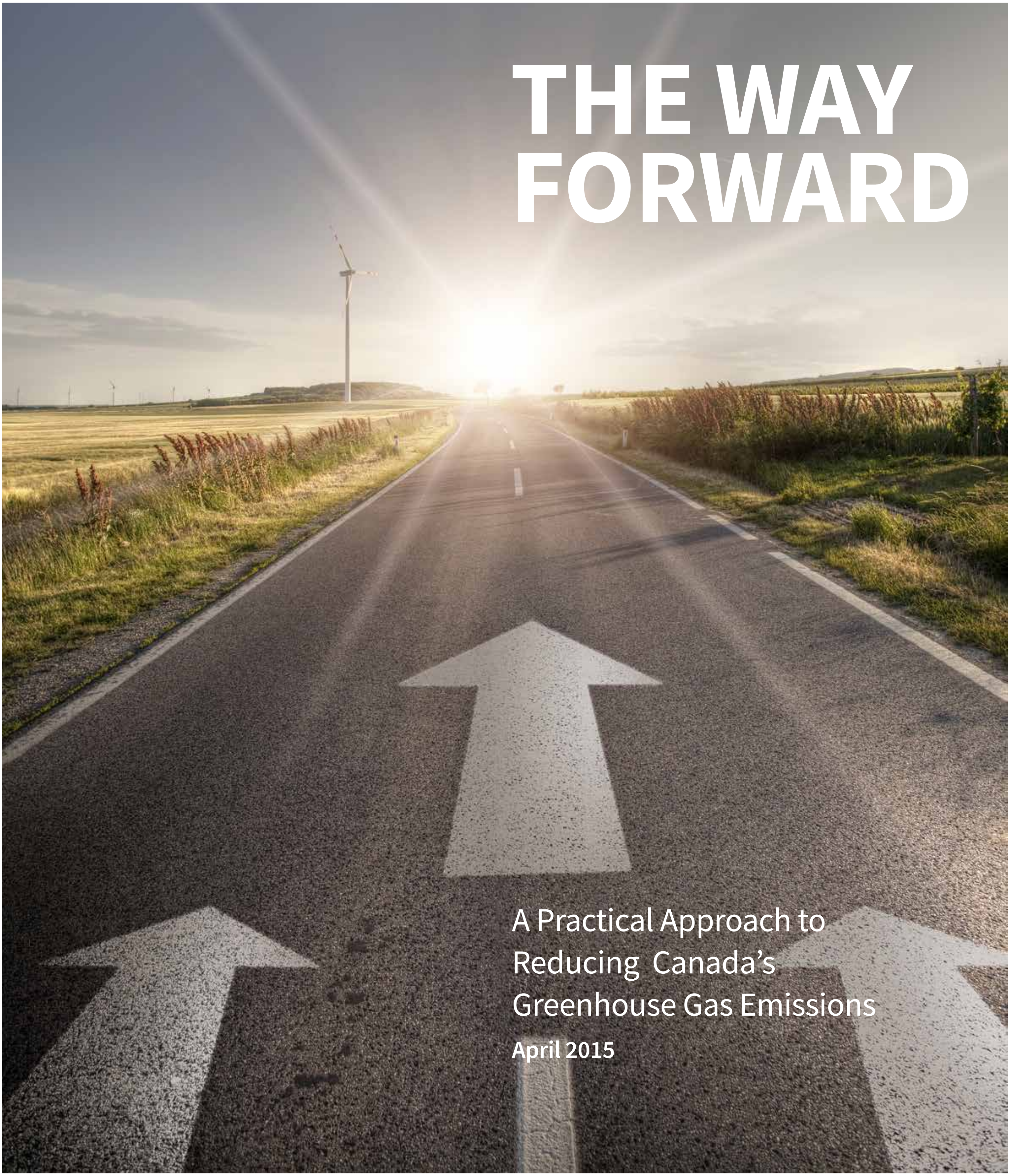
Practical solutions for growing prosperity



THE WAY FORWARD

A Practical Approach to Reducing Canada's Greenhouse Gas Emissions

April 2015

CANADA'S ECOFISCAL COMMISSION

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To identify and promote practical fiscal solutions for Canada that spark the innovation required for increased economic and environmental prosperity.

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EXECUTIVE SUMMARY

For most Canadians, "doing nothing" in response to climate change is simply not an option. Canadians already bear significant economic costs associated with the climate impacts from rising greenhouse gas (GHG) emissions; almost all regions and economic sectors are vulnerable. However, most provinces and the country as a whole are not on track to achieving existing emissions-reductions targets for 2020, let alone the deeper reductions required over the longer term. Achieving meaningful reductions will require the design and implementation of more-stringent policies.

Delaying such policy actions will mean higher future costs for Canadians. Getting moving now allows policy to begin reducing GHG emissions and then ramping up to yield more significant reductions over time. In this way, households will have the ability to adapt their behaviour, and businesses will have the flexibility to adopt and develop technologies required to transform our energy system. Falling behind the rest of the world can lead to competitiveness challenges in a global economy that increasingly recognizes the economic value of low-carbon activities.

The question we now face in Canada is *how* to move ahead in the most practical and cost-effective way. This report offers a clear way forward—through provincial carbon pricing.

The report explores two central issues. First, why provincial carbon pricing is the most practical way to move forward on achieving meaningful, low-cost reductions in GHG emissions. Second, which details and fundamentals of policy design need to be considered as provinces take their next steps.

These ideas are explored by drawing on analysis and evidence from economic theory, from policy experience both internationally and in Canada, and from new economic modelling. Three key policy criteria are emphasized throughout the report: (1) policies are *effective* if they achieve the required level of emissions reductions; (2) policies are *practical* if their designs reflect local economic contexts and priorities; and (3) policies are *cost-effective* if emissions reductions are achieved at least cost.

The report concludes with four recommendations for Canadian policymakers.

Recommendation 1:
All provincial governments should move forward by implementing carbon-pricing policies.

Making national progress on reducing GHG emissions is necessary, and the longer progress is delayed, the more it will cost Canadians. Provinces have the jurisdictional authority and policy momentum to make important headway on this issue now by adopting carbon-pricing policies, which achieve emissions reductions at the lowest cost.

Carbon pricing is increasingly emerging as a central policy instrument for reducing GHG emissions, with support from a broad range of influential entities, such as the World Bank, the Organisation for Economic Co-operation and Development, the International Monetary Fund, and the Canadian Council of Chief Executives. The analysis presented in this report demonstrates the considerable economic benefits of carbon pricing relative to other policies in every Canadian province. Carbon pricing provides emitters with the flexibility to identify least-cost ways to reduce emissions. It also generates revenue that governments can use to drive additional environmental or economic benefits. And, over time, carbon pricing will also drive more innovation, further reducing costs.

Independent provincial carbon-pricing policies offer a practical way forward. Coordination of these policies may be desirable down the road, and different paths to that coordination, including a role for the federal government, are possible. However, it makes good sense to lead action from the provinces. These policies already exist in some provinces and there is momentum building in other provinces to follow suit. The Council of the Federation has now signalled that provincial carbon pricing has a role to play in a provincially led national energy strategy. Furthermore, provinces have unique economic structures, emissions profiles, and political contexts, to which carbon-pricing policies can be customized. Using provincial policies can ensure that carbon-pricing revenues remain within the province in which they are generated, avoiding both real and perceived challenges of a centralized system. Moving forward with provincial policies now allows Canada to make crucial progress on the necessary and inevitable transition toward a cleaner, lower-emissions economy.

Recommendation 2: Provincial carbon-pricing policies—existing and new—should increase in stringency over time.

Carbon-pricing policies are not automatically environmentally effective; stringency is essential. A more stringent policy has a higher carbon price. A carbon tax with a very low price is weak policy, as is a cap-and-trade system with a very high cap. Similarly, a policy with a high carbon price that covers only a small fraction of emissions is weak policy. To achieve the required economy-wide emissions reductions at least cost, and to produce the necessary incentives for innovation, any carbon-pricing policy needs to be stringent.

What is the "right" level of stringency? Our modelling analysis uses the provinces' current 2020 targets as a convenient, though arbitrary, benchmark. With the exceptions of Nova Scotia and Newfoundland and Labrador, no Canadian province is projected to meet its emissions-reductions targets for 2020; in this sense, current policies are insufficiently stringent. These targets, in any event, are only relevant for the short term. Much deeper reductions will be required over the next few decades. Even those provinces now pricing carbon lack policies stringent enough to achieve their stated targets.

The dynamics of stringency are also important. Ramping up the stringency of policies over time will avoid unnecessary shocks to the economy, but will nonetheless encourage households and businesses to change their behaviours. The sooner policies are put in place, the more time is available for the carbon price to increase smoothly, rather than abruptly. An economic environment with a predictable escalation in price is conducive to long-range planning.

Existing provincial policies vary in terms of stringency. British Columbia's carbon tax is the most stringent, and appears to have driven notable emissions reductions. The price of carbon in B.C. is now static at $30 per tonne, however, with no increases since 2012. Quebec's comparatively new cap-and-trade system has a lower carbon price, but its cap on emissions is scheduled to decrease steadily each year. Alberta's system with flexible regulations has led to minimal emissions reductions, partly due to its limited stringency.

Recommendation 3: Provincial carbon-pricing policies should be designed to broaden coverage to the extent practically possible.

Broad coverage creates incentives for emissions reductions throughout the economy. Coverage also matters for minimizing the costs of any given amount of emissions reduction. The more emitters (and emissions) are covered by the policy, the more incentives exist to realize all available low-cost reductions. Carbon-pricing policies should thus be as broad as possible. The most cost-effective policy would impose a uniform price on all GHG emissions, irrespective of their source. Specific sectoral exemptions not only introduce inequities, but also raise the overall cost of the policy.

The British Columbia carbon tax and the Quebec cap-and-trade system both have reasonably broad coverage. Alberta's flexible regulation, however, creates no incentives for emissions reductions from small emitters, including buildings, vehicles, and small industrial sources. And only a very small fraction of emitters actually pays the price on carbon. This narrow coverage contributes to the limited effectiveness of Alberta's existing policy.

Recommendation 4: Provinces should customize details of policy design based on their unique economic contexts and priorities; they should also plan for longer-term coordination.

While consistency of provincial carbon prices is a desirable goal, other dimensions of policy design can remain customized to provincial contexts.

Revenue recycling, in particular, provides an opportunity for diverse provincial policy choices. Some provinces may choose to reduce existing business or personal income taxes, as in British Columbia. Others may prefer to use the revenue to invest in the development of new technology, as in Quebec and, to some extent, Alberta. Carbon-pricing revenue could also be used to finance investments in critical public infrastructure, to address competitiveness risks for exposed industrial sectors or to ensure fairness for low-income households. Different provinces with different contexts and priorities are likely to make different choices. This flexibility is a key strength of the provincial approach to carbon pricing.

Over the longer term, consistency of the carbon price across provinces is desirable for two reasons. First, such consistency improves overall cost-effectiveness by ensuring incentives exist for realizing all potential low-cost emissions reductions, whatever their location. Second, a common price avoids policy-induced challenges of interprovincial competitiveness. When policy is equally stringent across provinces, all firms face a level playing field.

While a consistent carbon price across Canada is eventually desirable, it is not critical in the short term. Nor should the pursuit of such a common price be an obstacle to effective and timely provincial action. Canadian provinces have a long history of differential policies. By developing effective provincial policies now, and thereby beginning to mobilize markets toward low-carbon innovation, provinces can make crucial headway on an important challenge.

CONTENTS

1 INTRODUCTION

Climate change presents an urgent policy challenge for Canadians, as it does for people all over the globe. Economic costs associated with the gradual but inexorable rise in Earth's average temperature are occurring now, and they will escalate unless significant actions are taken to reduce our greenhouse gas (GHG) emissions. While there is no longer any serious debate about the science of climate change, there is continuing debate about which policies can most effectively address the problem. Further delays in effective policy action will increase the costs of achieving meaningful emissions reductions. Canadians and their governments need to build on existing momentum by implementing smart climate policies.

At the meeting of the Council of the Federation in August 2014, Canada's provincial premiers explicitly recognized the importance of using carbon-pricing policies to help drive a transition to a low-carbon economy. Their conclusion makes sense. Though British Columbia, Alberta, and Quebec have already begun to address GHG emissions by putting a price on carbon, other provinces could follow suit.

This report explores the opportunity for building on these early provincial policies. It has two main objectives: First, it makes the case that Canada needs to reduce its aggregate GHG emissions, and that a practical method for doing so are for provincially designed and implemented carbon-pricing policies that reflect the essential economic contexts within the respective province. Second, it provides an overview and preliminary guide to key issues of policy design, and sets the stage for a deeper discussion on design details that will appear in future reports from Canada's Ecofiscal Commission.

The central case for implementing well-designed provincial carbon pricing is threefold.

First, carbon-pricing policies are *effective* in driving the needed reductions in GHG emissions. Evidence both here at home and internationally strongly supports the effectiveness of carbon pricing. Canada needs more stringent carbon policy to drive reductions both in the short and longer term. As the world moves toward a new global agreement in 2015, insufficient policy action at home will cost Canada in terms of international reputation and may result in our products being denied the market access we desire. As Canada's trading partners move forward with their own policies, Canada risks putting its industries at a competitive disadvantage in a global economy that values emissions reductions.

Second, provincial carbon pricing offers a *practical* path forward for Canadian policy. Canada's existing federal structure is not a barrier; it is an opportunity for smart and effective policy. Building on existing momentum, provincial governments can design ecofiscal carbon policies based on their own economic and policy contexts. Governments can move forward with policies now, beginning the needed transition and avoiding the costs of delay. Any revenues generated by the policies would be retained within the province, available for provincial priorities. This approach does not preclude a future role for the federal government, but instead provides a practical path forward for crucial new policies.

Third, well-designed carbon-pricing policies are *cost-effective*. They help achieve emissions reductions at the lowest possible costs because they allow emitters to find the most efficient methods to reduce emissions. Other policies—such as building and vehicle regulations, subsidies, and investment in research and development—may also be useful components of a comprehensive policy package, but their effectiveness is significantly diminished in the absence of a carbon price. Given the benefits of carbon pricing in terms of policy flexibility, the economic gains from revenue recycling, and the incentives for clean innovation, carbon pricing is an essential foundation of any cost-effective approach to reducing GHG emissions.

For an effective, practical, and cost-effective policy, smart design is essential. This report provides a starting point for a more comprehensive discussion of the details of policy design. It lays out a framework based around five central issues: What policy instruments can be used to price carbon? How stringent is policy in terms of the price of carbon? How broad is the coverage of the policy? What is done with the revenues obtained? How can competitiveness risks be addressed?

The stringency and coverage of a policy matter a great deal. A carbon-pricing policy that applies a low carbon price to a small share of overall emissions is neither effective nor cost-effective and not much better than no policy at all. Other design choices have more complex trade-offs. The unique characteristics of each province may lead to different design choices; but all can achieve the desired goals of efficient and effective emissions reductions.

This is the first of several reports on carbon pricing from Canada's Ecofiscal Commission. The analysis presented here will be a starting point for the Commission's regional engagement on carbon-pricing policy through 2015, which will in turn inform the Commission's future research and policy recommendations on these critical design issues.

The remainder of this report is structured as follows. Section 2 reviews the need for new policies in Canada to reduce GHG emissions. It lays out the fundamentals of Canada's emissions challenges and the rationale underpinning a need for policy action. Section 3 considers the economic and policy contexts of the different provinces, making the case that the provinces offer a practical path forward for new carbon-pricing policies. Section 4 uses economic modelling to illustrate how ecofiscal carbon pricing is the most cost-effective approach to achieving each province's existing GHG emissions-reductions targets. Section 5 provides a framework for comparing provincial policies. Finally, Section 6 makes clear policy recommendations based on the analysis and findings from this report.

Note two important things this report does not attempt to do. It does not lay out a comprehensive climate policy for Canada. Without dismissing the need for selected regulations, subsidies, or clean-tech investments, the focus here is to explore the important role that can be played by carbon-pricing policies. Nor does this report provide detailed design recommendations for carbon-pricing policies within each province. Instead, it creates a framework for analysis of the various objectives and constraints that could inform policy design in each region. These design details will be considered extensively in future Commission reports.

2 THE NEED FOR NEW CARBON POLICIES

Why are new climate policies needed in Canada? This section summarizes the broad global consensus around climate science, and surveys some of the economic costs of climate change for Canada. It then assesses the progress of Canadian governments in implementing policies to reduce GHG emissions, and reviews the main options for further policy actions.

2.1 CLIMATE CHANGE IS REAL AND COSTLY

The science is clear: GHG emissions are inexorably changing Earth's climate. It is also becoming increasingly clear that these changes pose significant economic risks for Canada and for the world.

The growing atmospheric concentration of GHGs contributes to climate change

A clear consensus has emerged regarding the core science of climate change (Intergovernmental Panel on Climate Change [IPCC], 2013, 2014a; Wolff et al., 2014). A survey of climate science research finds that 97% of scientific studies supports the hypothesis that climate change is driven by human actions (Cook et al., 2013, 2014). The members of Canada's Ecofiscal Commission are not climate scientists, but we defer to the best available evidence from the scientific community. The most recent report from the International Panel on Climate Change—which brings together diverse scientific research on climate change—indicates there is more than a 95% probability that human activity is responsible for climate change (IPCC, 2014a).

Global and comprehensive action is required to reduce the annual flow of GHG emissions so as to stabilize their accumulated atmospheric concentrations (e.g., Hoffert et al., 1998; Peters et al., 2013). Stabilizing atmospheric GHG concentrations at levels sufficient to slow current warming trends requires a fundamental shift in the way the world's economies produce and use energy.

Since climate change is a global phenomenon, policies in any one country are insufficient for addressing the challenge (Auditor General of Canada, 2014). As part of the international Copenhagen Accord, however, the Government of Canada adopted a target for emissions reductions by 2020, and has committed to achieving this target (Canada, 2013). As discussed below, all Canadian provinces have adopted similar emissions-reductions targets.

The full range of GHGs matters for policymakers. The release of carbon dioxide from burning fossil fuels is the largest source of GHG emissions—76% of total human-related GHGs, accounting for both volume and global warming potential—and is rightfully a priority for policy (Global Carbon Project, 2014). Sensible policy, however, must be comprehensive and focus on all types of GHGs, including methane, nitrous oxide, and sulphur hexafluoride, and all sources of these emissions. In the rest of this report, we refer to GHGs more generally, measured in terms of "equivalent" tonnes of carbon dioxide (CO_2e).

Climate change is costly for Canada

The economic costs of *not* reducing GHG emissions are potentially very large, though notoriously difficult to estimate with precision. Nordhaus (2010) estimates annual global damages by 2095 at $12 trillion, and den Elzen et al. (2014) estimate potential annual damages of approximately 4% of global GDP by 2100. A recent commentary in *Nature* notes that the impacts of methane released from thawing Arctic permafrost could have global costs of $60 trillion in net present value—a value almost as large as today's entire global GDP (Whiteman et al., 2013).

While these estimates are large, they likely understate the economic risks of climate change for two main reasons. First, the models used to generate the estimates tend to have limited representation of catastrophic events. Weitzman (2009) argues that better incorporating low probability but catastrophic outcomes into estimates would substantially raise the projected economic costs of climate change. The standard models tend to ignore, for example, impacts of climate change from increased conflicts and illnesses from mass migration, impacts on ocean ecosystems, food security, or energy supply disruptions (Pindyck, 2013; Howard, 2014). Second, many potential impacts are not easily quantified in terms of GDP. How should mass extinctions or catastrophic impact on ecosystems be valued? Both factors suggest that estimates of the GDP costs of climate change should be seen as illustrative, and probably as lower bounds of the full costs.

Canada's economy is not immune to these global costs. Rising sea levels and extreme weather events can threaten coastal cities and infrastructure. Industrial sectors such as forestry, mining, and energy face risks from permafrost degradation and the migration of plant species. Invasive species and diseases threaten food production in some Canadian regions (Warren & Lemmen, 2014). The National Round Table on the Environment and the Economy (2011) estimates that the economic costs of climate change in Canada (in 2006 dollars) would rise from around $5 billion annually in 2020 to between $21 billion and $43 billion annually by 2050.

The scale of potential threats is very large, though often expressed only in abstract, statistical terms. At a more local scale, however, the impacts become much more concrete. Almost all regions and economic sectors of Canada are vulnerable.

Extreme Weather. The increasing intensity and frequency of extreme weather events, such as wildfires and storms, are leading to large financial losses for Canadian insurers. Kovacs and Thistlethwaite (2014) note that the Canadian insurance industry paid out a record $1.7 billion in 2011 for property damage from extreme weather events. This record was broken in 2013, however, which saw major flooding in Calgary and a particularly costly storm in Toronto. The southern Alberta floods in 2013 alone are estimated to have led to $4.7 billion in damages, including large-scale damage to Calgary's electrical network, the shuttering of many businesses, and the associated losses in income and production (Swiss Re, 2014).

