CANADA'S **ECOFISCAL** COMMISSION
Practical solutions for growing prosperity

CLEARING THE AIR: HOW CARBON PRICING HELPS CANADA FIGHT CLIMATE CHANGE

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EXECUTIVE SUMMARY

We've come a long way in Canada. We have real, working examples of both carbon taxes and cap-and-trade systems that are reducing GHG emissions while maintaining strong economies.

Yet the growing consensus around carbon pricing is not yet universal. Some voices have questioned the extent to which carbon pricing will affect GHG emissions. And elections are on the horizon, both nationally and in several provinces, in which carbon pricing could be a source of debate and even a key issue.

Such policy debates are healthy and necessary. But debates will support good policy decisions only if they are based on facts and evidence. And there is strong evidence, grounded in solid economics and policy experience, that carbon pricing works.

Part of the problem is communication. Governments and policy analysts (including here at the Ecofiscal Commission) haven't always done a good enough job explaining carbon pricing to Canadians. This really matters because carbon pricing affects us all. How we design these policies will influence how we live and how we do business. We all want better understanding.

In short, we need a more informed conversation about carbon pricing. So let's have that conversation. Let's clear the air.

Done right, carbon pricing changes household and business behaviour, reduces GHG emissions, and provides an incentive for the development and adoption of the technologies that can play a key role in a low-carbon economy.

In addition (and this point is also often overlooked), carbon pricing will achieve these outcomes at a lower economic cost than other policies. Together, this means that carbon pricing can support both a clean economy *and* a prosperous economy. It achieves these goals by changing incentives and unleashing market forces. It lets businesses and individuals identify the best ways to reduce their GHG emissions and at the times and places that are right for them. And it doesn't require governments to identify and enforce specific ways to reduce GHG emissions.

This essay unpacks the overall story. *What* does "working" mean for carbon pricing? *Where* has carbon pricing worked? *Why* does carbon pricing work? *When* does carbon pricing work? *Who* supports carbon pricing? *How* do policies put a price on carbon? We provide clear answers to these questions in (mostly) jargon-free language. Just the facts.

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1. Introduction

Canadians increasingly agree that climate change requires action. Evidence continues to mount that melting ice packs and extreme weather events pose serious risks to Canadians and their economy. Other climate impacts, such as sea level rise and warmer temperatures, are of particular concern to Canada's coastal and Arctic communities. The risks are even worse for other, more vulnerable countries.

Despite its relatively small population, Canada has a role to play in the global efforts to reduce greenhouse gas (GHG) emissions to avoid the worst of these risks. Canadians do not want to "free ride" on the actions of others. They want to do their part and contribute to these efforts.

Canadians are also moving closer to agreement on *how* we should tackle these challenges. Several large provinces have already introduced well-designed carbon-pricing policies. And the federal government is now committed to filling in the remaining policy gaps — by requiring every Canadian province and territory to put a price on carbon by the end of 2018.

That growing consensus around carbon pricing, however, is not yet universal. Various economists and policy experts have made the case for carbon pricing as the best way to reduce GHG emissions while maintaining a strong economy. Yet recently, others have questioned the extent to which carbon pricing will affect GHG emissions. And elections are on the horizon, both nationally and in several provinces, in which carbon pricing could be a source of debate and even a key issue.

Such policy debates are healthy and necessary. Historically, significant shifts in the consensus around policy emerged only after vigorous public discussion. While free trade and balanced budgets might now be broadly accepted, they were once controversial ideas.

But debates will support good policy decisions only if they are based on facts and evidence. And there is strong evidence, grounded in solid economics and policy experience, that carbon pricing works.

Part of the problem is communication. Governments and policy analysts (including here at the Ecofiscal Commission) haven't always done a good enough job explaining carbon pricing to Canadians. This really matters because carbon pricing affects us all. How we design these policies will influence how we live and how we do business. We all want better understanding.

In short, we need a more informed conversation about carbon pricing. So let's have that conversation. Let's clear the air.

The many details of carbon pricing are important for governments to consider when they design good policy. The Ecofiscal Commission has undertaken extensive economic research exploring these details, some of it fairly technical. We've explored how to design policy for fairness, and how to design it to ensure Canadian businesses remain competitive. We've considered the best ways for governments to recycle revenues generated from carbon pricing. And we've looked at the *other* climate policies that work best with carbon pricing.

Amidst all these details, however, the most important finding of the Ecofiscal Commission's work often gets lost: *Carbon pricing works*.

Done right, carbon pricing changes household and business behaviour, reduces GHG emissions, and drives the development

and adoption of the technologies that will play a key role in a low-carbon economy.

The evidence is clear: carbon pricing shifts us away from "business as usual," changing our emissions trajectory. And higher carbon prices drive deeper emissions reduction.

In addition (and this point is also often overlooked), carbon pricing will achieve these outcomes at a lower economic cost than other policies.