Forestry Products. Climate change has already had major impacts on Canada's forest-products sector, an industry critical for the prosperity of over 190 Canadian communities (Forest Product Association of Canada, 2014). Warmer winter temperatures driven by climate change is the major factor contributing to the outbreak of the mountain pine beetle in Western Canada, which has reduced the economic value of over 18 million hectares of Canadian forest (Warren & Lemmen, 2014). These impacts contributed to mill closures and lost jobs. Similarly, climate change has altered the frequency and distribution of fire cycles, in some cases bringing new threats to communities that previously never experienced the risk of wildfires. The most common deciduous tree in our boreal forests—the trembling aspen, which has high ecological and commercial value—has been experiencing more severe dieback in recent years (Warren & Lemmen, 2014).

Freshwater Levels. A warmer climate brings with it the risk of reduced water levels in Canada's lakes and rivers, which could have major implications for a range of sectors. One estimate suggests that moderate climate change could increase annual shipping costs in the Great Lakes – St. Lawrence system by 13%, while more extreme changes could increase costs by 29% (Millerd, 2005). Lower water levels due to climate change could also lead to reduced tourism, lower hydroelectric capacity, and decreased property values (Shlozberg et al., 2014).

The North. The Canadian Arctic faces both more severe threats and greater likelihood of further impacts. The most recent report from Working Group II of the IPCC identifies the dire impacts of such changes on Arctic communities (many of which are highly reliant on their surrounding ecosystem) as one of the key climate-change risks to humans (IPCC, 2014b). Arctic First Nations and Inuit people, for example, face major disruptions to their way of life with loss of ice cover and threats to Arctic fisheries.

Sea Level. The melting of glaciers and ice sheets from warming in both the Arctic and Antarctic, along with thermal expansion from warming ocean water, contributes to global sea-level rise and poses huge threats to urban residents and infrastructure on both the Pacific and Atlantic coasts of Canada (IPCC, 2013). Sea-level rise leads to greater risks of coastal erosion, flooding from storm surges, and submergence (Andrey et al., 2014). Coastal British Columbia is particularly threatened, where sea-level rise could flood airports, roads, homes, and more; one analysis indicates that approximately $25 billion of Vancouver's real estate could be heavily impacted by unmitigated sea-level rise (Keenan & Yan, 2011).

Agriculture. A warming climate can have both positive and negative economic effects on Canadian agriculture. On the positive side, for example, climate change may increase income from the production of winter wheat (Environment Canada, 2014c). Yet the increased frequency of droughts and pest infestations due to climate change is expected to increase the vulnerability of Canada's overall agricultural sector (Environment Canada, 2014c; Warren & Lemmen, 2014). Stewart et al, (2011) note that the prairie drought of 2001—the driest year in the region in hundreds of years—led to an estimated $5.8 billion in financial losses, largely due to the reduction in agricultural production.

Fisheries. Another impact of global climate change falls on Canada's fisheries. The rising atmospheric concentration of GHGs is leading to rising ocean acidification, which is expected to have far-reaching effects on marine ecosystems along all three of Canada's coastlines (Nantel et al., 2014). An estimate prepared for Fisheries and Oceans Canada puts the value of the threatened fish harvest in the Northwest Territories and Nunavut at $3.4 million annually (G.S. Gislason & Associates Ltd. and Outcrop Ltd., 2002). Similar threats exist for elements of Canada's Pacific fisheries.

Mining and Exploration. Even Canadian mining, exploration, and oil sands operations bear economic costs associated with the changing climate—especially in the North, where operations often rely on ice roads for the transportation of both inputs and outputs. With recent changes in climate, there is a smaller window of time in which the ground remains frozen and road transport is possible. For example, in 2006, the shortened winter season forced the Diavik diamond mine in the Northwest Territories to incur extra air-transport costs of over $11 million (Ford et al., 2010).

2.2 CANADIAN OPPORTUNITIES FROM POLICY ACTION

As other countries adopt and expand their efforts to reduce GHG emissions, Canada can seize economic opportunities by being at the leading edge of these policy initiatives. Canadian opportunities come in four forms.

First, there are significant costs associated with delayed policy action. The Organisation for Economic Co-operation and Development (OECD) estimates that for every $1 of clean energy investment *not made* in the electricity sector before 2020, expenditures of $4.3 would be required between 2021 and 2035 to make up for increased emissions (OECD, 2011). In the United States, each decade of climate policy delay is estimated to increase the costs of the eventual policy actions by 40% (Council of Economic Advisers, 2014). In Canada, the National Round Table on the Environment and the Economy (2012a) suggests that waiting until 2020 to implement policies sufficient to achieve deep emissions reductions by 2050 (65% below 2005 levels) would cost Canadians $87 billion more than taking equivalent action now. In short, delay is very costly.

Second, implementing effective Canadian policies to reduce GHG emissions can create social licence and help secure global market access for Canadian natural resources. Some suggest that had more effective Canadian policies been in place over the past few years, we might not have witnessed the extensive international and American criticism regarding the oil sands, with the associated obstacles to the approval of the Keystone XL pipeline (e.g., Panetta, 2014; Cleland, 2014). We can only speculate as to what would have occurred had a more stringent policy been in place, yet clearly environmental performance matters. Alberta Premier Jim Prentice recently said that the solution to the province's biggest challenge of finding new markets for its oil is to redefine Alberta "as an environmental leader" (*Globe and Mail*, 2014). Indeed, as our trading partners implement their own climate policies, Canadian firms could even face more explicit threats to competitiveness in the form of trade measures such as border carbon adjustments or low-carbon fuel standards.

Third, actions to reduce GHG emissions also reduce air pollutants—such as particulate, nitrogen oxides, and sulphur dioxide—that threaten our health and raise our health-care costs. A recent study from the International Monetary Fund (IMF) shows that Canada could see net benefits from carbon pricing, especially given the significant benefits from reducing air pollutants and avoiding costly health impacts (Parry et al., 2014).

Fourth, Canadian businesses and workers can benefit from actively participating in the global shift toward a cleaner economy. As major economies such as China, India, and the United States implement more thorough carbon-reduction policies, global demand for cleaner technologies will naturally increase. McKinsey & Company (2012) suggests that under the right policy conditions, Canada could have comparative advantages in sustainable resource development, carbon capture and storage, uranium mining, and hydroelectricity expertise. Canada could be a leader in nascent markets such as off-grid solar photovoltaic power, biomass energy, conventional hydro and marine power, and energy-efficient buildings. In short, Canada can benefit by supplying the world's increasing demands for cleaner technologies and the associated expertise.

2.3 CANADIAN GOVERNMENTS ARE UNLIKELY TO ACHIEVE THEIR GHG OBJECTIVES

Canadian federal and provincial governments have established formal targets for reducing GHG emissions. This report does not assess their appropriateness in terms of stringency (see Box 1 on page 6). In Canada and elsewhere, such targets are often set for political and diplomatic reasons, rather than as the result of a coherent weighing of costs and benefits. In addition, targets of any stringency will not achieve emissions reductions unless they are coupled with effective policies.

Box 1: On Targets and Stringency

How can policymakers know the appropriate stringency of any given carbon-pricing policy?

The answer is not necessarily clear-cut. Three different approaches for defining stringency are discussed below.

A cost-based approach. One approach to defining stringency is to align the price of carbon embodied in the policy with the social cost of carbon (SCC). The SCC is an estimate of the damages from emitting an extra tonne of CO_2e today. Aligning carbon prices with the SCC is economically efficient, because it fully internalizes the external costs associated with GHG emissions. The key challenge, however, is to estimate the SCC. Updated estimates based on the analysis from the well-known Stern review, for example, place the SCC at roughly $100 per tonne of CO_2e . But other credible estimates place the number much lower, while still others estimate the number to be much higher (Nordhaus, 2011; Ackerman & Stanton, 2012; Hope, 2013). A recurring theme in these studies is that the inclusion of uncertainty increases the estimated SCC; analyses that do not consider low probability but catastrophic events of climate change tend to produce estimates of the SCC that are biased downward (Heyes et al., 2013).

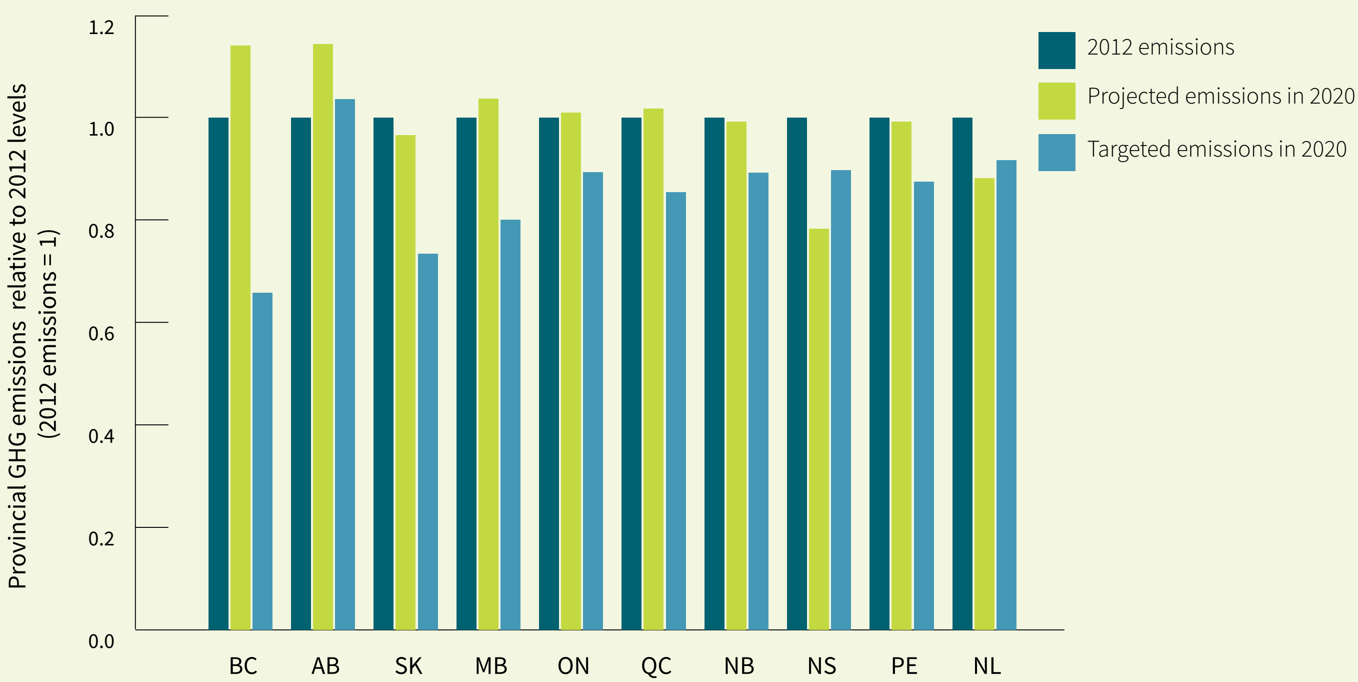
A quantity-based approach. An alternative approach to defining policy stringency starts from an estimate of the necessary long-run global emissions reductions. To reduce the likelihood of dangerous and irreversible climate change, for example, the IPCC estimates that global GHG emissions must fall to the level necessary to stabilize the global atmospheric concentration of CO_2e at 450 parts per million. An economic model can then be used to estimate the carbon price required to generate this reduced level of GHG emissions. The most recent estimates by the IPCC suggest that such a global carbon price would start below $100 per tonne and ramp up to about $200 per tonne by 2050.

A target-based approach. Finally, any individual jurisdiction could measure the stringency of its policy in terms of the policy's ability to achieve a stated target for GHG emissions. However, since the target may itself be chosen arbitrarily, with little regard for the details of climate science, this approach is more about the effectiveness of a policy in achieving its stated goals, rather than about whether the stated goals are themselves appropriate.

Canadian policy stringency? In the case of existing Canadian policies designed to reduce GHG emissions, any of these approaches would conclude that our current policies are insufficiently stringent. Existing Canadian policies do not price carbon as highly as the lower estimates of the SCC; they are certainly insufficient to achieve the much deeper reductions necessary over the longer term; and they are even unlikely to achieve the provinces' stated emissions targets for 2020.

The need to ascertain the "right" stringency of policy is not a task that should distract Canadian policymakers today. The practical path forward is to put smart policies in place as soon as possible, and then gradually increase their stringency to levels that can better be determined with further study.

FIGURE 1: Current, Projected, and Targeted GHG Emissions for Canadian Provinces



The figure shows actual GHG emissions in 2012, projected emissions in 2020, and targeted emissions in 2020 in each province, normalized by 2012 emissions to allow for comparisons between provinces. The gaps between the 2020 targets (blue bars) and the projected 2020 emissions (green bars) show the need for new emissions-reductions policies. Note that given a lack of data on projections for the individual territories, we cannot project their emissions gap. However, their relatively low emissions do not significantly impact countrywide measures.

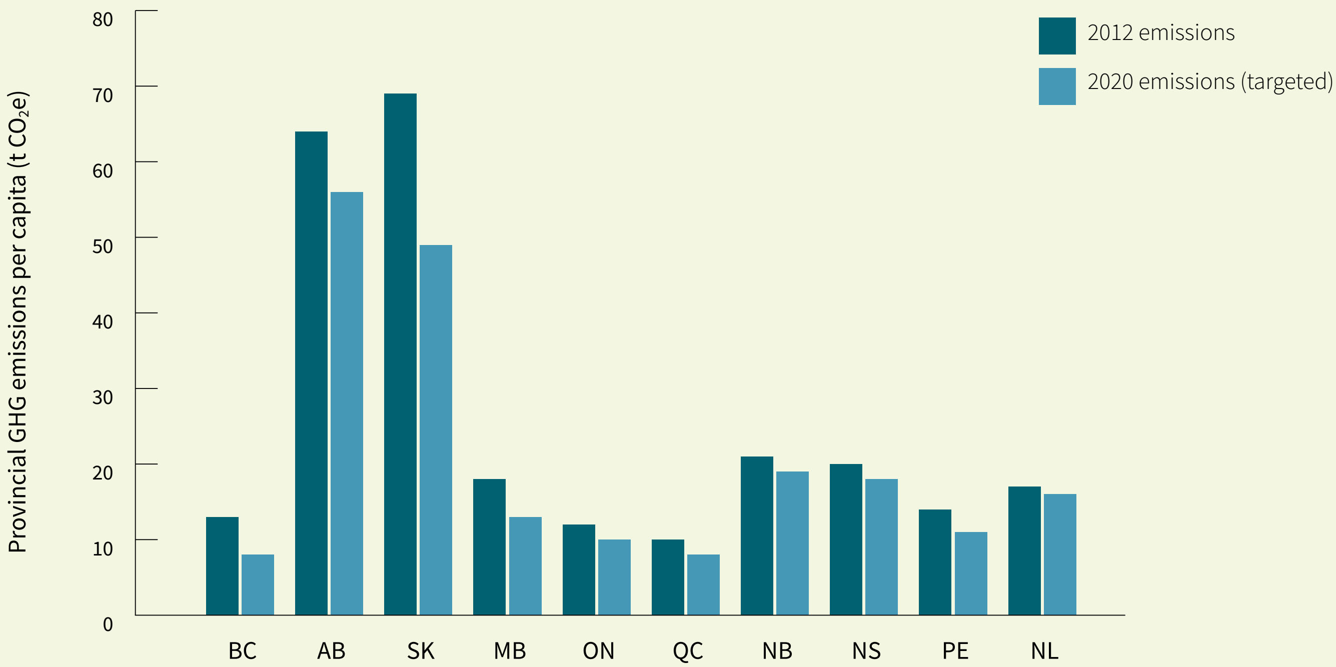
Sources: Auditor General of Canada (2014); Environment Canada (2014a); Environment Canada (2014b); and Alberta Environment (2014).

Whatever the underlying logic of any individual emissions-reduction target, the data show that most of Canada's provinces are unlikely to achieve them. Figure 1 shows that the provincial targets for 2020 vary considerably in their ambition, ranging from 4% above current emissions in Alberta to 34% below current emissions in British Columbia. Achieving the targeted reductions is made more difficult by ongoing economic growth and the associated rise in emissions; for many provinces, such growth makes the "business as usual" projected emissions for 2020 even higher than current emissions.

The gaps between projected and targeted emissions clearly show that current policies are insufficient to achieve stated goals. This conclusion is consistent with the findings of other analyses (Environment Canada, 2014c; Auditor General of Alberta, 2014; Auditor General of Canada, 2014; Environmental Commission of Ontario, 2013; NRTEE, 2011). Only Nova Scotia and Newfoundland and Labrador are on track to achieve their emissions-reductions targets for 2020. British Columbia has established a relatively aggressive target, but is still projected to have emissions in 2020 well above that level.

How deep are the various provincial targets? To put them in context, Figure 2 shows both current per capita GHG emissions and the projected per capita emissions in 2020, based on each province's stated target and Statistics Canada's population projections. The figure illustrates that Alberta's and Saskatchewan's targets could result in the largest absolute improvements in terms of per capita emissions. Yet it also shows that even if they achieved their targets, they would continue to produce far more emissions per capita than the other provinces.

FIGURE 2: Provincial GHG Emissions Per Capita (2012 and targeted for 2020)



The figure shows provincial GHG emissions per capita for each province based on actual emissions and population in 2012 and projected emissions and population in 2020, assuming that each province achieves its own stated target.

Sources: Environment Canada (2014a); and Statistics Canada (2014c, 2014d).

The sum of the provincial targets is very close to the federal government's national target. If all provinces were to achieve their individual targets, total Canadian GHG emissions would fall from their 2012 level of 699 Mt to 632 Mt by 2020. The federal government's national target is slightly more ambitious, requiring total emissions to fall to 626 Mt by 2020, 19 Mt of which are projected to come from credits due to land use, land-use change, and forestry (Environment Canada, 2014a).

In either case, however, deeper reductions in Canadian emissions will be needed over the longer term, assuming the world as a whole strives to reduce annual GHG emissions to stabilize the global climate by 2050. In 2008, for example, Canada specified a non-binding target of 60-70% below 2006 levels by 2050 (Environment Canada, 2008).

Whether we consider provincial or federal targets, or the 2020 targets, or probable ones for 2050, it is clear that a policy of business as usual will not be sufficient to achieve them. Getting new policies firmly in place, and then ramping up their stringency over time, can position Canadian provinces to contribute meaningfully to required long-run global reductions.

2.4 GOVERNMENTS CAN USE DIFFERENT POLICY APPROACHES

Achieving both the necessary short-term and long-term emissions reductions requires that broad actions be taken throughout the economy. Government policy can create the incentives needed to drive these actions.

Government policy is needed to align economic and environmental objectives

Climate solutions should not be expected from the market alone. In the absence of government policy, households and businesses do not bear the costs they impose on others through their own emissions of GHGs. Producing GHGs is free for the individual emitters, even though climate change imposes broad, wide-ranging costs on the economy. This *market failure* underpins the challenge of GHG emissions. As a result, it will fall on our governments to implement policies to ensure that private incentives are aligned with society's environmental objectives.

A variety of policies can correct this misalignment. Whichever policy is used, the nature of the problem suggests that Canadian policies should be comprehensive, aimed at all major types of GHG emissions, and thus all major emitters. Policy aimed too narrowly at specific technologies and/or sectors can delay the pace of emissions reductions, increase the costs of achieving them, and permit "free riding" by some while others face a greater adjustment burden.

Various policy instruments can drive emissions reductions

Three major types of policy instruments are available: regulations, subsidies, and ecofiscal policies. Each type can play a useful role in an overall comprehensive approach to reducing GHG emissions, but some important trade-offs exist.

Regulations typically set mandatory limits on GHG emissions, define standards for emissions performance, or mandate the use of low-carbon technologies. Designing regulations requires detailed information on the firms being regulated as well as their production processes. Since different companies often face different costs in meeting the regulatory requirements, the regulatory approach often leads to a higher overall cost for a given amount of emissions reductions. The prescriptive nature of regulations can also reduce the incentive to innovate beyond the regulation's specific requirements.

Regulations can nonetheless be quite effective in certain circumstances (Moxnes, 2004; Murphy et al., 2007). Regulations requiring more fuel-efficient vehicles to be produced by automotive manufacturers, for example, can ensure that drivers have the option to purchase lower-emission vehicles. Given the relatively small number of vehicle manufacturers, these regulations can be applied relatively cost-effectively, and can help to drive the decarbonization of the transportation sector. Federal fuel-efficiency standards for light- and heavy-duty vehicles are forecast to drive emissions reductions of approximately 14 Mt in 2020 (NRTEE, 2012).

Regulations can improve their cost-effectiveness by being specifically designed for flexibility. Renewable electricity standards, for example, such as the one implemented in Nova Scotia, require utilities to use a given level of renewable or low-carbon energy, but are not prescriptive as to the specific technologies to be used. If such "smart" regulations also allow energy providers to trade compliance permits, the overall costs can be further reduced (Murphy et al., 2007).

For the economy as whole, however, cost-effectiveness requires that sector-specific regulations be carefully aligned. This design process requires detailed information about the firms' abatement costs, which government generally does not have and the private sector is averse to providing. The ensuing negotiations with industry are often quite complex, time-consuming, and costly. Moreover, as technology changes at different rates in different sectors, regulations must continually be adapted to remain cost-effective. Even smart regulations designed today are likely to lose their intelligence over time (Popp, 2003).

Subsidies use public funds to support technologies or behaviours that reduce GHG emissions. Many subsidy programs are plagued by free-ridership challenges; if subsidized activities would occur even in the absence of the subsidy, the policy is not cost-effective in terms of reducing emissions, and may even be ineffective at generating any emissions reductions. Subsidies can make sense in some contexts, however. Public financing may be required for public-transit infrastructure, for example, and this could help achieve reductions in GHG emissions. Public funds are also usually required to support basic research, which for well-established reasons tends to be underprovided by the private sector (Jaffe et al., 2005).

The third major policy approach is to use *ecofiscal* policies, which establish a price on carbon emissions and generate revenues that can be returned back to the economy. The main advantage of carbon pricing is its cost-effectiveness. Carbon pricing can drive emissions reductions at lowest cost. Three main factors underpin this advantage. Because carbon pricing relies on the market, emitters have flexibility in how they reduce emissions, based on their unique costs of abatement. Carbon-pricing policies also generate revenue that can be used to achieve other economic and environmental objectives. Finally, carbon-pricing policies create stronger incentives for innovation than do regulatory approaches;

when carbon has a price, there is always value to be gained through innovations that reduce emissions.

A carbon price can be established in two different ways: *cap-and-trade systems* and *carbon taxes*. Cap-and-trade systems set a limit on the total allowable level of emissions, allocating permits equal to this level, and then creating an active market in which firms can trade the permits at a market-determined price. Carbon taxes directly establish a price that must be paid by emitters of GHGs. Both approaches create incentives for firms and households to reduce their emissions, and both systems create incentives to adopt and develop cleaner technologies. We return to policy instruments and design details for carbon-pricing policies in Section 5.

Experience suggests that carbon pricing is an essential policy tool

The focus of this report is on carbon pricing. Such ecofiscal policies are unlikely to be the only element in a comprehensive policy package that is effective at achieving emissions reductions while doing so in a cost-minimizing manner. In some situations, regulations and subsidies may play an important complementary role (Bramley et al., 2009; NRTEE, 2009). But carbon pricing is an essential element, and one that is currently underused in Canada.

Across the world, governments are increasingly implementing carbon pricing (World Bank, 2014a). In its report *State and Trends of Carbon Pricing 2014*, the World Bank notes that 39 national and 23 sub-national jurisdictions have put a price on GHG emissions or have stated their intention to do so in the near future. In addition, 74 countries and more than 1,000 companies and major investors have expressed support for a carbon price (World Bank, 2014b). See Box 2 for additional details.

The growing prominence of these policies reflects a practicality that is well known in the economics literature. Economists have long recognized that market-based policies can be used successfully to reduce pollution—including the emission of GHGs—at the lowest possible cost. Putting a price on emissions creates market incentives for innovation and for emitters to identify and implement the lowest-cost reductions.

The possibility of generating revenue that can be used to advance economic and environmental goals is an important part of ecofiscal policies. Such *revenue recycling* can add further economic benefits to carbon pricing (e.g., Jorgensen et al., 2013; Carbone et al., 2013). Revenues raised through carbon pricing can be used to finance reductions in existing taxes on labour and capital. Alternatively, governments can use the revenues to support the development of environmental technologies, invest in critical public infrastructure, protect vulnerable segments of the population, or reduce existing budget deficits.

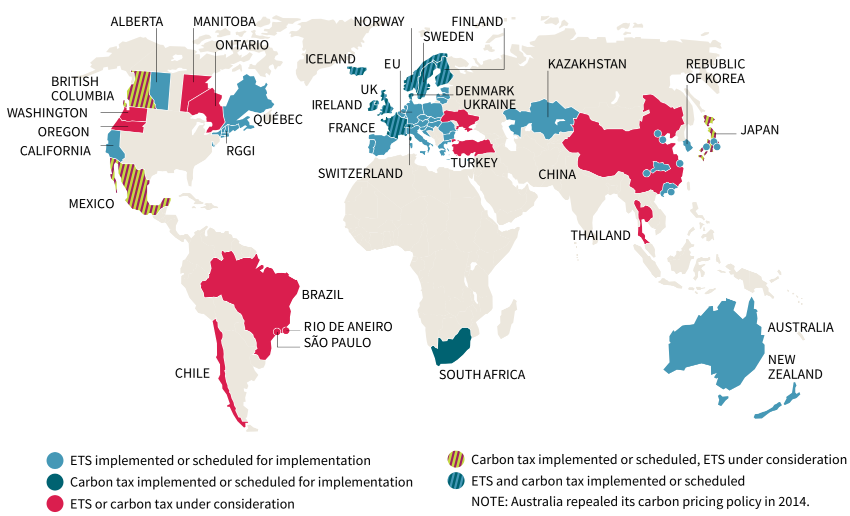
Real-world policy experience also suggests that carbon pricing is quite effective at reducing GHG emissions without negatively affecting the economy. Based on data from the first six years of British Columbia's carbon tax, per capita use of fuels subject to the tax decreased by 16%, but increased by 3% over the same period in the rest of Canada, while B.C. slightly outperformed the rest of the country in terms of GDP growth (Elgie, 2014). An assessment of carbon-pricing policies in six European nations finds that emissions were reduced and that GDP slightly increased (Barker et al., 2009). Murray et al. (2014) also find that the U.S. states that are part of the Regional Greenhouse Gas Initiative (RGGI) achieved proportionally greater emissions reductions compared with the rest of the United States. Similarly, the price incentive created by the UK carbon levy reduced energy intensity by 18.1% and electricity use by 22.6%, with no evidence of negative effects on employment or plant closures (Martin et al., 2014).

Box 2: From Economics 101 to Mainstream Policy

Increasingly, carbon-pricing policies are widely accepted by governments and businesses as an essential policy tool.

National and sub-national governments all over the world have implemented or are planning to implement carbon pricing. And a wide chorus of mainstream economic voices including world leaders, international institutions, investors, and businesses are promoting the use of carbon taxes or cap-and-trade systems.

As the figure below illustrates, the World Bank counts 39 countries and 23 sub-national jurisdictions that have implemented or are considering implementing carbon-pricing policies. The cumulative GHG emissions of these jurisdictions accounts for about a quarter of global emissions. The World Bank notes that 2013 saw the addition of 10 carbon-pricing initiatives and one in early 2014. The beginning of 2015 marked the opening of South Korea's cap-and-trade system also known as an emissions trading sytem or ETS, the world's second-largest carbon market after Europe's.



Source: World Bank (2014a).

This growth in carbon pricing coincides with a growing support base of important political and economic actors, which includes the following:

- The **World Business Council for Sustainable Development (WBCSD)** identifies carbon pricing as being a must-have for a sustainable future (WBCSD, 2011).
- Here in Canada, the **Canadian Council of Chief Executives (CCCE)** supports putting a price on GHG emissions and says carbon pricing can "lead to innovation and new technologies that have positive outcomes for consumers" and improve the competitive position of Canadian firms (CCCE, 2010).
- The former **U.S. Secretary of the Treasury** recently stated, "[W]e must not lose sight of the profound economic risks of doing nothing. The solution can be a fundamentally conservative one that will empower the marketplace to find the most efficient response. We can do this by putting a price on emissions of carbon dioxide"(Paulson, 2014).
- The **OECD** calls carbon pricing a key element of fiscal policy and calls for faster progress (OECD, 2014).
- The **IMF** suggests that all countries should implement carbon pricing and urges them not to wait for a formal international agreement (CBC News, 2014).

3 THE PRACTICALITY OF PROVINCIAL CARBON PRICING

As discussed in the previous section, Canada needs new, more stringent, cost-effective climate policies in order to achieve stated objectives. And there is a strong argument for filling the current policy gap with pan-Canadian carbon pricing. The broader and more consistent the price across Canada, the more emissions will be reduced in a cost-effective way. Moreover, the costs of delay underline the urgency of policy action. While all levels of government can play a useful role in climate policies, provincial action on carbon pricing is a practical path forward for reducing Canadian GHG emissions.

This section briefly reviews the new initiative of Canada's provincial premiers and the specific progress already made by some provinces. It explores key differences between provinces in terms of their emissions and economic structures. It recognizes the practicality of continuing this provincial momentum, but also the desirability of longer-term coordination in order to produce an efficient system across the country.

3.1 PROVINCES CAN TAKE THE INITIATIVE—AND ALREADY ARE

Canadian provincial premiers have clearly expressed their support for carbon pricing. Since August of 2014, all provinces and territories are now participating in the development of a national energy strategy, and addressing climate change is a key part of this strategy. Critically, the premiers explicitly recognize carbon pricing as a valuable policy instrument for transitioning to a lower-carbon economy (Council of the Federation, 2014). This momentum shows that the provinces are moving on carbon pricing, and that such actions offer a practical path forward—politically, legally, and economically—toward a pan-Canadian approach.

Some provinces are already pricing carbon, in different ways

Three provinces have already implemented policies that put a price on GHG emissions. While the design and stringency of these policies vary widely, these policies highlight the potential for implementing ecofiscal policies at a provincial level. Section 5 revisits the design of these policies in detail.

British Columbia implemented its carbon tax in 2008. The tax applies to GHG emissions associated with the combustion of fossil fuels; it was introduced at a rate of \$10 per tonne CO_2e and has gradually increased to its current level of \$30 per tonne. The tax applies to approximately 70% of B.C.'s GHG emissions.

In 2007, Quebec applied a small carbon tax on fossil fuels equivalent to about \$3.50 per tonne CO_2e. It then moved forward with a cap-and-trade system in 2013, which superseded the tax. The policy sets a limit on emissions from regulated sectors, but allows emitters to trade emissions permits. Quebec's cap-and-trade system is linking with a similar system in California, under the Western Climate Initiative. As of February 2015, the cap-and-trade system has a minimum permit price of \$15 per tonne CO_2e.

The Alberta Specified Gas Emitters Regulation (SGER), implemented in 2007, is a regulation with elements of carbon pricing. It requires regulated emitters to reduce their emissions intensity (emissions per unit of output) relative to a stated benchmark by 12%, but allows them to comply with the policy by trading permits with other regulated emitters, purchasing credits for other emissions reductions within Alberta, or contributing to a technology fund at a cost of $15 per tonne CO_2e.

Other provinces have implemented policies to reduce GHG emissions, although generally not based on carbon pricing. Ontario, for example, has entirely phased out its use of coal-fired electricity plants. Nova Scotia has implemented a renewable energy standard. Manitoba has implemented a narrow emissions tax, applied only to coal. Overall, provincial policies are a key driver of emissions reductions. Analysis from the National Round Table on the Environment and the Economy (2012b) finds that provincial policies were projected to drive more than two-thirds of Canada's total expected emissions reductions in 2020.

Provinces share constitutional authority to price carbon with the federal government

While Canada's Constitution is not explicit and the courts have not ruled on the issue, British Columbia and Quebec have demonstrated that provinces can use either carbon taxes or cap-and-trade systems to price GHG emissions. The federal government also has a clear legal ability to price carbon, although exclusive provincial jurisdiction over natural resources and electricity generation likely puts the provinces at the centre of any carbon-pricing policy. Provincial authority may nonetheless have limits, particularly in terms of interprovincial trading, trade measures such as border carbon adjustments, and compliance with international treaties, all of which may require some involvement of the federal government (Courchene & Allan, 2008; Elgie, 2008). In the short term, however, the provinces clearly have considerable room to manoeuvre.

A province-driven approach is practical

Many people argue that a global problem requires a global solution. GHG emissions from any individual location in the world contribute to global climate change. A uniform carbon price, applied equally in all countries, would create equivalent incentives for all emissions reductions and ensure that no one jurisdiction was competitively disadvantaged. Not surprisingly, however, the multilateral approach to climate policy has proved to be very challenging. A "top-down" agreement that sets binding national targets has not yet emerged, even after many years of international discussion and negotiation. Perhaps in response to these difficulties, as negotiators move toward a potential new global agreement in Paris at the end of 2015, focus has shifted toward a more practical "bottom-up" approach, with nations taking on voluntary commitments (Flannery, 2014). How the recent bilateral agreements involving China, India, and the United States alter this dynamic remains to be seen.

The emergence of different provincial policies in Canada parallels developments in international climate policy. Previous research highlighted uniform, Canada-wide carbon pricing as economically ideal in principle (NRTEE, 2009). Yet important differences across the provinces—which are often underappreciated and even ignored—present challenges for any federal carbon-pricing policy. In particular, the perceived risks of financial redistributions among provinces can be politically divisive (Gibbons, 2009). Inside Canada, as with the multilateral efforts, a bottom-up approach driven by the provinces offers a practical path forward.

3.2 PROVINCES HAVE UNIQUE ECONOMIC AND EMISSIONS PROFILES

Provincial differences pose a challenge for many pan-Canadian policy discussions, and climate policy is no exception. A range of local factors can drive regional climate policy choices (Harrison, 2013). Given different emissions profiles and economic structures, the nature of the emissions-reduction challenge varies widely from province to province. Practical and successful policy must take into account these important differences, no matter which level of government is implementing the policy.

How then, are the provinces different? To set the stage, we explore provincial contexts through emissions and economic data.

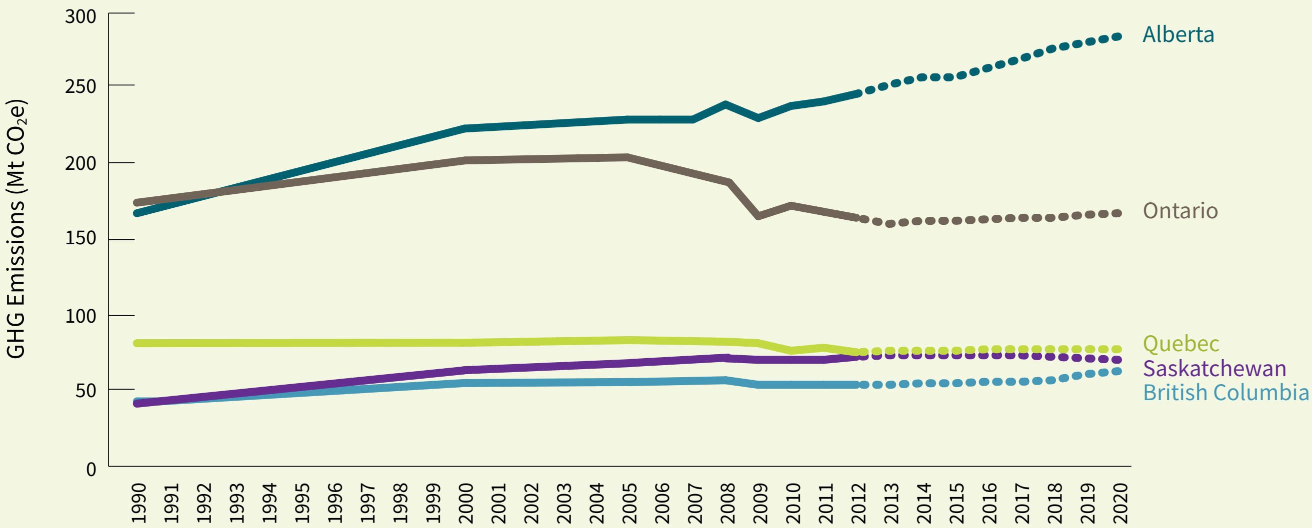
Provinces have different emissions profiles

Reducing GHG emissions is already a stated objective for each province. Yet the nature of this challenge is unique to the circumstances of each province, in terms of the levels of provincial GHG emissions, the rate at which emissions are changing over time, and the costs of abatement. Figure 3 draws on Environment Canada (2014a, 2014b, 2014c) data and analyses to show actual and projected emissions trends from 1990 to 2020.

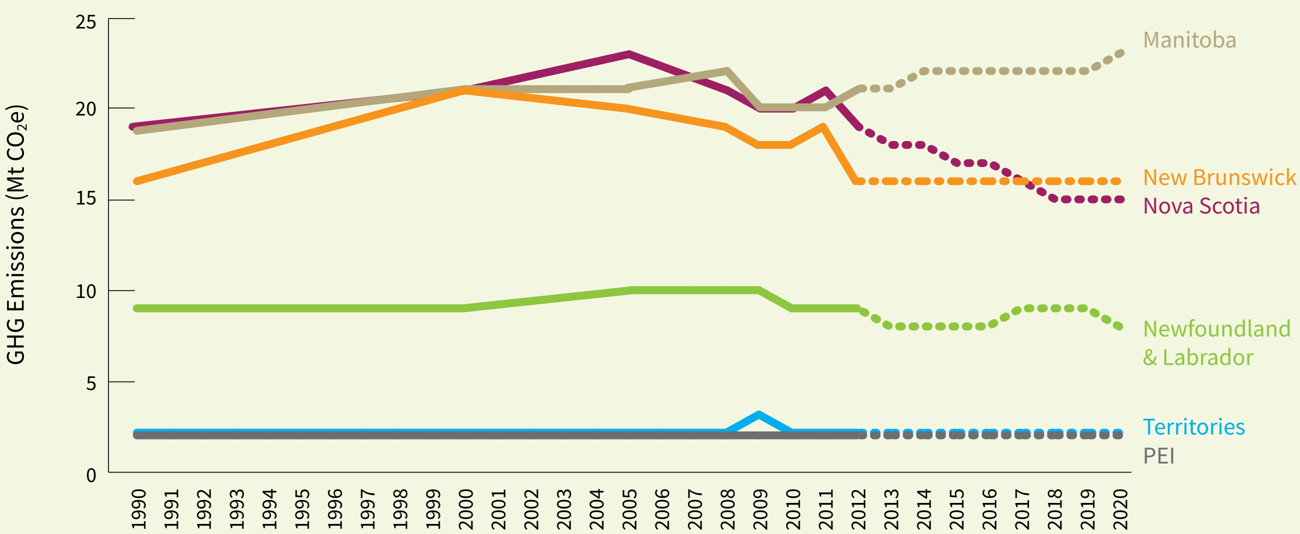
Emissions are attributed to the province in which they are created based on well-established accounting rules. Alberta's emissions, for example, include those associated with the production of oil and gas, but not the emissions associated with the consumption of its fossil-fuel exports to other jurisdictions. Similarly, Prince Edward Island consumes emissions-intensive electricity generated outside the province; yet these emissions are attributed to the site of generation, not to P.E.I.

FIGURE 3: Historical and Projected GHG Emissions by Province

Historical and projected GHG emissions for highest-emitting provinces



Historical and projected GHG emissions for smallest-emitting provinces and territories

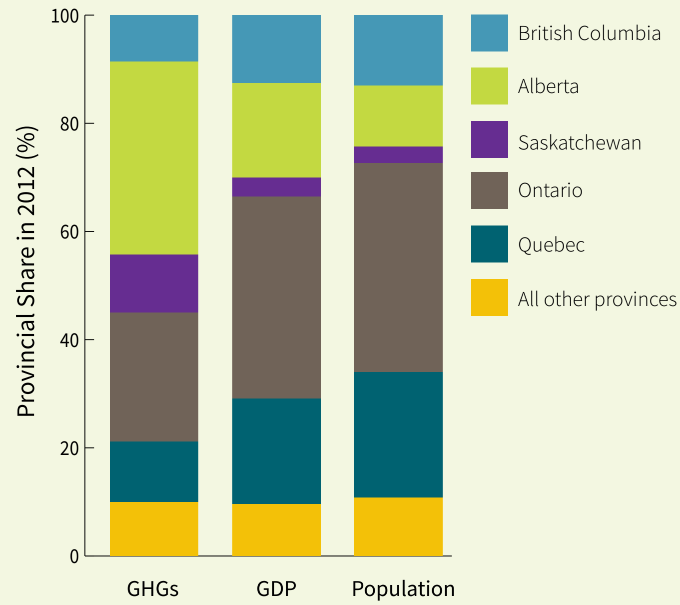


Five provinces made up 90% of Canada's GHG emissions in 2012. Alberta's emissions are projected to grow by 20% from 2012 to 2020, while other provinces have generally flat or declining projected trends. These data exclude international credits from land use, land-use change, and forestry.

Sources: Environment Canada (2014a, 2014c).

Table 1: Provincial Shares of GHG Emissions, GDP, and Population in 2012

Province	GHGs	GDP	Population
BC	8.6%	12.6%	13.1%
AB	35.7%	17.5%	11.2%
SK	10.7%	3.6%	3.1%
MB	3.0%	3.3%	3.6%
ON	23.9%	37.3%	38.6%
QC	11.2%	19.6%	23.3%
NB	2.3%	1.7%	2.2%
NS	2.7%	2.1%	2.7%
PE	0.3%	0.3%	0.4%
NL	1.2%	1.6%	1.5%
Terr	0.3%	0.5%	0.3%
Canada	100%	100%	100%



Sources: Environment Canada (2014b); Statistics Canada (2014b, 2014c).

The projected emissions paths to 2020, based on policies currently in place, are relatively flat in most provinces. As we will explore below, these trends suggest that even though the economies are growing, emissions per unit of GDP are actually falling. Part of this trend comes from ongoing improvements in technology and energy efficiency. Another part is due to policy: British Columbia's carbon tax, Ontario's phase-out of coal-fired plants, and federal vehicle regulations are examples of policies helping to reduce GHG emissions.

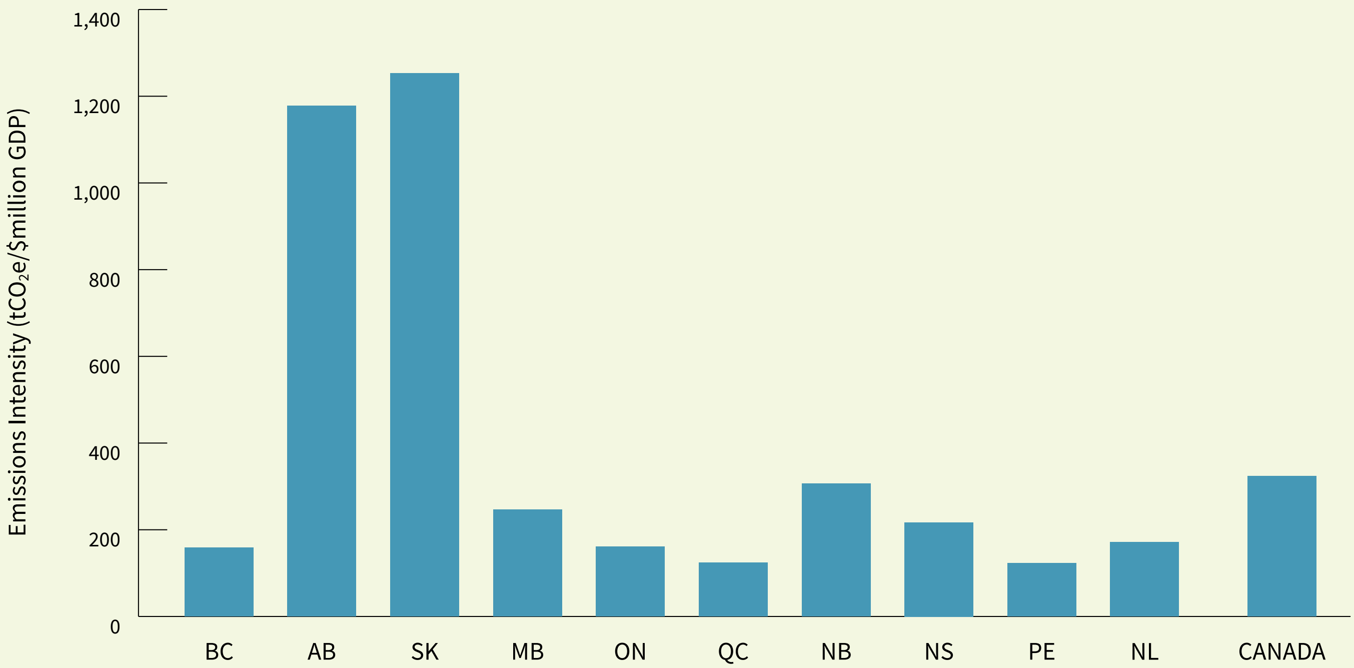
Alberta's GHG emissions, projected to grow by 20% from 2012 to 2020, are the one major exception. Projected growth in the oil sands is a key driver of the province's rising emissions, though this would likely change if oil prices persist at their current low level. While emissions from coal-fired electricity plants remain an important source of Alberta's emissions (approximately 14% of its total in 2012), the province's emissions growth to 2020 is largely due to the predicted expansion of its oil and gas sector.

About 90% of Canadian GHG emissions comes from five provinces: British Columbia, Alberta, Saskatchewan, Ontario, and Quebec; about 60% comes from Alberta and Ontario alone. While emissions in the smaller provinces matter, the five largest provinces are fundamental to the country's overall emissions and will therefore be the focus of the remainder of this section.

As shown in Table 1, provincial emissions are not necessarily proportional to population or economic size. Alberta and Saskatchewan stand out as the only two provinces with shares of national GHG emissions significantly larger than their shares of total population or GDP.

The distribution of emissions, GDP, and population across the provinces is central to the potential challenges of any centralized, federal approach to carbon pricing. Revenues generated from any federally imposed carbon-pricing policy would be proportional to the levels of GHG emissions. Approximately 36% of revenues would therefore be generated from Alberta, yet that province has only 18% of Canada's GDP and 11% of its population. Depending on the mechanisms by which revenues would be recycled back to the economy, Alberta and Saskatchewan would potentially contribute far more financially than they would receive through recycling. We return to this potential challenge below.

FIGURE 4: Provincial Emissions Intensity (GHGs per unit of GDP) in 2012



Provincial emissions intensity varies widely, with Saskatchewan having more than three times the emissions per dollar of GDP than the national average.

Sources: Statistics Canada (2014a, 2014b); Environment Canada (2014b).

Provinces have different emissions intensities

Emissions intensity, or the emissions produced per dollar of provincial GDP, is also quite different across the provinces. Figure 4 shows overall provincial emissions intensities in 2012, and displays their considerable variation across provinces. Alberta and Saskatchewan are the clear outliers, with emissions intensities more than three times the national average.

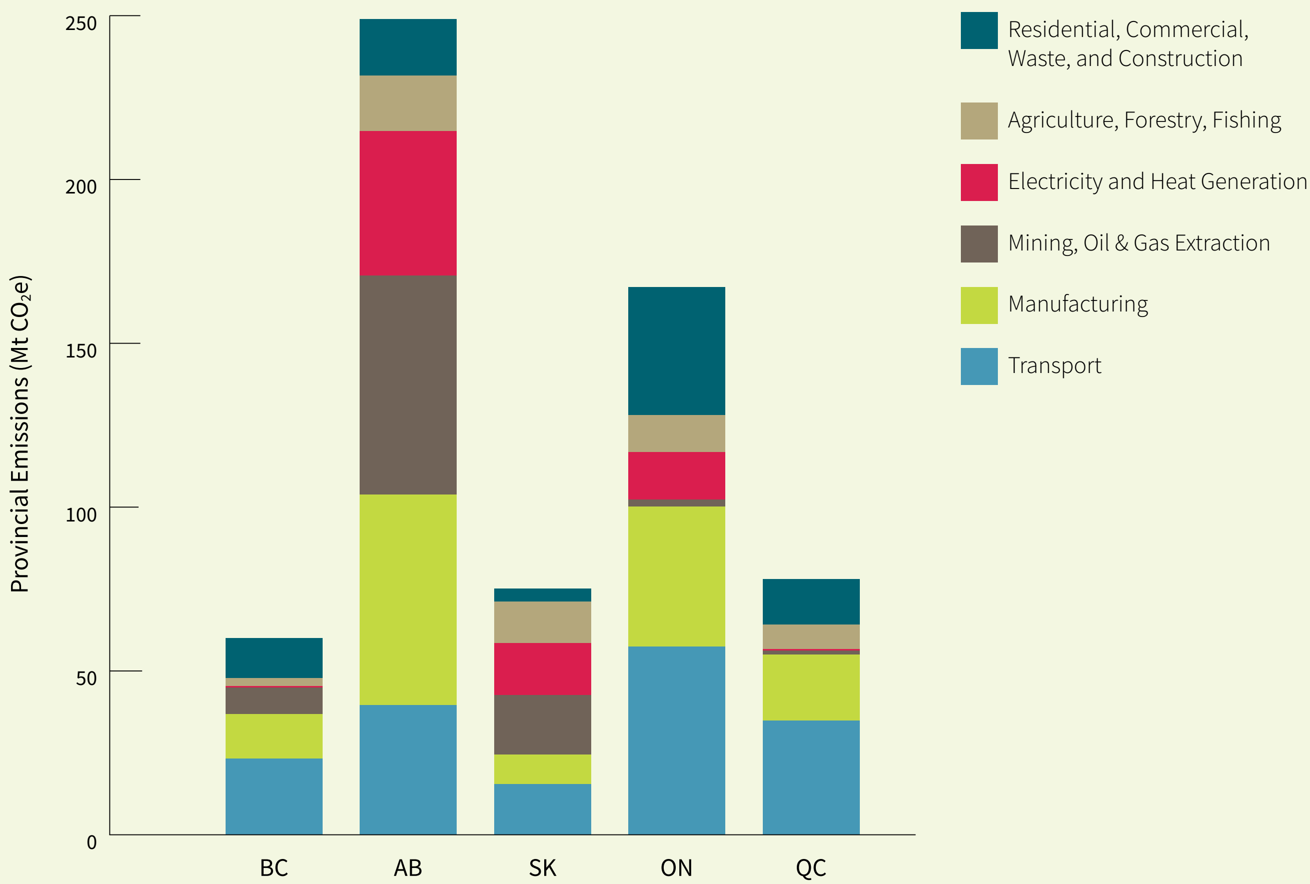
Structural differences between provincial economies are a key factor underpinning these differences in emissions intensity. Different sectors—with different emissions intensities—differ in their relative importance in different provinces. Figure 5 breaks down GHG emissions by sector for the five largest-emitting provinces in 2012. Four main differences between the provinces emerge from the data.

First, key emissions-intensive sectors, such as resource extraction (dark brown bars) and agriculture (beige bars), are concentrated in Alberta and Saskatchewan. Resource extraction makes up 27% and 24% of Alberta's and Saskatchewan's emissions, respectively, but less than 2% of Ontario's and Quebec's. Agriculture makes up 17% of Saskatchewan's emissions.

Second, there are important differences in the nature of manufacturing emissions (green bars). While some specific manufacturing sectors (such as cement) are emissions-intensive, much manufacturing is relatively non-intensive. Ontario's large and relatively non-intensive manufacturing sector contributes to its relatively small emissions profile, even though its manufacturing sector is the country's largest. On the other hand, manufacturing in Alberta includes emissions-intensive petroleum refining and bitumen upgrading. As a result, overall manufacturing emissions are larger in Alberta than in Ontario, even though Alberta's manufacturing sector is smaller in terms of economic output.

Third, transportation emissions by province have both similarities and key differences (light blue bars). On the one hand,

FIGURE 5: Provincial GHG Emissions by Sector in 2012



Composition of provincial GHG emissions varies widely, and helps explain differences in overall emissions intensity.

Source: Environment Canada (2014a).

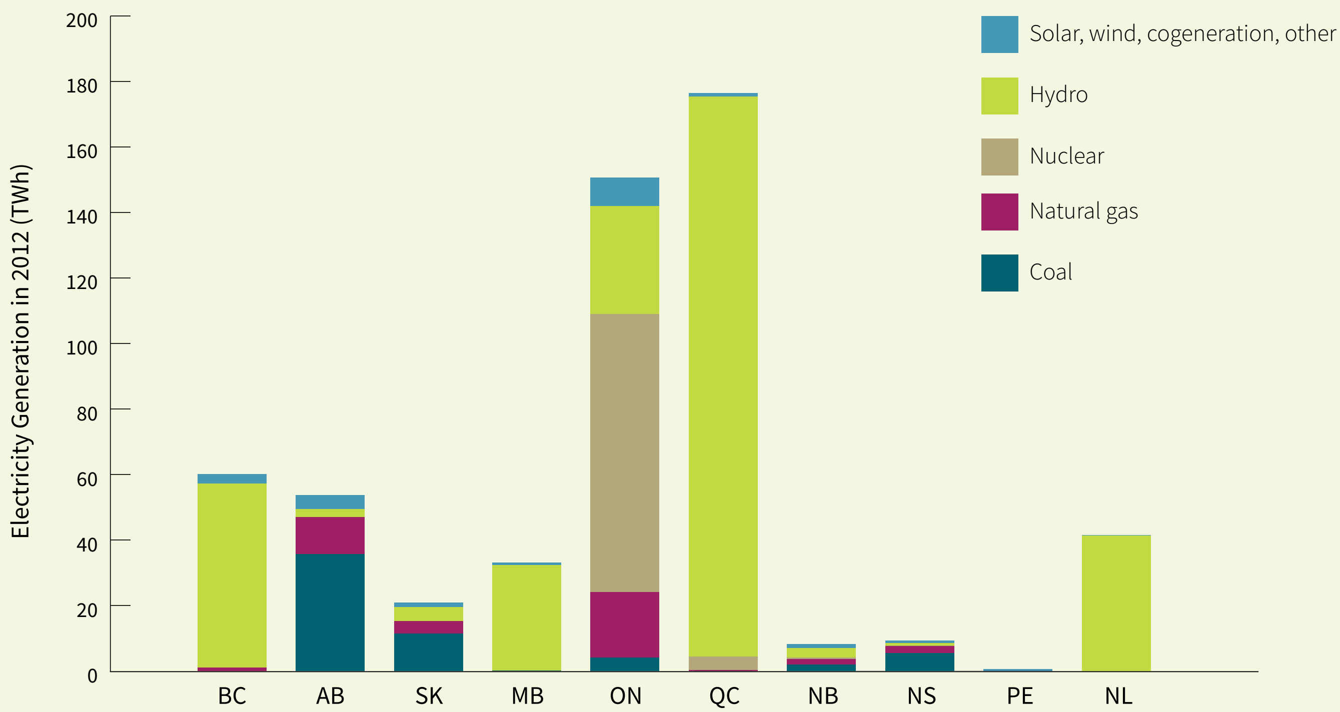
transportation is a major source of emissions for all provinces. Dependence on gasoline-consuming vehicles is common to all provinces, as is the general makeup of the fleet of passenger vehicles. As a result, national vehicle fuel-efficiency standards such as those imposed by the federal government can be both effective and cost-effective. On the other hand, Alberta's transportation emissions are disproportionately large, around twice those of Ontario on a per capita basis. Transportation emissions also include heavy-duty commercial vehicles; in Alberta, the use of these vehicles for transporting goods to the oil sands is a notable contribution to that province's total emissions (Environment Canada, 2014a).

Finally, different electricity systems are a crucial driver of the differences in provincial emissions intensities. Figure 6 shows electricity generation by province in 2012, but also breaks out the different sources of electricity.

These profiles highlight three main types of supply mixes. British Columbia, Manitoba, Quebec, and Newfoundland and Labrador rely almost exclusively on low-carbon hydroelectric power (green bars). Alberta, Saskatchewan, and Nova Scotia, meanwhile, continue to rely on emissions-intensive coal-fired plants (teal bars). Ontario and New Brunswick have a mix of natural gas, nuclear, cogeneration, hydro, and renewables. Since 2012, Ontario has completed its coal phase-out, and added additional renewable capacity.

Note that trade in electricity is not captured in Figure 6. Quebec, for example, exports substantial electricity to the United States, and so does not consume as much as it produces. In contrast, while all

FIGURE 6: Sources of Provincial Electricity Generation



Provinces have vastly different energy systems, with different levels and sources of electricity generation. British Columbia, Manitoba, Quebec, and Newfoundland and Labrador rely almost exclusively on hydroelectricity. Alberta, Saskatchewan, and Nova Scotia continue to rely on coal-fired combustion plants, while Ontario has a mix of gas, nuclear, cogeneration, hydro, and renewables. (Since 2012, Ontario has completed its coal phase-out, and added additional renewable capacity.)

Source: Environment Canada (2014a).

electricity produced in Prince Edward Island is generated through renewable wind power, it also consumes imported power from the United States, and so consumes much more than it generates.

Taken together, these provincial differences in economic structure, emissions intensities, and energy mixes naturally contribute to differences in political context and policy priorities. As a result, practical carbon-pricing policies would likely be designed within each province to reflect these differences. Box 3 considers how provincial economies respond differently to changes in important market prices, using the recent collapse in the world oil price as a particularly timely example.

3.3 PROVINCIAL CARBON PRICING OFFERS A PRACTICAL WAY FORWARD

The provincial differences above frame the challenges for Canadian climate policy. Although differences between provinces suggest that a uniform, countrywide carbon-pricing policy could reduce emissions at lowest cost, those same differences pose two main challenges for any federal approach to carbon pricing. First, a centralized approach, with carbon-pricing revenues accruing to the federal government, could create significant financial redistributions among provinces. Second, different economic contexts and policy priorities suggest that different policy designs and revenue recycling options could make sense in different provinces. Any practical approach to carbon pricing—whether provincial or federal—would need to seriously consider these issues.

Box 3: World Oil Prices and Canada's Provincial Economies

Major fluctuations in world commodity prices and exchange rates have diverse impacts in different parts of the Canadian economy.

The per-barrel price of West Texas Intermediate (WTI), a common North American benchmark, fell from US$105 in July of 2014 to below US$50 in February of 2015. This massive decline in the world oil price creates both losers and winners in Canada, with implications for income, government budgets, and GHG emissions.

Income

For firms and workers directly involved in the production of oil—concentrated in Alberta, Saskatchewan, and Newfoundland and Labrador—the price decline leads to an immediate and large reduction in income. As oil companies reduce their production, lay off workers, and scale back investment, the negative economic impact spreads to the many industries supplying Canada's oil sector.

In contrast, for consumers across the country and for businesses that use oil intensively, the decline in the world price is a significant financial windfall. Consumers find that heating their homes and filling their gas tanks is cheaper than before, and more money is thus available for other uses. Firms that use oil-based products as inputs find the decline in costs improves their competitiveness, fuelling an expansion in sales and employment. For consumers, these gains occur across the country; this is also true for firms, but their largest concentration occurs in Ontario and Quebec—still the heart of Canadian manufacturing.

The decline in the world oil price also leads to a depreciation of the Canadian dollar, which stimulates exports of a wide range of Canadian products, thereby dampening the direct negative impact on the country's economy. In the oil-importing provinces, which suffer little or no direct reduction in activity from the declining oil price, the weaker currency has an important expansionary effect.

For Canada as a whole, which is a significant net exporter of crude oil, the decline in the world oil price leads to a decline in overall economic activity. The economic decline in the oil-exporting provinces offsets the expansions in the oil-importing provinces. The Bank of Canada's estimate for overall GDP growth in 2015 was adjusted downward from 2.4% to 2.1%, largely as a result of the decline in the world price of oil (Bank of Canada, 2015).

Government budgets

Changes in the world price of oil also have important implications for the fiscal situations of provincial governments. In each of Alberta, Saskatchewan, and Newfoundland and Labrador, earnings from natural resources in 2014 represented between one-quarter and one-third of its government's annual program spending. The decline in the world oil price significantly reduces these revenues and forces the governments into cutting spending, raising taxes, or increasing their budget deficits.

For the non-oil-producing provinces, the reduction in the price of oil, combined with the depreciation of the Canadian dollar, works to stimulate economic growth. Along with the higher growth, the government's tax base also expands. Governments in these provinces with existing budget deficits may therefore find a return to a budget balance easier in a world of low oil prices.

The decline in expected Canadian GDP growth caused by the oil-price decline also affects the fiscal situation of the federal government. TD Economics (2015) estimates that the federal budget, which in early 2014 was expected to have a small surplus in each of the 2015 and 2016 fiscal years, is now expected to remain in deficit until 2017.

Box 3 continued

Greenhouse gas emissions

Sustained low oil prices will lead to less production of oil and other petroleum products, and as a result, fewer emissions of GHGs. Any decline in investment in oil sands projects will result in slower growth of Alberta's emissions. Alberta and Saskatchewan might therefore come closer to achieving their existing GHG emissions targets, and Newfoundland and Labrador may achieve its current target by a larger margin.

Emissions associated with energy consumption, on the other hand, are likely to be higher, as firms and households consume more petroleum products. (The magnitude of this effect depends on how sensitive petroleum demand is to changes in its price.) Drivers may drive more, and even choose less-efficient vehicles. Manufacturing sectors will produce more output and also more GHG emissions. Consequently, Ontario and Quebec will likely face greater challenges in achieving their targeted emissions reductions.

Whatever changes are created in Canada's economy as a result of fluctuations in the world price of oil, such changes do not affect the underlying case for carbon pricing as a means of addressing climate change. Whether oil prices are high or low, carbon-pricing policies create powerful market incentives for reducing GHG emissions.

A decentralized approach—with carbon-pricing policies designed and implemented by each province—is a practical and expedient way to move forward. The practicality of this approach is explained below.

Provincial policies can sidestep the difficult issue of burden sharing

Not stated in the federal government's current target for Canada's emissions reductions (17% below 2005 levels by 2020) is the issue of how the required reductions are to be distributed among the provinces. As discussed above, provincial emissions and emissions intensities are far from uniform. The distribution of provincial emissions reductions, therefore, has significant implications for the distribution of the associated burden.

As noted in Section 2, however, the provinces have also established their own emissions-reductions targets. If each province were to successfully achieve its own target, and Canada received the expected credits for emissions reductions from land use, land-use changes, and forestry, Canada would come very close to complying with the current federal target under the Copenhagen Accord.

Provincial policies can avoid financial redistributions among provinces

Just as burden sharing affects the regional distribution of the *costs* of policy, the allocation of carbon-pricing revenue affects the distribution of *benefits*. A decentralized approach to carbon pricing could ensure that all carbon revenue would be recycled inside the province in which it is generated. For example, even though more total revenue might be generated in Alberta (given its larger emissions), the primary benefits of recycling this revenue would similarly be experienced within Alberta. Revenue generated in one province would not be recycled to another.

In principle, a federal policy could be designed to prevent interprovincial redistributions, with all revenues returned to the province in which they were generated (Snoddon & Wigle, 2009; Snoddon, 2010). Given the scale of the potential revenues and the relationship between these revenues and the existing federal equalization program, many details would need to be studied thoroughly. As a result, some provinces might understandably be concerned about how such a policy would be implemented in practice. In contrast, a policy approach based on provincial action avoids this important complication in a simple and transparent manner.

Provincial policies can be designed to suit provincial priorities

A provincial approach to carbon pricing would not only ensure that each province kept its own carbon revenue, it would also allow each province to determine *how* its carbon revenue would be recycled. Different approaches to revenue recycling—reducing other taxes, investing in technology or infrastructure, protecting vulnerable Canadians or sectors, or some combination of these approaches—have different benefits and costs. Any government's chosen approach would naturally reflect its provincial priorities. Just as provinces have different economies and emissions profiles, so too do they have different political and policy priorities. Province-led carbon-pricing policies would also allow for other policy details to be customized to each province. British Columbia and Quebec, for example, have implemented different policy instruments to price carbon. Each has advantages and disadvantages, but these trade-offs may play out in different ways in different provinces. We return to this issue in Section 5.

Provinces can serve as laboratories for learning about best practices

As carbon pricing continues to evolve in Canada, it is hardly surprising that we observe a considerable *range* of policy designs. Such diversity can provide important benefits for policymakers, especially over time. Competing policy ideas can allow us to learn about the strengths and limitations of different options (The Climate Group, 2014). Provincial approaches can be monitored to draw lessons for policy improvement, leading to the diffusion of the most effective policy ideas (Sawyer et al., 2013; Belanger, 2011). Such "policy diffusion" can be an important pathway for better policy in the longer term (Aulisi et al., 2007; Jänicke, 2005). Indeed, lessons are already beginning to emerge from the policy experiences in British Columbia and Alberta, as discussed in Box 4.

Our shared history has shown that pan-Canadian policy need not be the creation of the federal government. Education at all levels, publicly financed health care, and labour-market training are just three spheres of many in which broadly similar policies exist across the country, even though individual provinces operate their own systems in their own ways. Furthermore, provincial policies have often been the source of policy innovations that have also spread across the country. Saskatchewan led in the creation of public health care, while both Alberta and Saskatchewan led the fight against public budget deficits. In both cases, what started as unique provincial priorities have become entrenched as pan-Canadian economic values.

3.4 POLICY CAN BECOME MORE COORDINATED AND COMPREHENSIVE OVER TIME

This section has laid out a practical path forward for Canadian carbon pricing. Yet in the end, a comprehensive and coordinated system is desirable across the country. Despite the significant benefits of provincial carbon pricing, such an approach has one key disadvantage: the possibility that different provincial systems will lead to a range of carbon prices across the country—and perhaps to some provinces having no price at all. Over time, a more comprehensive and coordinated policy can be achieved in several ways.

Over time, coordination of provincial policies is desirable

The coordination of provincial policies is desirable for four reasons. First, strong policy in some provinces and weak policy in others, reflected in differentials in carbon prices, could result in inexpensive emissions reductions being left unrealized. The most cost-effective approach to pan-Canadian policy is to have a single carbon price applied to as large a share of national emissions as possible.

Second, provincial differences in policy introduce the possibility of interprovincial competitiveness issues that benefit neither the economy nor the environment. Firms in emissions-intensive industries could face incentives to move their facilities to jurisdictions with weaker policies, thereby relocating an unchanged level of GHG emissions and increasing the economic costs for those provinces with more ambitious policies.

Third, a decentralized approach can lead to insufficiently stringent policy. While setting targets is politically easy, implementing effective policy comes with clear challenges. If implementing policy is perceived to be costly, individual provinces would have an incentive to avoid using strong policies, hoping the other provinces will make the tough choices. As in the case of international climate politics, individual provinces may tend to free-ride on the policy actions of others. And provinces with more expensive emissions reductions may be particularly less inclined to take action (Harrison, 2013).

Box 4: Policy Lessons from British Columbia and Alberta

British Columbia's revenue-neutral carbon tax has been in place since 2008, and Alberta's Specified Gas Emitters Regulation (SGER) since 2007.

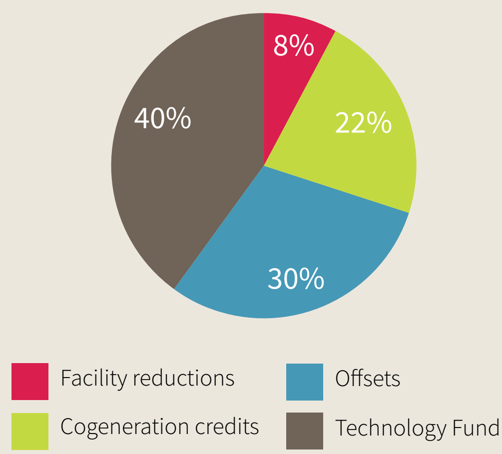
The evidence so far suggests that the impacts of the two policies are quite different. As we discuss in Section 5, differences in the *stringency* of the policies are a key explanatory factor.

Trends in B.C. relative to the rest of Canada provide preliminary evidence as to the effect of B.C.'s carbon tax. Fuel use per capita declined by 16% in the first six years, but increased by 3% over the same period in the rest of Canada. These provincial differences cannot be explained by differences in economic growth: over the same period, B.C.'s economy grew by 1.8%, as opposed to 1.3% in the rest of the country (Elgie, 2014).

Econometric analysis supports this preliminary finding. Rivers and Schaufele (2012) estimate that the tax led to a reduction of more than 3 Mt of gasoline-related GHG emissions. They reject alternative explanations such as cross-border shopping and other vehicle-efficiency policies as likely explanations of the emissions reductions.

Additional research is beginning to emerge on other impacts of B.C.'s policy. Preliminary analysis, for example, suggests that the combination of the carbon tax and the corresponding reductions in other taxes has led to an increase in aggregate employment within the province (Yamazaki, 2014).

Alberta's SGER policy appears to be much less effective. The share of total emissions priced by the policy was only about 3% in 2012. Specific design details dilute the policy's effectiveness in reducing GHG emissions. For example, in lieu of reducing emissions, emitters can comply with the policy by purchasing offsets, receiving credits for cogeneration, or by contributing to the province's Technology Fund. The figure at right shows the breakdown of actual compliance from 2007 to 2012, cumulatively. The significant fraction (52%) of compliance obligations satisfied through credits and offsets is a source of some concern. Given that some of these offsets and cogeneration projects were in place before the regulation, concerns exist over the policy's genuine contribution to *marginal* emissions reductions (Horne & Sauve, 2014).



Source: Alberta Environment (2014).

Statistical analysis provides further evidence on the limited effectiveness of Alberta's SGER. Preliminary analysis from Rajagopal (2014) finds that the regulation had no significant impact on annual GHG emissions or even emissions intensity for average facilities in all sectors.

Fourth, a diverse patchwork of policies can be complex and expensive for businesses with operations in multiple provinces. Different compliance and reporting rules can increase transaction costs for firms. The harmonization of procedures for measurement and verification between provincial policies can address this problem.

A range of different mechanisms for more coordinated and comprehensive policy could be part of a pan-Canadian provincial approach to carbon pricing. Either provincial or federal approaches to coordination can be effective; a future report from Canada's Ecofiscal Commission will explore options in more detail.

Provincial governments could coordinate their policies

Coordination could emerge from continued provincial cooperation. For example, the Council of the Federation (2014) suggests provincial carbon-pricing policies could be part of a coordinated, province-led national energy strategy.

One possible method of coordination is *linkage*, which allows for the trading of emissions permits between regional cap-and-trade markets. The result is a consistent carbon price, and more cost-effective policy overall (Jaffe & Stavins, 2008). Linkage allows regions with higher abatement costs to reduce fewer emissions, and regions with lower costs to reduce more. As a result of a joint market, emitters in both jurisdictions can benefit. Quebec and California, for example, are currently linking their permit markets as part of the Western Climate Initiative.

Other mechanisms for linkage also exist, including access to a common offset market (Jaffe & Stavins, 2008; Aldy & Stavins, 2011; Ranson & Stavins, 2012).[1] Prices in different cap-and-trade systems would converge to the market price of offsets, thereby leading to a consistent carbon price. Even carbon taxes could be linked with other carbon-pricing instruments via shared offset markets.

Provinces could also align their carbon-pricing policies without formal linkage. By aligning policy design elements with other provinces, such "linking by degrees" would allow the provinces to share best practices and reduce the administrative costs of implementing policies (Burtraw et al., 2013).

The federal government could help the provinces coordinate

Alternatively, the federal government could play a useful role in provincial coordination. To be effective, federal coordination would need to focus on two main elements of the provincial policies: *stringency* and *revenue recycling*.

The most centralized approach to coordination would involve an eventual shift toward a uniform federal policy. Under this approach, such a nationwide policy would eventually replace provincial policy. The most economically efficient federal approach would involve a consistent carbon price across the country. Yet, if federally implemented, this approach would encounter a significant hurdle. All revenues generated by the federal carbon price would naturally flow to Ottawa—unless some element of the policy design prevented such financial flows.

Snoddon and Wigle (2009) and Snoddon (2010) propose a revenue recycling approach to address this problem. They suggest that the federal government could set the overall stringency of policy but decentralize revenue recycling by sharing the revenue with provincial governments. Similarly, Peters et al. (2010) argue that recycling all revenue back to the province in which it was generated could ameliorate distributional impacts between regions.

Alternatively, equivalency agreements between federal and provincial governments could provide a mechanism for the coordination of provincial policies. Federal policy could establish a minimum standard (e.g., a minimum carbon price), but allow provinces to implement provincial policies to match or exceed this level. Nova Scotia, for example, has signed an equivalency agreement with the federal government that exempts it from the federal coal-fired electricity GHG regulations (Canada, 2013). The Nova Scotia renewable energy standard achieves equivalent emissions reductions. In the face of potential federal oil and gas regulations, various provinces have explored the potential of equivalency agreements that would allow them to implement provincial policies (including carbon-pricing options) and thereby be exempted from the federal regulations. No policies have been finalized, however, since the federal regulations were put on hold (Sawyer et al., 2013).

[1] Offsets are credits for emissions reductions that can be purchased by regulated emitters from emitters not regulated under a carbon-pricing policy (e.g., forestry, waste, agriculture).

International experience highlights a range of approaches to coordination

International examples illustrate both more and less centralized approaches to coordination. The European Union's Emissions Trading System (ETS) is a continent-wide cap-and-trade system. In the early phases of the ETS, individual EU states made their own design decisions about the stringency of their caps and how permits were allocated, with some guidance and approval from the European Commission. Over time, the policy has become more centralized, with the Commission setting overall continental emissions caps and increased permit auctioning (Ellerman, 2008; and International Carbon Action Partnership [ICAP], 2015).

An overall approach in which policy stringency is set centrally, but all other details of policy design are decentralized, is now emerging in the United States. Regulations from the U.S. Environmental Protection Agency (EPA) essentially require states to implement state-level policies no less stringent than the EPA's emissions guidelines. States can use existing policies or craft new ones, customized to the unique elements of their own economies and energy systems (Konshnik & Peskoe, 2014). This emerging approach builds on pre-existing policy leadership at the state-level (Rabe, 2008).

Similarly, China has been moving forward with a more decentralized approach, involving seven provincial and municipal pilot cap-and-trade systems. China's National Development and Reform Commission announced these initiatives in 2011. As of June 2014, all seven are in operation, with local governments managing the design and implementation of the pilot programs. As a result, design choices such as sector coverage, auctioning, allowance schedules, and other details are specific to each system. These differences allow China to accumulate experience and inform the development of its national cap-and-trade system, planned to start between 2016 and 2020. While it is still too early to know how the pilot programs will link to the national program, the most successful pilot programs will likely be used as models (World Bank, 2014a; Munnings et al., 2014).

4 THE COST-EFFECTIVENESS OF CARBON PRICING

The previous section made the case that provincially led carbon-pricing policies are a practical path forward for achieving greater emissions reductions in Canada. But why the focus on carbon pricing, rather than on other policy approaches?

Carbon pricing's big advantage is that it can drive a given amount of emissions reduction at lower cost than alternative policies. Firms and households facing a carbon price have the flexibility to choose how best to reduce their emissions and avoid paying the carbon price—whether by reducing their emitting activities or by investing in low-carbon processes and technologies. The result of this flexibility is that emissions reductions throughout the economy are achieved at lowest cost. A carbon price also generates revenue that, if used wisely by government, can create additional economic benefits.

This section uses a formal macroeconomic model to demonstrate the benefits of using carbon pricing for reducing GHG emissions relative to a less flexible regulatory approach.

4.1 ECONOMIC MODELLING OF GHG EMISSIONS REDUCTIONS

Though economic models are necessarily a simplification of the actual economy, they are invaluable for illustrating key insights and for comparing the effects of alternative policies.

The modelling framework is well suited to cost-effectiveness analysis

Analysis in this section applies a "computable general equilibrium" model of the Canadian economy to explore provincial policy options.[2] This model simulates the pattern of production and trade throughout the economy and is particularly useful for comparing alternative policy options in terms of likely macroeconomic outcomes. For technical details, see the description in Böhringer et al. (2015). The model used here has several key features:

- It includes explicit representation of each province (given their size, Prince Edward Island and the territories are combined), showing the unique patterns of production and consumption in each province as well as the trade flows between them. This representation is based on input-output tables from Statistics Canada.
- The model includes rich detail on energy use and GHG emissions, but also includes non-energy emissions from industrial processes and agriculture.
- Canada is modelled as a "small open economy," which trades goods and services with the rest of the world, but does not influence international terms of trade.
- The model includes 17 industrial sectors within each province, representing a wide range of emissions profiles and abatement costs.
- By representing the full Canadian economy, the model can capture the implications of climate policies for production, consumption, prices, and both international and interprovincial trade.

[2] Computable general equilibrium (CGE) models are a type of analytical tool used to assess the impacts of policy changes on the economy. Such models are "computable" in that they are solved numerically; they are "general" in that the model considers all sectors of the economy; and they solve for an "equilibrium" in which all markets clear simultaneously. CGE models are commonly used in macroeconomic analyses.

- The model has been developed by top modelling experts in Canada and internationally, and has been used in an academic setting (e.g., Böhringer et al., 2015), but also in applied policy contexts by Environment Canada.

The model's rich detail on industrial sectors, energy, and GHG emissions allows for a thorough assessment of distinct provincial carbon-pricing policies. And because the model represents the full Canadian economy and is grounded in economic theory, it is well suited to consider the relative costs of different policy options.

As with all economic models, however, there are limitations. The complexity of the model in terms of its regional and sectoral detail comes at some cost. In particular, the model is based on assumptions around existing technologies, and does not allow for the possibility that new technologies and processes might be developed in response to carbon pricing. While the model is very useful in comparing different scenarios, it is less well suited to predicting specific future outcomes; more can be learned from the relative changes in GDP between scenarios, for example, than from the levels within any one scenario. Finally, the model is static and therefore does not consider important dynamics, such as the process of capital accumulation. We return to these limitations later in this section.

Four modelling scenarios illustrate the range of policy options

The analysis in this section considers four policy scenarios, described in Table 2. These scenarios are defined in terms of the policy's stringency, flexibility, and revenue recycling. Comparing model outcomes under these scenarios allows us to better understand the benefits of the various aspects of carbon pricing.

Table 2: Modelling scenarios

Scenario	Stringency sufficient to achieve provincial targets	Flexibility within provinces	Revenue recycling	Flexibility between provinces
1. Inflexible regulations	✓			
2. Flexible policies	✓	✓		
3. Ecofiscal policies	✓	✓	✓	
4. Linked ecofiscal policies	✓	✓	✓	✓

All four scenarios assume that each province implements a policy sufficiently stringent to achieve its own provincial target for GHG emissions. With stringency held constant across all scenarios, we can then compare the cost-effectiveness of various policies. The analysis uses the provinces' existing stated targets as a benchmark. (This approach does not endorse these existing targets; it simply uses them as a means of comparing alternative policy approaches.)

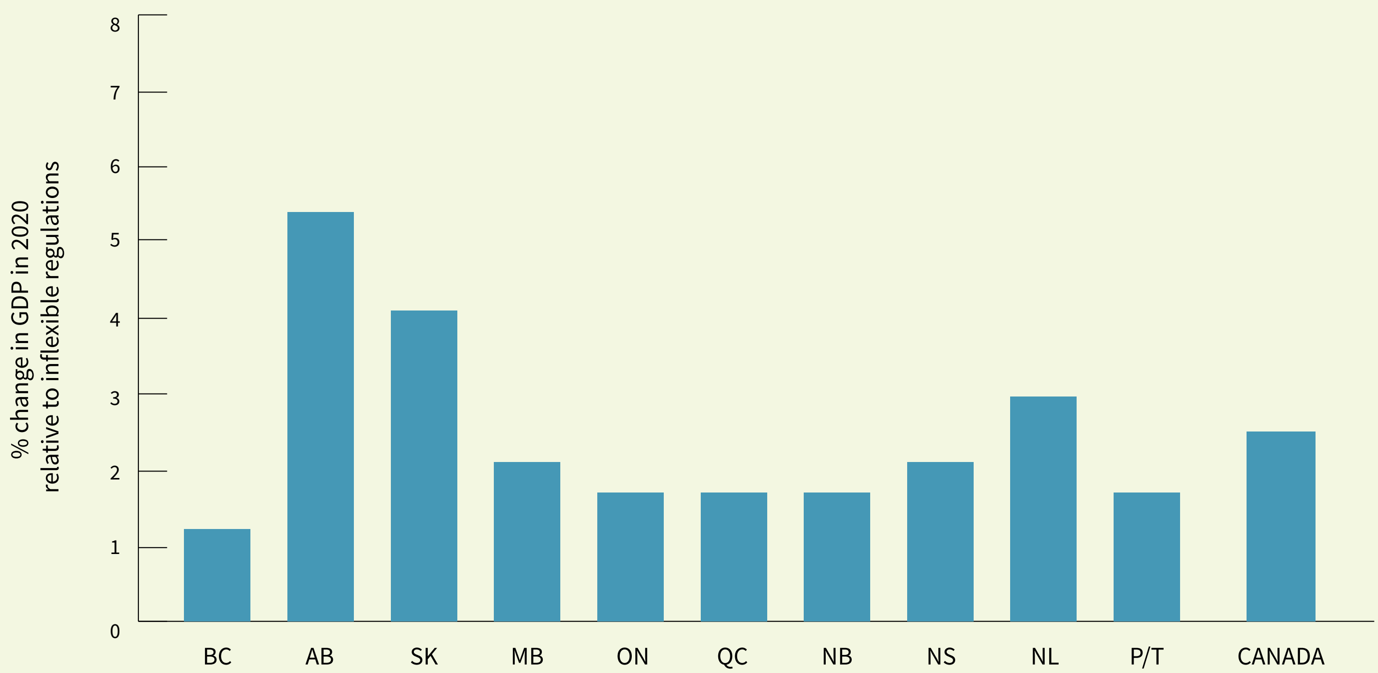
Scenario 1: Inflexible Regulations. This scenario assumes that the provinces achieve their emissions targets using inflexible regulations; each sector within the province reduces its emissions by the same percentage amount, whatever its relative abatement costs. In addition, the policy does not generate revenue to be recycled back to the economy. Scenario 1 approximates an inflexible regulatory policy in which emitters bear the costs of their emissions reductions, but pay no price on their remaining GHG emissions.

Scenario 2: Flexible Policies. This scenario introduces flexibility within each province. Each province still achieves the required reductions as a whole, but the contributions of different sectors vary according to their relative costs of abatement. This scenario replicates the effect of a carbon-pricing policy in one important way: the marginal abatement costs of all emitters are equated (and so total provincial emissions reduction is achieved at least cost). However, unlike a genuine carbon price, this scenario generates no revenue to be recycled.[3] Scenario 2 could represent provincial cap-and-trade systems with permits allocated for free, or a set of "smart" regulations designed to maximize flexibility between sectors.

Scenario 3: Ecofiscal Policies. This scenario represents a set of independent provincial ecofiscal policies. Full flexibility exists within each province, as in Scenario 2. As a result, a single carbon price exists within each province. But the policy also generates revenue,

[3] Scenario 2 is modelled using a provincial carbon price with revenue recycled back to the economy via lump sum payments. This approach is a non-distortionary approach to revenue recycling; it results in no substitution effects, other than those induced by the price of carbon.

FIGURE 7: Benefits of Policy Flexibility



The figure shows the benefits of using flexible (rather than inflexible regulatory) policy to achieve provincial GHG emissions-reduction targets. Flexibility improves cost-effectiveness of carbon policy for all provinces (P.E.I. and the territories are combined as P/T). For the country as a whole, flexibility can increase GDP by 2.5% relative to inflexible regulations.

Source: Ecofiscal Commission modelling.

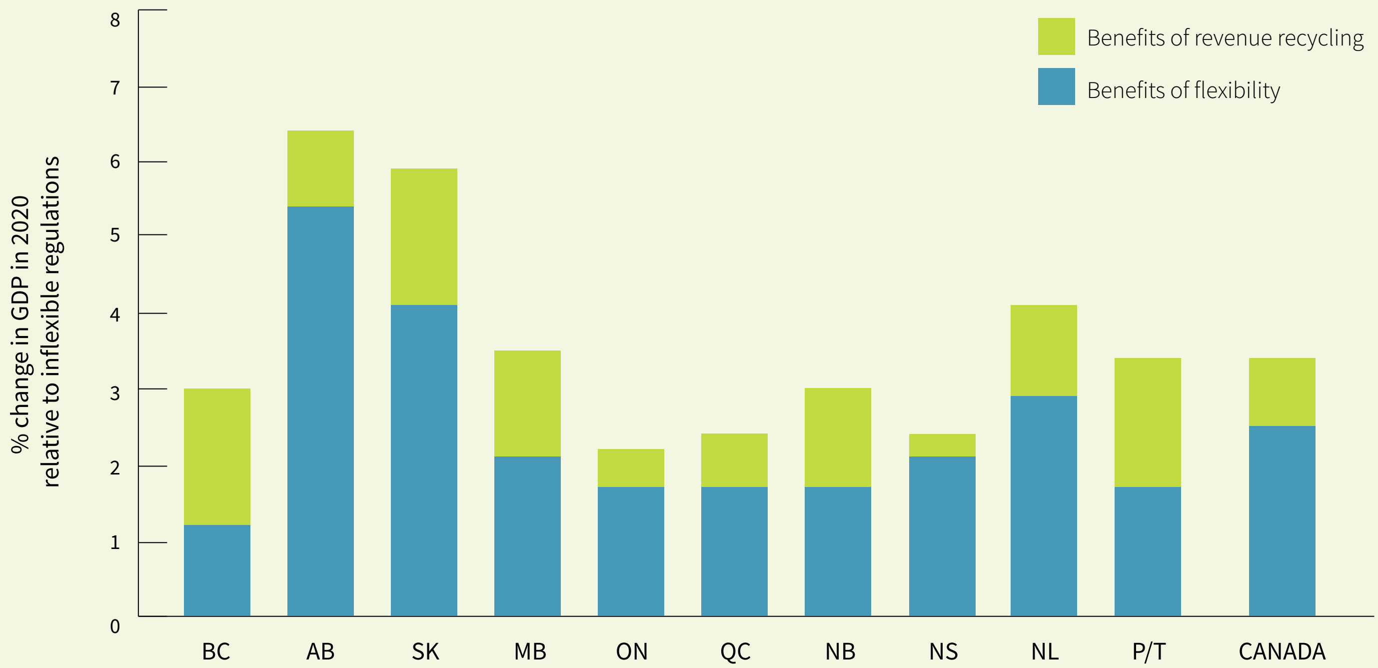
which in this case is used to reduce personal income taxes in each province. Each provincial policy is independent: so all revenue stays within provincial borders. Note that only one option for revenue recycling—reducing personal income taxes—is considered. The analysis is meant to be illustrative and not to preclude other options for revenue recycling. Future research from the Ecofiscal Commission will explore alternative recycling options.

Scenario 4: Linked Ecofiscal Policies. In this scenario, provincial governments are assumed to implement the same policies as in Scenario 3, but now allow for permit trading between provinces. As a result, emitters in provinces with higher marginal abatement costs can purchase emissions permits from provinces with lower marginal abatement costs. The result is the same total amount of emissions reduction for Canada, but a single carbon price across all provinces.

Modelling shows benefits of policies relative to inflexible regulations

The objective of the modelling analysis is to assess the cost-effectiveness of different policy approaches to achieving a given level of emissions reduction. We use Scenario 1 (inflexible regulations) as the benchmark, against which we compare the benefits of the other three policy scenarios. This approach reflects the Commission's view that the relevant policy question is not about *whether* to achieve a given level of emissions reductions, but rather *how* best to achieve such reductions. The analysis measures these benefits in terms of improvements in provincial GDP relative to the benchmark (where GDP is the total value of income and production generated within each province).

FIGURE 8: Benefits of Policy Flexibility and Revenue Recycling



The figure shows the economic benefits of policy flexibility (blue) and of revenue recycling (green) relative to inflexible regulations. Revenue recycling can generate benefits for all provinces; for Canada as a whole, it can improve an already-flexible policy by 0.9% of GDP.

Source: Ecofiscal Commission modelling.

4.2 BENEFITS OF POLICY FLEXIBILITY

One of the key benefits of ecofiscal policy is its flexibility. Ecofiscal policies work through increasing the economic incentives for emitters to reduce their emissions, who then respond by seeking out the most cost-effective emissions reductions. To assess the magnitude of these benefits, we compare scenarios with and without flexibility (Scenarios 1 and 2). Figure 7 shows the percentage change in GDP from introducing policy flexibility.

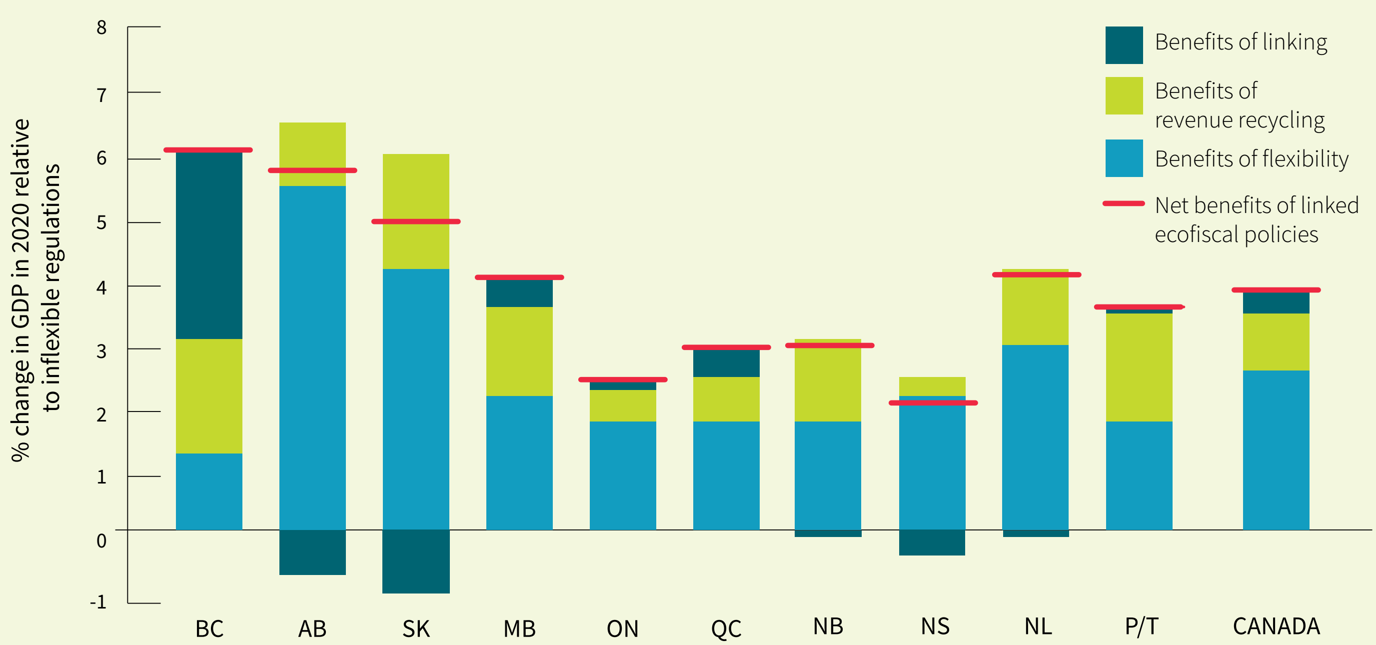
Relative to the use of inflexible regulations, flexible policy increases GDP in all provinces, by an average of 2.5%. As should be expected, these benefits are larger for provinces in which the costs of abatement vary widely within the province: flexibility allows for fewer emissions reductions in sectors with high costs of abatement, but more reductions in sectors with lower abatement costs.

In Alberta, for example, electricity generation with coal-fired plants is highly emissions-intensive. Yet emissions reductions from switching to alternative sources (such as high-efficiency natural gas) can occur at relatively low cost. Gas power is only slightly more expensive than coal without a carbon price, and has a cost advantage even at relatively low carbon prices. As a result, policy flexibility allows electricity generation to contribute more emissions reductions, while sectors with limited options for abatement, such as cement manufacturing, contribute fewer.

In contrast, the benefits of flexibility for British Columbia are relatively modest. With no production of coal-fired electricity, B.C. has fewer lower-cost emissions reductions available. Further, given B.C.'s very ambitious target, deep reductions are required throughout the economy, limiting the benefits of flexibility in this case.

Nova Scotia is a special case, as it is on track to achieve its currently stated provincial target even without new policies; unfortunately, it will achieve its target mostly through the ongoing decline of its industrial base and its associated emissions. (The developments in offshore natural gas and oil could change the province's emissions and economic trends.) As a result, no

FIGURE 9: Benefits of Policy Flexibility, Revenue Recycling, and Linking



Interprovincial linking (with a single Canada-wide carbon price) can slightly improve cost-effectiveness of carbon policy for Canada overall, with some mixed impacts for individual provinces. It can increase Canadian GDP relative to inflexible regulations by about 0.4% in addition to the benefits of flexibility discussed above.

Source: Ecofiscal Commission modelling.

additional provincial policy is required for Nova Scotia. Yet, given provincial trade, Nova Scotia experiences secondary impacts of carbon policies implemented in *other* provinces. A key factor in this result is interprovincial linkage: Nova Scotia can increase its emissions and *still* achieve its target. Consequently, emitters in Nova Scotia have an advantage over others in Canada, and so produce a greater number of emissions-intensive products, such as cement, while provinces with more aggressive policies produce fewer.

4.3 BENEFITS OF REVENUE RECYCLING

Unlike regulations, ecofiscal policies generate revenue for the government that can be recycled back to the economy in a variety of ways, further improving the cost-effectiveness of policy. This *revenue recycling* is the second key advantage of ecofiscal policies.

Modelling results, shown in Figure 8, illustrate these provincial benefits. In addition to providing flexibility from carbon pricing within the province, the policies also generate revenue, which in this modelling exercise is used to reduce personal income taxes. Each provincial policy is independent, with all revenue staying within the province. In reality, several approaches to revenue recycling are available, and we explore this further in Section 5. The purpose of this modelling exercise is simply to illustrate the benefits of revenue recycling relative to a regulatory approach. It is not to suggest that reducing personal income taxes is the preferred way of recycling.

Revenue recycling leads to benefits for all provinces and for the country as a whole. In this scenario, the benefits come from reducing existing income taxes; as is usually the case in computable general equilibrium models, income taxes reduce both work effort and GDP. The modelling suggests that revenue recycling can improve cost-effectiveness for Canada by 0.9% in terms of GDP—over and above the benefits from policy flexibility. Combining both benefits, provincial ecofiscal policies are more cost-effective than inflexible regulations by 3.4% of GDP in 2020.

Note the variation across provinces in terms of the benefits from revenue recycling. This variation is partly explained by the existing variation in provincial income tax rates. Manitoba, New Brunswick, and Quebec, for example, have relatively high personal income tax rates, and so experience greater benefits than other provinces from reductions in these taxes.

4.4 BENEFITS OF INTERPROVINCIAL LINKAGE

The analysis has so far considered policy in each province independently. Flexibility *between* provinces can further improve cost-effectiveness of Canada's overall emissions reductions. Scenario 4 represents the case of *linked* provincial ecofiscal policies.

The first three modelling scenarios require each province to achieve its own emissions target in 2020, independent of the policies in other provinces. Yet considering each province's target in isolation may result in one province incurring relatively costly emissions reductions, while another leaves lower-cost reductions unrealized. Such an outcome would not be cost-effective for the country as a whole, but would occur if the carbon prices were not equalized across the provinces.

With the modelling assumptions of Scenario 3, provincial carbon prices vary notably across the provinces. British Columbia's ambitious emissions-reduction target, for example, requires a higher price than in other provinces. In contrast, Alberta's less stringent target requires only a low carbon price.

The benefits of linking provincial policies emerge because, for the country as a whole, the most cost-effective approach occurs when the carbon price is equalized across provinces. Figure 9 shows the benefits of linking the provincial systems through permit trading (light blue bars), a process that produces a consistent Canada-wide carbon price. Similar to the agreement between Quebec and California, linked cap-and-trade systems allow permit trade between emitters in different provinces.[4] Firms with lower abatement costs in one province reduce more emissions, and sell permits to firms in other provinces with higher abatement costs. The result is a consistent carbon price across all provinces.

Two key findings emerge from this analysis, each with implications for Canadian policy. First, the benefits of linking are not distributed evenly across the provinces, and linking even leads to decreases in GDP in some provinces. Second, the overall benefits of linking are generally modest relative to the benefits of flexibility and revenue recycling. We discuss each finding in more detail below.

Uneven benefits of interprovincial linkage

Simple models of linkage suggest permit trading should benefit both buyers and sellers. Buyers purchase low-cost reductions from other provinces, avoiding higher-cost reductions at home. Sellers implement additional emissions reductions at lower cost than the value of the permit they sell. The results for British Columbia, for example, illustrate these benefits. B.C. has deep provincial targets and has higher abatement costs given the low carbon intensity of it hydro-based electricity system. Under linking, B.C.'s firms therefore purchase a large number of permits from other provinces, and avoid higher-cost emissions reductions at home. Other provinces, such as Manitoba, Ontario, and Quebec, see similar benefits, leading to an overall benefit of linkage for Canada.

In terms of the overall impact on provincial GDP, however, the model's general equilibrium results are more complex than this simple intuition. This complexity highlights the potential challenges of linking, particularly for net permit sellers. Saskatchewan, for example, sees a small decrease in its GDP. Saskatchewan has a relatively shallow target, but also has access to relatively low-cost emissions reductions, particularly from its coal-fired electricity plants. Saskatchewan's firms therefore sell a large number of permits to other provinces and achieve benefits by earning more on their permit sales than they incur in costs from their emissions reductions. While this transaction makes sense for the individual emitters selling permits, it leads to an increase in the price of carbon in Saskatchewan, increased costs for other emitters in the province, and a small net decrease in provincial GDP. Saskatchewan, Nova Scotia, New Brunswick, and Newfoundland and Labrador see similar increases in the price of carbon under linkage.

The costs and benefits from interprovincial linkage illustrated in Figure 9 apply to a modelling scenario in which each province is assumed to implement policy sufficient to achieve its own stated objective. It is worth noting that a different allocation of provincial targets—with the same aggregate emissions reductions for the country overall, but distributed among the provinces differently—could lead to different distribution of costs and benefits.

Benefits from interprovincial linkage are relatively modest

The second key takeaway from the analysis is that the overall benefits of linkage—for Canada and for most provinces separately—are relatively modest compared with benefits from revenue recycling and policy flexibility. Again, a key driver of the size of these benefits is the level of policy ambition embodied within the various provincial emissions-reduction targets. The finding that the overall benefits from interprovincial linkage are modest is driven by the fact

[4] Other approaches to price harmonization are possible. Any province with a carbon tax could peg its carbon price to the market price in other jurisdictions, or the purchase of permits from other jurisdictions could allow for exemptions from the tax. Provincial systems could also be indirectly linked through access to a common offset market. Future Commission research will explore these issues in more detail.

that the various province-specific carbon prices (in Scenario 3) are broadly similar. British Columbia, with its very aggressive target, and Alberta, with its relatively shallow target, are the two outliers from this general pattern. If the provincial targets used in this modelling exercise are to be taken at face value, the analysis here suggests that a significant share of the benefits of carbon-pricing policies can be achieved through provincial action, without interprovincial linkages.

4.5 IMPORTANT LIMITATIONS OF THE MODEL

As discussed, all economic models have limitations. In terms of assessing the relative benefits of ecofiscal policies, three key limitations of the model are relevant. Two suggest the actual cost-effectiveness benefits will be larger than what is suggested by the model. One suggests they could be smaller.

First, the model does not capture the innovation benefits of ecofiscal policy. Over time, carbon pricing creates incentives to adopt and develop new technologies that can reduce emissions at lower costs. A carbon price makes these innovations valuable no matter what, while an inflexible regulation provides incentives to reduce emissions only to the level required by the regulation (Köhler et al., 2006). Furthermore, economic opportunities for Canadian firms would be created as other countries implement their own carbon-pricing policies, thus increasing the global demand for such innovations. Though the model does not consider these benefits, they remain an important consideration for Canada and its provinces.

Second, additional benefits of flexibility may exist given variation between individual firms. The modelling analysis illustrates the cost-effectiveness benefits only of flexibility between different *sectors* of the economy. That is, it reflects the fact that some sectors have lower abatement costs than others. Yet the model does not capture the benefits of flexibility owing to differences *within* sectors but *between* firms. In any given sector, different firms will also face different technologies and thus different abatement costs. On this front, the model clearly underestimates the benefits of policy flexibility.

The third factor goes in the other direction. Realistically, regulatory policies will rarely be as costly as the inflexible regulations depicted in this analysis. Scenario 1 is based on the strong assumption that all sectors are required to achieve the same percentage level of reductions. In reality, government would often consider differences in sectoral abatement costs and negotiate with the sectors directly. In addition, regulations can be designed with some flexibility. The federal government, for example, has built some flexibility into its regulations for GHG emissions for vehicles (Sawyer & Beugin, 2012).

This third argument should not be pushed too far, however, given the important and practical limitations to smart regulations. Real-world regulations cannot be as cost-effective as the flexible-policy scenario. Designing smart regulations that truly replicate the efficiency of a market-based instrument requires policymakers to have detailed information on the abatement costs in each sector—information that governments simply do not have. The stringency of regulation is usually designed after analyzing sectoral abatement costs and consulting with firms in the industry. Yet the challenge of determining the “right” level of stringency in a regulation is precisely the advantage of ecofiscal policies. Rather than having to predetermine the source of low-cost emissions through analysis or negotiations, ecofiscal policies use market forces to seek out the lowest-cost reductions. Given these challenges, prescriptive regulations cannot be as flexible or cost-effective as ecofiscal policies.

4.6 POLICY LESSONS FROM THE MODELLING EXERCISE

Three main lessons can be drawn from this modelling exercise. Figure 9 shows the GDP benefits for each province from the combination of policy flexibility, revenue recycling, and interprovincial linking. The main lesson is that each province would benefit considerably by achieving its current emissions-reduction target through the use of carbon-pricing policies, rather than some form of prescriptive regulations. Given the practical limitations to policy design and access to information, even smart regulations would be significantly less cost-effective than a carbon-pricing policy.

A second lesson is that the benefits of revenue recycling are considerable, and also point to the value of the ecofiscal approach. Since carbon pricing generates revenues for governments, economic benefits can be achieved by using these revenues to reduce existing taxes. Regulatory policies do not generate revenues, and hence are denied this potential benefit. While the modelling only illustrates one approach to revenue recycling, other approaches can also create economic benefits, if designed well.

The third lesson relates to the benefits of interprovincial linkages. Most provinces benefit from linking their policies to those in other provinces, but some do not. In any event, the benefits or costs are generally quite small relative to the benefits from flexibility and revenue recycling. It therefore makes sense for the provinces to implement carbon-pricing policies independently, and then work over time toward coordinating their respective policies. Timely provincial action is the practical path forward.

5 A FRAMEWORK FOR POLICY DESIGN

This section is a starting point for examining the design of carbon-pricing policies. Though the focus here is on provincial policies, the framework would also be relevant in a federal context. Smart policies are both effective at driving emissions reductions and cost-effective in doing so. In addition, they need to reflect local circumstances, and should be designed to permit a transition toward nationwide coordination over time. Our purpose here is to develop a general framework for examining the design details that will ultimately be determined by the provinces. Future reports by the Ecofiscal Commission will use this framework to explore design choices in greater detail.

The framework developed here is based around five central design issues:

1. Which different policy instruments can be used to price carbon?
2. How stringent is the policy, and what is the price of carbon?
3. How broad is the policy coverage?
4. How is revenue recycled back to the economy?
5. How can competitiveness risks be addressed?

To make the discussion concrete, the various issues are illustrated by examining the existing provincial carbon-pricing policies, including British Columbia's carbon tax, Quebec's cap-and-trade system, and Alberta's Specified Gas Emitters Regulation (SGER). We conclude with a high-level evaluation of these existing provincial policies.

5.1 CARBON-PRICING INSTRUMENTS CONSTRAIN PRICES, QUANTITIES, OR BOTH

GHG emissions can be priced using different policy instruments. Though implemented differently, each instrument can be used to establish a price on GHG emissions, and each can generate revenue to be recycled back to the economy.

A carbon tax directly sets the price of carbon

A *carbon tax*, such as the policy used in British Columbia, directly sets a price on GHG emissions. The government sets the level of the tax; in B.C., it is currently $30 per tonne of CO_2e. Faced with a clear carbon tax, individual emitters are led to reduce emissions whenever the cost of doing so is less than the tax; if the abatement cost is higher than the tax, the emitter will not reduce emissions, and will instead pay the tax.

While the price of emissions is set clearly by the policy, and is thus certain at any given time, the level of the resulting total emissions can only be estimated, as it depends on the specific behaviours and abatement costs of firms and households, neither of which are known with precision to the government.

A cap-and-trade system directly sets the quantity of emissions

The opposite logic is true for a *cap-and-trade system*. In such systems, as currently used in Quebec, the government caps the aggregate allowable emissions and then distributes emissions permits among the covered entities. Permits can be issued for free, auctioned, or some combination thereof. Whether auctioned or not, the permits can be traded in a market that determines the price of GHG emissions. Faced with a clear market price for permits, individual emitters will reduce emissions when the cost of doing so is less than the permit price; they will buy permits (and avoid making reductions) when their price is lower than abatement costs.

By setting the aggregate cap, the total level of GHG emissions is known. The resulting market price of carbon, however, can only be estimated, as it depends on the emitters' abatement costs, technologies, and the general level of economic activity.

Other mechanisms can blend price and quantity constraints

Alternative, more complex policy instruments can also be used to establish a price on GHG emissions. Alberta's SGER, for example, is a flexible performance standard with some similarities to both cap-and-trade systems and carbon taxes, but also has some unique elements (discussed below in the context of other design choices). The SGER requires improvements in emissions intensity of covered entities from a baseline level of emissions specific to each emitter.

The SGER provides firms with some flexibility in how they comply with the performance requirements. Emitters can choose to improve emissions intensity by reducing emissions (for a given level of output). Or, as in a cap-and-trade system, they can purchase credits from other regulated emitters that have reduced beyond the required intensity standard. Alternatively, similar to a carbon tax, firms can comply with the policy by purchasing offset credits or by paying $15 per tonne of emissions into a technology fund.

The Alberta policy provides greater price certainty than would be the case with a conventional cap-and-trade system. The Technology Fund protects emitters from high carbon prices by setting a maximum permit price. However, the contributions to the Fund (which are then reinvested by government in technology projects) may or may not lead directly to emissions reductions. While a maximum price clearly increases price certainty by preventing unexpected price spikes, it reduces certainty with respect to the quantity of emissions reduced.

Other policies include similar design elements that can blend carbon taxes and cap-and-trade systems. Floor prices guarantee a minimum carbon price. If emitters achieve reductions more easily than expected—for example, because of depressed economic conditions—a minimum price maintains incentives for long-run innovation and emissions reductions.[5] The Quebec cap-and-trade system, for example, has a minimum auction price of $15 per tonne CO_2e as of February 2015. (It also has a "soft" price ceiling: If the price rises above $40, the government will hold extra auctions to distribute new permits, thus providing downward pressure on prices.)

Carbon taxes can also be designed to provide some of the quantity certainty normally provided by a cap-and-trade system. Government could commit to adjusting the tax rate over time, partly based on emissions levels. If total emissions are not on track to achieve stated objectives, the carbon price could be increased; conversely, if emissions unexpectedly decreased rapidly, the carbon price could in turn be decreased. The disadvantage of such a scheme is that the greater quantity certainty comes at some cost; the reduced certainty regarding the carbon price is likely to diminish the ability of firms to make long-run investment decisions. See Box 5 for a brief summary of the main trade-offs regarding instrument choice.

[5] One disadvantage of the European Emissions Trading System is that it lacks a price floor. The market price for permits dropped sharply during the global financial and economic crisis, and remains low today; as a result, the incentives for innovation in that system are currently quite limited.

Box 5: Trade-offs in Instrument Choice

Different policy instruments, including a carbon tax, a cap-and-trade system, and a range of hybrids, can create a price on GHG emissions.

Future research from the Ecofiscal Commission will explore in detail the trade-offs between these instruments. The table below highlights potential advantages and disadvantages of each at a very high level.

	Key Advantages	Key Disadvantages
Cap-and-trade	• Drives cost-effective emissions reductions • Provides certainty as to the quantity of emissions reduced • Creates opportunities for linkage with other systems, broadening scope and harmonizing prices	• More administratively complex to implement and manage • Allows for price volatility, because the carbon price fluctuates over time • In practice, most cap-and-trade systems have initially not auctioned all permits, reducing the scope for revenue recycling
Carbon tax	• Drives cost-effective emissions reductions • Provides certainty as to the carbon price • Simple and transparent; easy to administer	• Perceived as having greater public opposition • Does not provide certainty as to the quantity of emissions reductions to be achieved

Sources: Goulder & Schein, 2013; Stavins, 2008; Parry & Pizer, 2007.

In addition to pure cap-and-trade systems and carbon taxes, a wide variety of hybrid instruments can also be designed that blend elements of both instruments, or even add additional dimensions of complexity. The Specified Gas Emitter Regulation in Alberta, for example, is neither a carbon tax nor a cap-and-trade system, but has elements of both. In terms of comparing instruments, several points are worth noting.

1. Cap-and-trade systems and carbon taxes are fundamentally more similar than different. Both put a price on carbon, both create market-based incentives for emissions reductions and innovation, both can generate revenue that can be recycled back to the economy. Most importantly, both are more cost-effective than inflexible regulations.

2. The core advantage of a carbon tax is its simplicity. A carbon tax on fuels can be easily and quickly implemented, as the example in British Columbia illustrates. It is transparent for all emitters and has limited administrative costs. It is also simple for businesses to plan in response to the tax, since it creates a clear, predictable price on carbon. Cap-and-trade systems, in contrast, generally require more institutional capacity to handle permit trading, and monitoring of transactions and ownership of permits. In practice, free allocation of permits tends to be politically popular, but reduces the cost-effectiveness of the policy.

3. The core advantage of a cap-and-trade system is that it is easier to harmonize with other cap-and-trade systems. Linking two cap-and-trade systems allows permit flows between emitters in each jurisdiction, leading to a common permit market and a harmonized price. Linking systems—as Quebec and California have done—can therefore be one effective path from a patchwork of separate systems toward a broader, more unified policy.

Box 5 continued

4. Differences between systems often get blurred by practical details. While a carbon tax creates certainty about the price of carbon, making planning easier for businesses, a cap-and-trade system provides greater certainty as to the emissions reductions to be achieved. In practice, most policies have hybrid characteristics that blend the two instruments. For example, price floors and price ceilings protect against price volatility in cap-and-trade systems, though at the cost of losing certainty regarding the levels of emissions reductions to be achieved.

5. The details of design are extremely important. Tax, cap-and-trade, and hybrid systems can all achieve cost-effective emissions reductions if designed and implemented well. But comparing the instruments in the abstract is challenging, given the extent to which different design elements can affect performance. Future research from the Ecofiscal Commission will evaluate carbon-pricing instruments in greater detail.

5.2 MORE-STRINGENT POLICY DRIVES GREATER EMISSIONS REDUCTIONS

Carbon pricing sets a crucial constraint: depending on instrument choice, the constraint is either the carbon price or the maximum level of emissions. The stringency of the policy depends on the extent to which the constraint is binding, and thus requires action from emitters.

Two main metrics can be used to compare the stringency of different policies. The *carbon price* measures emitters' marginal incentive for reducing GHG emissions. Carbon prices change relative prices of goods and services: they make carbon-intensive activities relatively more expensive and carbon-reducing activities relatively less expensive. The higher the carbon price, the more firms and individuals are induced to change their behaviour.

The *average carbon cost* reflects the costs of policy across emitters' total emissions. The average carbon cost (per tonne of CO_2e emitted) can differ from the carbon price if permits are given away for free or if the carbon price does not apply to all emissions. A firm's decision to build a new facility is partly based on the firm's return on investment, which is affected by the average carbon cost (Leach, 2012).

In the case of a carbon tax, the carbon price is set directly by the policy. In contrast, a cap-and-trade system or an intensity-based regulation imposes some form of *quantity constraint* on emitters, which applies to either the allowable level of emissions or emissions intensity. A lower permitted level of emissions is a more stringent policy, because it requires more action by emitters. A carbon price then emerges from the market created by the presence of the quantity constraint. A lower permitted quantity generates a higher carbon price.

Table 3 compares current levels of stringency for existing provincial carbon-pricing policies, based on the most recently available data. British Columbia's carbon tax, set directly at $30 per tonne, has the highest carbon price of any Canadian policy. Indeed, it is currently the most stringent carbon-pricing policy in North America. Emitters pay the carbon price on their regulated emissions (i.e., those share of emissions covered by the policy), so the average carbon cost in B.C. is also $30 per tonne.

The price of carbon in Quebec's cap-and-trade system currently emerges from a combination of the cap and the price floor. As of February, 2015, the price of permits in the joint California-Quebec auction was $15.14 per tonne CO_2e. This price was slightly above the price floor of $15, unlike earlier Quebec auctions, in which the cap was not binding.[6] Quebec is initially providing some permits for free, so the average carbon charge is lower than the carbon price. Quebec's floor price will rise by 5% (plus inflation) per year, and the emissions cap will fall by 3-4% annually. The policy will thus become more stringent over time (Dumont, 2013).

The stringency of Alberta's SGER system emerges from a combination of the 12% required improvement in emissions intensity and the $15 price ceiling (created by the Technology Fund). The price ceiling defines the maximum cost per tonne of compliance, setting the marginal carbon price for emitters, and providing incentives for existing firms to take actions to reduce emissions if those actions cost less than $15 per tonne. The 12% intensity standard defines the compliance obligation for emitters. In 2012, total compliance obligations amounted to about 13 Mt, or slightly less than 5% of total emissions (Alberta Environment, 2014).

[6] Emissions by covered entities in 2012 and 2013 were slightly above 18 Mt CO_2e, while the 2013 cap was at 23.2 Mt. See Ministère du développement durable, Environnement et Lutte contre les changements climatiques (MDDELCC) (2014b) and Gouvernement du Québec (2012).

Table 3: Carbon Prices and Quantity Constraints in Provincial Carbon-Pricing Policies

Province	Instrument	Carbon price (per tonne CO_2e)	Average carbon cost (per tonne CO_2e)*	Quantity constraint
British Columbia (2014)	Carbon tax	$30	$30	None
Alberta (2012)	Flexible intensity standard	$15	~$1.14**	None***
Quebec (2015, projected)	Cap-and-trade	$15.14****	$11.41*****	Cap is set at 2014 emissions, and will decline 3-4% annually from 2016 to 2020

Sources: Alberta Environment (2014); California Air Resource Board (2014); Sawyer (2014); Government of British Columbia (2014b); Régie de l'énergie (2013); Purdon et al. (2014).
*This calculation represents a slight overestimate of average carbon cost because all abatement is assumed to occur at the price of carbon. This difference is small because so far, abatement levels are relatively low.
**Based on data in Alberta Environment (2014) for compliance in 2012. As Leach (2012) notes, the average cost depends on changes in output and emissions intensity relative to the benchmark.
***The SGER sets a compliance obligation based on required improvements relative to a 2003-05 average intensity. This requirement does not place a constraint on the absolute quantity of emissions, but instead defines the share of emissions on which emitters pay the carbon price.
****Based on settlement price for February 2015 auction (California Air Resource Board, 2015).
*****This price represents the maximum possible average carbon cost given that Quebec may auction up to 23% downstream permits.

As a result, Alberta's average carbon cost is vastly lower than its carbon price—estimated at $1.14 per tonne by Alberta for 2012—and thus the policy plays only a slight role in affecting firms' investment decisions. Bošković and Leach (2014) find that the SGER imposes compliance costs on a typical oil sands facility of around $0.03 per barrel of oil, averaged over the project's life, with negligible impact on expected rates of return. These very low costs are a function of both low policy stringency and Alberta's royalty regime. As the carbon-pricing policy reduces firms' revenues, a significant share of the reduction is absorbed by the government's loss of royalty earnings. This finding supports the evidence presented in Box 4 that the SGER has not been effective in reducing GHGs.

Finally, the carbon price in Alberta established by the Technology Fund merits comment. As discussed below, revenue from the Technology Fund is used to invest in development and deployment of technologies to reduce additional GHG emissions. Yet because it does so by funding projects by the same firms that contribute to the fund, its effects may be to reduce the effective carbon price. If contributing firms can reasonably expect to receive money back from the fund, then contributions may not be viewed as a cost, and their incentives to reduce emissions will likely be diminished.

5.3 COVERAGE DETERMINES WHICH GHG EMISSIONS ARE PRICED

The *coverage* of a policy, which defines the emissions subject to the carbon-pricing policy, has major implications both for the extent to which policy drives emissions reductions and the costs at which it does so. Covering more emissions means broader incentives for emissions reductions. Together, the level of the carbon price and the breadth of coverage of a policy define the policy's overall stringency. Broader coverage also reduces costs: as is true with various forms of taxation, a broader base enables a lower rate (i.e., carbon price) to achieve the same levels of overall emissions reductions.

Pricing policies can be designed with different levels of coverage

Two different metrics of coverage are relevant for comparing carbon-pricing policies. *Regulated emissions* are those to which the marginal incentive for reduction applies. *Priced emissions* are those on which emitters actually pay a carbon price. The difference between the two metrics relates to the difference in average and marginal carbon prices discussed above. We discuss each in turn with respect to the B.C., Alberta, and Quebec systems, illustrating the different coverage choices available.

Upstream and Downstream. In practical terms, where in the life cycle of carbon emissions the carbon price is applied—what is known as the *point of regulation*—is a key determinant of which emissions are regulated.

Applying the carbon price to fuel distributers and importers based on the carbon content of the fuels they sell is an *upstream* policy. Final consumers, however, still see the effects of the policy, because fuel distributers pass these costs on to consumers, who then face the appropriate price incentives. In British Columbia's upstream policy, for example, the carbon tax is clearly shown on households' bills for natural gas for home heating and gasoline for vehicles.

Non-combustion industrial process emissions (such as those in cement manufacturing processes, or venting and flaring emissions from oil and gas production) will not be covered when carbon pricing is applied only to fuel, since these emissions are not the result of fossil fuel consumption; for broader coverage, these additional emissions can be priced separately.

Alternatively, a *downstream* policy applies the carbon price at the point where the GHG emissions actually occur. Downstream approaches, however, must also define a threshold for the size of emitter covered by the policy. Including a very large number of small final emitters creates a significant administrative burden for governments.

To avoid such a burden, downstream systems tend to include only large industrial emitters and, critically, to exclude small emitters—including vehicles, buildings, and small businesses—which make up a large share of total emissions. Alberta's SGER, for example, is a downstream policy that covers facilities with annual emissions greater than 100 kt CO_2e. The threshold is pragmatic, because Alberta has a small number of extremely large emitters—power plants, oil sands facilities, and refineries (Leach, 2012). If Alberta reduced its threshold by half, to 50 kt CO_2e, it would need to monitor 40% more facilities in order to expand covered emissions by only 3% (Alberta Environment, 2014). Given the policy's exclusive focus on large emitters, however, it effectively ignores half the province's emissions.

Policies can also be designed with multiple points of regulation to enable broad coverage. For example, Quebec's system has both downstream and upstream pricing. It covers upstream carbon content of fuels and electricity, as well as downstream industrial process and electricity generation emissions with a 25-kt CO_2e threshold (more details below). Quebec is also the only jurisdiction in Canada that covers non-combustion process emissions. Given this combination, the province's cap-and-trade system achieves the highest coverage of the three Canadian carbon-pricing policies.

Regulated vs. Priced Emissions. The effective coverage of a policy is reduced if emitters are required to pay a price on only a small share of regulated emissions. The difference between regulated emissions and priced emissions for each of the three provincial carbon-pricing policies reflects differences between marginal and average carbon prices.

Under the B.C. carbon tax, all regulated emissions face the same price (the marginal price is equal to the average price). As a result, the share of priced emissions is the same as the share of regulated emissions, or about 70% of B.C.'s total GHG emissions.

Under the Alberta SGER, by contrast, while approximately 50% of emissions are regulated by the policy, emitters pay the carbon price on only 3% of total emissions. Regulated emitters must only reduce emissions that exceed the emissions-intensity threshold defined by the policy. Only these marginal emissions are priced; no payments are required for the remaining emissions. This discrepancy again highlights the large difference in marginal and average costs under the Alberta system.

Under Quebec's cap-and-trade system, around 27% of emissions permits are allocated for free. Similar to the Alberta system, these free permits reduce the share of emissions for which emitters pay the marginal price of carbon.

The share of priced emissions matters in measuring the stringency of policy, because it affects the materiality of the policy for major emitters. When emitters pay a carbon price on a very small share of their emissions, the total cost of policy is small relative to the size of projects and overall profits. As a result, firms may not spend the time or money to optimize their costs perfectly based on marginal costs and benefits. In other words, smaller effective coverage given a lower share of priced emissions can reduce the effectiveness of the policy in creating incentives for emissions reductions. This issue is particularly significant in Alberta.

Table 4 summarizes the coverage of policies in B.C., Alberta, and Quebec. It describes the point of regulation for each system, identifies thresholds for emitters, and estimates the share of provincial emissions covered by the respective policy in terms of both regulated emissions and priced emissions. It also identifies key sources of GHG emissions *not* covered by the policy.

Table 4: Coverage of Provincial Carbon-Pricing Policies

Province	Instrument	Points of regulation	Non-covered emissions	Threshold for industrial facilities	Regulated emissions	Priced emissions
British Columbia (2014)	Carbon tax	• Distributors and importers of fossil fuels	• Non-combustion industrial processes • Agricultural • Waste management	N/A	~70%	~70%
Alberta (2012)	Flexible intensity standard	• Industrial combustion (including oil and gas) • Electricity generation	• Fuel combustion (non-major emitters) • Non-combustion industrial processes • Agricultural • Waste management • Aviation and shipping	100 kt CO_2e per year	~50%	~3%
Quebec (2015, projected)	Cap-and-trade	• Industrial combustion and process emissions • Distributors and importers of fossil fuels • Generators and importers of electricity	• Agricultural • Waste management • Aviation and shipping	25 kt CO_2e per year (both upstream and downstream)	~85%	~62%

Sources: Dumont (2013); Gouvernement du Québec (2013); Horne & Sauve (2014); ICAP (2014); Leach (2012); MDDELCC (2014a); LiveSmart BC (2012); McMillian LLP (2008); Picard (2000).

Carbon offsets can broaden policy coverage, though could pose practical problems

Allowing the purchase of carbon offsets as a means of compliance can provide covered entities with lower-cost possibilities, and increase coverage by including activities that would otherwise be difficult to include directly in the carbon-pricing policy. In theory, if offsets are genuinely additional—that is, they represent emissions reductions that would not have occurred in the absence of the offset purchase—they will not undermine the overall effectiveness of the policy. In practice, however, ensuring the credibility of offsets can be challenging; future reports of the Ecofiscal Commission will evaluate trade-offs with respect to allowing offsets in carbon-pricing policies.

Table 5 presents the role of carbon offsets within the three different provincial policies. Given the concerns over whether carbon offsets represent genuine emissions reductions, Quebec only allows up to 8% of an entity's compliance obligation to be covered by offset purchases (Purdon et al., 2014). Alberta has the most extensive offsetting system, which allows the policy to extend to a larger share of its economy. From 2007 to 2012, over 20% of SGER compliance consisted of offset purchases (Sawyer, 2014).

5.4 CHOICES FOR REVENUE RECYCLING DEPEND ON PRIORITIES

A carbon tax generates revenue, as does a cap-and-trade system, if the emissions permits are auctioned. How this revenue is recycled back to the economy has major implications for the economic impacts of a carbon-pricing policy. Revenue can be recycled in many ways, including reducing corporate or personal income taxes, public investments in critical infrastructure, or directly supporting technology. Governments could alternatively choose to forgo revenue from a cap-and-trade system by allocating permits for free; in this case, the monetary value of the permits is transferred to the emitters.

Table 6 summarizes the current provincial approaches to revenue recycling, identifying the most recent (or forecasted) levels of carbon-pricing revenue, the extent to which revenue is generated (as opposed to forwent through free permits), and how the revenue is recycled.

Table 5: Offset Markets in Provincial Carbon-Pricing Policies

Province	Instrument	Limits on compliance via offsets	Eligible projects for offsets
British Columbia (2014)	Carbon tax	Offsets not permitted as compliance	• None
Alberta (2012)	Flexible intensity standard	Only in-province offsets accepted	• Waste management • Agricultural • Renewable energy & energy efficiency • Industrial • Others
Quebec (2015, projected)	Cap-and-trade	Only offsets from California or Quebec accepted, to a maximum of 8% of compliance	• Manure storage facilities (methane) • Waste disposal sites • Ozone-depleting substances projects

Sources: Alberta Environment (2008); Government of Alberta (2013); Government of British Columbia (2014a, 2014b); Purdon et al. (2014).

The total revenue generated by the various provincial policies results from a combination of policy stringency and coverage. With the highest carbon price and broad coverage, British Columbia generates by far the most revenue. As Quebec includes fuel distributors and importers in its cap-and-trade auctioning process beginning in 2015, that province will increase its carbon revenue from $56 million in 2013 to a forecasted $425 million annually. Alberta's revenue of $55 million, generated only through its price-ceiling mechanism, is the lowest of the three provincial systems.

Under Alberta's intensity-based system, emitters pay a price only on emissions above the benchmark intensity standard. As a result, the system is analogous to a cap-and-trade system in which permits are provided for free; it *forgoes* additional revenue generation. This explains the small revenues from the Alberta system. Because the system is based on emissions intensity (i.e., emissions per unit of output), the system creates stronger incentives to reduce emissions intensity than to reduce the absolute level of GHG emissions (Fischer & Fox, 2004).

Revenue generated from carbon-pricing policies can be used to reduce existing taxes and maximize the cost-effectiveness of policy. In British Columbia, for example, revenue from carbon taxes enables reductions in personal and corporate income taxes, as well as other tax measures to address fairness. Reducing existing taxes helps achieve the policy's objective at least cost, because such taxes impose costs on the economy; personal income taxes discourage working, while corporate income taxes discourage investment and innovation.

Recent studies in the United States and Europe have considered how carbon-pricing revenues can be used to address fiscal challenges (e.g., Ramseur et al., 2012; Marron & Toder, 2013; Vivid Economics, 2012). If governments face a need for greater revenues, revenue from carbon pricing could represent an efficient alternative to increasing other taxes, such as corporate or personal income taxes, which tend to retard economic growth.

Alternatively, using revenue to support innovation and clean technology could facilitate greater long-run emissions reductions. Revenue generated from Alberta's Technology Fund, for example, supports the development and deployment of technologies to further reduce GHG emissions. Quebec's carbon revenues are used mostly to support emissions reductions in the transportation sector—a key source of Quebec's emissions—but also to support technology and other emissions-reducing projects.

5.5 POLICY DESIGN CAN ADDRESS RISKS TO COMPETITIVENESS

Unilateral carbon pricing by a province can create competitiveness risks for firms within the province. If the policy makes firms less competitive than rivals in jurisdictions with less-stringent policies, domestic firms could lose market share and reduce production or profits.

At current low carbon prices, such competitiveness risks are likely to be small, and measures to manage them may be unnecessary. In addition, the most vulnerable sectors are those that are emissions-intensive and that engage actively in trade with other jurisdictions; this is a minority of sectors in most provinces.

Table 6: Revenue Recycling from Provincial Carbon-Pricing Policies

Province	Instrument	Revenue (millions)	Effective free allocations	Uses of revenue*	Allocation of revenue
British Columbia (2014)	Carbon tax	$1,212	0% of eligible emissions unpriced	Personal income tax reduction	16%
				Other personal tax measures	23%
				Corporate income tax reduction	51%
				Other business tax measures	9%
Alberta (2012)	Flexible intensity standard	$55	~95% of eligible emissions unpriced Revenue generated only through Technology Fund compliance	Investments in innovation and research and development for GHG emissions reduction and adaptation	8%
				Market demonstration for GHG-emissions-reducing technologies and adaptation	42%
				Projects that reduce GHG emissions or support adaptation	51%
Quebec (2015, projected)	Cap-and-trade	$425	~At least 25% of eligible emissions unpriced in 2015	Development and use of public and alternative modes of transportation	59%
				Green-energy substitution and energy efficiency	17%
				Innovation, research and development, and market demonstration for GHG emissions reductions	5%
				Other projects for GHG emissions reduction and climate change adaptation	19%

Sources: Ministry of Finance of Quebec (2012); Climate Change and Emissions Management Corporation (2013); Government of British Columbia (2014b); MDDELCC (2014); Ecofiscal Commission calculations.
*The data for Quebec's use of revenues represent the total funding since the inception of its Green Fund in 2007, which was previously funded with revenues from the province's carbon tax.

The issue of competitiveness would become more important, however, if provinces increase carbon prices significantly and unilaterally. In that case, design elements to manage these risks will be more important (Stopler, 2014). While competitiveness risks remain a concern, various design choices can address these challenges. Table 7 summarizes how current provincial carbon-pricing policies have been designed to manage such risks. Each of these options is discussed in more detail below.

Border adjustments could level the playing field

Border adjustments can ensure that domestic firms are not disadvantaged relative to competitors in jurisdictions with less-stringent policies. Tariffs could be applied, for example, to imports from other jurisdictions based on the carbon content of the imported products. Given Canada's constitutional division of power, such border adjustments could not be implemented by a single province, but would require involvement by the federal government.

In practice, border adjustments could invite reciprocating taxes from other jurisdictions or challenges under international trade law (McAusland & Najjar, 2014). Even if successfully implemented, they could be costly for Canada in terms of reduced trade (NRTEE, 2009).

For specific emissions that fall under provincial jurisdiction, some form of border adjustment could nonetheless be practical. Imports of electricity into Quebec, for example, are subject to that province's cap-and-trade system, thus ensuring that coal-fired electricity generation outside the province is not advantaged relative to cleaner generation within Quebec. If Hydro Quebec imports such electricity from other provinces or U.S. states, it must have sufficient permits to account for the associated GHG emissions. The measure is constitutionally possible because of pre-existing provincial regulatory authority over imported electricity (Parlar et al., 2012).

Table 7: Competitiveness Measures in Current Provincial Carbon-Pricing Policies				
Province	Instrument	Addressing competitiveness risks by:		
		Price levels	Coverage	Revenue recycling
British Columbia	Carbon Tax	Phase-in of tax at $10 per tonne, with $5 increase per year	Refund program for greenhouse growers and exemptions for agricultural fuel use	Corporate tax cuts
Alberta	Flexible intensity standard	Gradual phase-in of intensity standard Low average carbon cost, given intensity standard and royalty interactions $15 price ceiling	Exemption for small commercial emitters Low share of priced emissions, given intensity standard Offsets	Free allocation of permits to covered entities
Quebec	Cap-and-trade	Allowance price containment reserve (“soft” price ceiling)	Point of regulation for imported electricity	Free allocation of permits to vulnerable industrial facilities

Sources: Hydro-Québec (2014); Horne & Sauve (2014); Sawyer (2014); Government of British Columbia (2013).

Partial permit rebates could address competitiveness risks

Central to competeveness risks is the concern that domestic industry will respond to carbon prices by reducing production and losing market share to foreign competitors, with no overall change in global emissions. Carbon-pricing policies can be designed to address this concern directly by using free permits or rebates. Full or partial rebates in a cap-and-trade system can reduce the total cost of compliance for firms while maintaining a carbon price that creates the incentive to reduce emissions.

For example, recall from Table 6 that Quebec’s cap-and-trade system provides free permits for process emissions from industrial firms. Allocation is based on the level of production and emissions intensity of each sector. In 2013, a minimum of 75% of permits were freely allocated, but the number of free permits is scheduled to decline by 1 to 2% annually (Dumont, 2013).

Alberta’s SGER is similar to a cap-and-trade system with free permits. Emitters only pay for emissions exceeding the benchmark emissions intensity. The intensity standard forgoes revenue generation, and provides incentives for firms to improve emissions *per unit of output*, but not to reduce the absolute level of emissions. The policy’s design moderates competitiveness risks, but allows for increases in the overall level of GHG emissions. In Alberta’s case, the costs to oil and gas producers are further reduced because of interactions with the royalty regime, which imply that producers pay only about half the costs imposed by the policy, the remainder being borne by the provincial government (Bošković & Leach, 2014).

Sectoral exemptions could address competitiveness concerns, but increase costs

An alternative approach to protecting vulnerable sectors is to exempt them from the carbon price. For example, to address concerns from British Columbia’s greenhouse growers and other parts of its agricultural sector, the province effectively exempted these firms from the carbon tax. While exemptions reduce the burden for these businesses, they do so at the expense of raising the total cost of the policy. Limiting the policy coverage reduces its ability to drive least-cost reductions, and simply requires greater emissions reductions from firms in the covered sectors. As noted, the lower coverage of the Alberta system undermines both its effectiveness and cost-effectiveness relative to the systems in B.C. and Quebec.

5.6 SUMMARY: HOW DO EXISTING CANADIAN POLICIES COMPARE?

As discussed in this section, current provincial carbon-pricing policies illustrate a range of potential design choices. Table 8 summarizes the key differences between British Columbia’s carbon tax, Alberta’s SGER, and Quebec’s cap-and-trade system.

How do these three systems compare overall? In terms of the type of policy instrument, carbon taxes, cap-and-trade systems, and even hybrid options can be designed to be effective. Yet, as this section has made clear, there is much devil in the details of policy design.

The essentials of smart policy design begin with stringency and coverage. A more stringent policy is based on a higher price

Table 8: Summary of Provincial Design Choices

Province	Instrument	Stringency		Coverage		Main revenue recycling	Addressing Competitiveness
		Carbon price (per tonne)	Average carbon charge (per tonne)	Regulated emissions	Priced emissions		
British Columbia (2014)	Carbon tax	$30	$30	~70%	70%	Business and personal income tax cuts	Phase-in of the carbon tax
Alberta (2012)	Flexible intensity standard	$15	~$1.14	~50%	~3%	Forgone revenue (intensity standard) Some technology support	Low stringency Effective free permits
Quebec (2015, projected)	Cap-and-trade	$14.03	$10.24	~85%	62%	Some forgone revenue GHG-emissions-reducing measures	Soft price ceiling Border adjustment on imported electricity Some free permits

of carbon, and the higher price drives more emissions reductions. A policy with more coverage means that this price is applied to a broader base of emissions, and this broader base improves the cost-effectiveness of emissions reductions.

In terms of stringency, the three policies are clearly not equivalent. The B.C. carbon tax is the most stringent, with both the highest price of carbon and the highest average carbon cost. While the price of carbon in Quebec is currently relatively low, the emissions caps in both Quebec and California are scheduled to decline steadily over time, thus increasing the stringency of the policy. Alberta's policy, on the other hand, has low stringency, particularly in terms of the associated average carbon cost. In addition, given that Alberta's total emissions are projected to rise over time along with planned expansion of the oil sands, average costs matter a great deal in terms of affecting investment decisions. New facilities are a major source of emissions growth.

As for coverage, both the B.C. carbon tax and the Quebec cap-and-trade system apply to the majority of emissions in the two economies. Quebec's system, which includes industrial process emissions, is the broadest of the three systems (that province has relatively few fugitive emissions, such as methane leaks, and venting and flaring in upstream oil and gas). Alberta's system has far narrower coverage than the other two. For regulated emissions, no small emitters (e.g., vehicles, buildings, and smaller industrial facilities) face financial incentives to reduce emissions, as they do in B.C. and Quebec. In addition, given the very small share of priced emissions in Alberta, total costs to firms are relatively low, and are thus not likely to be material to their investment decisions.

The next element to consider when comparing systems is the overall performance in terms of emissions reductions. Not surprisingly, the systems' differences in performance reflect their underlying differences in stringency in coverage. As discussed in Box 4, B.C.'s carbon tax appears to have successfully driven emissions reductions. In Alberta, however, compliance data from the government suggests that emissions reductions from the SGER have been minimal. Quebec's system has not been in place long enough to determine its effectiveness in this regard.

Unlike stringency and coverage, other elements of policy design are less clear-cut; different choices could nonetheless result in a coherent and effective system. Future research from the Ecofiscal Commission will explore issues such as revenue recycling and business competitiveness in more detail. Trade-offs exist between different choices for revenue recycling and addressing competitiveness, and different design choices across provinces partly reflect different economic realities and political priorities.

6 RECOMMENDATIONS: THE WAY FORWARD

This report began with two main objectives: first, to identify a practical policy approach for achieving meaningful, least-cost reductions in Canadian GHG emissions; and second, to begin a discussion about the details of policy design that recognize key differences across the provinces.

Three key concepts are embedded in both objectives. Policies are effective if they achieve the required level of emissions reductions. Policies are practical if their design details reflect local economic contexts and priorities. And policies are cost-effective if emissions reductions are achieved at least cost.

Based on these criteria, and on the findings from this report, this section provides recommendations for Canadian policymakers. Our recommendations relate to an overall approach, but also begin to provide guidance on the details of policy design.

RECOMMENDATION 1:
Provincial governments should move forward by implementing carbon-pricing policies.

The case for continuing with provincial carbon pricing is as follows:

First, more-stringent GHG policies are needed—and delay is costly. Climate change is a pressing issue for Canada, with significant economic costs associated with policy inaction. Canadian mitigation is also a necessary part of a global effort toward reducing GHG emissions—an effort that is gaining urgency in light of recent agreements involving the United States, China, and India. Yet most provinces and the country as a whole are not on track to achieving existing targets for 2020, let alone the deeper reductions required in the longer term. Whatever the benchmark—achieving domestic targets, aligning with current climate science, driving deep long-term reductions—more-stringent policies are required.

Delaying policy actions will increase costs for Canadian governments. Getting moving now allows policy to begin modestly and then ramp up over time. In this way, households will have the time to gradually adapt their behaviours, and businesses will have the flexibility to adopt and develop technologies required to reduce GHG emissions and transform the energy system. Falling too far behind the rest of the world can lead to competitiveness challenges in a global economy that increasingly recognizes the need to decarbonize.

Second, carbon-pricing policies achieve emissions reductions at lowest cost. Carbon-pricing policies should be a central element of each province's climate change strategy. Relative to inflexible regulatory approaches, ecofiscal policies have multiple advantages. The analysis here, based on economic modelling, demonstrates the considerable relative benefits of ecofiscal policy in terms of both flexibility and revenue recycling. Over time, carbon pricing will also drive more innovation, further reducing costs.

Third, provincial policies offer a practical path forward, even if coordination is desired in the longer term. The provinces have unique economies, emissions profiles, and political contexts to which carbon-pricing policies can be customized. These policies already exist in some provinces; and the Council of the Federation has now signalled that provincial carbon pricing has a role to play in a provincially led national energy strategy. Using provincial policies can ensure that carbon-pricing revenues remain within the province in which they are generated. While a federal policy could conceivably be designed to achieve this outcome, starting with the provinces sidesteps the real and perceived challenges in doing so. As a result, the province-first approach allows Canada to continue its current provincial momentum in making the inevitable transition toward a cleaner, lower-emissions economy.

RECOMMENDATION 2: Provincial carbon-pricing policies—existing and new—should increase in stringency over time.

Ecofiscal policies are not automatically environmentally effective; stringency is essential. A more stringent policy has a higher carbon price covering a broader base of emissions. A carbon tax with a very low price is weak policy, as is a cap-and-trade system with a very high cap. Similarly, a policy with a high carbon price that covers only a small fraction of emissions is weak. To achieve the required economy-wide emissions reductions at least cost, and to produce the necessary incentives for innovation, any carbon-pricing policy needs to be stringent.

What is the "right" level of stringency? Our modelling analysis uses the provinces' current 2020 targets as a convenient, though arbitrary, benchmark. With the exceptions of Nova Scotia and Newfoundland and Labrador, no province is projected to meet its emissions targets for 2020; in this sense, current policies are insufficiently stringent. And these targets, in any event, are only relevant for the short term. Much deeper reductions will be required over the next few decades. Even those provinces that now price carbon do not have policies stringent enough to achieve their stated targets.

The dynamics of stringency are also important. Ramping up the stringency of policies over time will avoid unnecessary shocks to the economy, but will nonetheless encourage households and firms to slowly change their behaviours. The accumulation of small changes over many years can generate dramatic changes over the long term. The sooner policies are put in place, the more time is available for the carbon price to increase gradually, rather than abruptly. An economic environment with a gradual and predictable escalation in price is conducive to long-range planning.

RECOMMENDATION 3: Provincial carbon-pricing policies should be designed to broaden coverage, to the extent practically possible.

Broad coverage creates incentives for emissions reductions throughout the economy. But it also matters for minimizing the costs of any given amount of emissions reduction. The more emitters (and emissions) are covered by the policy, the more it creates incentives to realize all available low-cost reductions. Ecofiscal policy should thus be as broad as possible without unduly increasing administrative costs. The most cost-effective policy would impose a uniform price on all GHG emissions, irrespective of their source. Specific sectoral exemptions not only introduce perceived inequities, but also raise the overall cost of the policy.

RECOMMENDATION 4: Provinces should customize details of policy design based on their unique economic contexts and priorities; they should also plan for longer-term coordination.

While eventual consistency of provincial carbon prices is desirable, other dimensions of policy design can remain customized to the unique provincial context.

Revenue recycling, in particular, provides an opportunity for diverse provincial policy choices. Some provinces may choose to reduce existing corporate or personal income taxes, as in British Columbia. Others may prefer to use the revenue to invest in the development of new technology, as in Quebec and, to some extent, Alberta. Carbon-pricing revenue could also be used to finance investments in critical infrastructure, to address competitiveness risks for exposed sectors, or to ensure fairness for low-income households. Different provinces with different contexts and priorities are likely to make different choices. This flexibility is a key strength of the provincial approach to carbon pricing.

Over the longer term, coordination across provinces (and indeed, across international jurisdictions) is an issue for both the cost-effectiveness and the effectiveness of carbon-pricing policies. Overall, consistency of carbon prices matters most, for two reasons.

First, consistency of carbon prices across provinces improves overall cost-effectiveness by ensuring incentives exist for realizing all potential low-cost emissions reductions, whatever their location. Second, a common price avoids policy-induced challenges of interprovincial competitiveness. When policy is equally stringent across the provinces, all firms face a level playing field. Such coordination can thus improve the overall effectiveness of the policy by ensuring that firms do not avoid reducing emissions by simply relocating to provinces with less-stringent policies.

Although a consistent carbon price across Canada is eventually desirable, it is not critical in the short term. Nor should the pursuit of such a common price be viewed as an obstacle to effective and timely provincial action. The provinces have a long history of differential policies. By developing effective policies now, and thereby beginning to mobilize markets toward low-carbon innovation, the provinces can make crucial headway on an important challenge. The coordination of different provincial policies can wait.

7 NEXT STEPS

The Ecofiscal Commission will use the framework developed in this report as a foundation for conversations with regional leaders and policy experts about how policies can best be customized to meet provincial interests while ensuring they are part of a cost-effective pan-Canadian system. This report is a starting point for broader research on policy design and coordination.

The Commission's future work on carbon pricing will explore the central policy design choices in greater detail. Drawing on input from regional outreach meetings to identify policy priorities, future reports will explore trade-offs between design options, particularly in terms of choosing policy instruments and revenue-recycling approaches. Future reports will also assess the competitiveness risks for different provinces and explore policy options to mitigate these risks. The Commission will also explore approaches to the coordination of various provincial policies within the context of fiscal federalism.

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