Together, this means carbon pricing can support both a clean economy *and* a prosperous one. It achieves these goals by changing incentives and unleashing market forces. It lets businesses and individuals identify the best ways to reduce their GHG emissions and at the times and places that are right for them. And it doesn't require governments to identify specific ways to reduce GHG emissions.

This essay unpacks the overall story. *What* does "working" mean for carbon pricing? Where has carbon pricing worked? *Why* does carbon pricing work? *When* does carbon pricing work? *Who* supports carbon pricing? *How* do policies put a price on carbon? We provide clear answers to these questions in simple, (mostly) jargon-free language.

2. What does "working" mean for carbon pricing?

We focus on two key outcomes that should drive Canada's climate policy.

First, we should be aiming to reduce our annual greenhouse gas (GHG) emissions. Not just this year but every year going forward. Moving Canada toward deep emissions reductions over time contributes to global efforts to avoid some of the costliest and most uncertain impacts of climate change.

Note that GHGs aren't just about carbon dioxide. They also include methane, nitrous oxide, and many other gases that collect in Earth's atmosphere and act like the walls of a greenhouse to lock in heat, raising average global temperatures. Policies that "put a price on carbon" are really designed to put a price on *all the major GHGs*, wherever feasible.

Second, we should be striving to sustain a strong economy — with the good jobs and incomes that come with it. We can choose to reduce our GHG emissions by having a weak economy, with little production and income, but this is a very costly way to clean up the environment. Far better alternatives are available. Our objective should be to reduce GHG emissions significantly but do so at the *lowest possible economic cost*.

Can carbon pricing achieve these dual objectives? Yes. We'll show how throughout this essay.

Q&A: Why is carbon pricing better for the economy than regulations?

Carbon pricing isn't the only option available to policy makers committed to reducing GHG emissions. In particular, **command-and-control regulations** are an alternative. This kind of policy requires businesses or individuals to adopt specific technologies or achieve certain levels of emissions performance.

For example, Canada has mandatory vehicle efficiency standards for cars and light trucks. These standards require car manufacturers to produce vehicles with a given average level of fuel economy for the vehicles they make, which lowers emissions per kilometre driven.

> **A central advantage of carbon pricing is that it works with market incentives by encouraging businesses and households to seek out the lowest-cost way to reduce emissions. Emitters are not all the same, and carbon pricing takes advantage of these differences to minimize the cost of reducing emissions.**

In contrast, command-and-control regulations generally cost more than carbon pricing because they provide far less **flexibility** to businesses and households, and they typically ignore the important differences between them. Such regulations require specific actions or outcomes from specific firms or groups, regardless of their different abilities to achieve these outcomes.

Some carefully designed regulations might come close to carbon pricing by building in market mechanisms. For example, Quebec requires that automakers produce a certain number of zeroemissions vehicles (ZEVs). Car manufacturers receive tradeable credits for each ZEV they produce and need a certain number of credits to meet their quota. Firms that produce ZEVs costeffectively can produce more than what is required by their quota to receive additional credits. They can sell these credits to other firms that cannot manufacture ZEVs as cheaply and are better off buying more credits than making more ZEVs.

3. Where has carbon pricing worked?

Carbon pricing has a track record of success. There are two basic approaches to carbon pricing: carbon taxes and cap-and-trade. It's also possible to combine them. We'll get to the details of *how* they work later. The bottom line is that they all put a price on GHG emissions, which creates an incentive to produce fewer of them.

Here, we'll explore outcomes in three different jurisdictions that have implemented different types of carbon pricing. None of these policies are perfect, but they all illustrate that carbon pricing works.

Isolating the impact of carbon pricing is critical. Changes in emissions that happen to coincide with new policy aren't *necessarily* the result of that policy. In statistics jargon: correlation isn't the same as causation.

Below, we focus on studies that explicitly isolate the impacts of carbon pricing. Using statistical or modelling analysis, these studies aim to answer the question: how would emissions or economic growth be different if carbon pricing policies hadn't been put into place?

BC's carbon tax has reduced GHG emissions by between 5% and 15%

British Columbia's carbon tax started in 2008 at $10 per tonne of carbon emissions, rose by $5 a year, and then paused at $30 in 2012. The tax applied to the burning of fossil fuels, or about 70% of the province's GHG emissions. Initially, all revenues were used to finance income-tax cuts and selected tax credits — the carbon tax was "revenue neutral" for the government.

Starting in April 2018, BC's carbon tax will start rising again by $5 per tonne every year until it hits $50 in 2021. The BC government will use the new revenues to finance initiatives such as public transit and home retrofits to drive further emissions reductions. It will therefore no longer be revenue neutral.

As a result of the carbon tax, annual emissions in BC are 5% to 15% lower than they would otherwise have been. This estimate draws from several analyses (see References for details) each of which isolates the impacts of the carbon tax from other factors.

Those reductions in GHG emissions were the result of various shifts, including:

- The fuel efficiency of BC's entire vehicle fleet improved by 4% more than it would have without the tax. In other words, people *invested* in vehicles that would reduce their emissions and thereby allow them to pay less carbon tax by purchasing less gasoline.
- People also changed their gasoline consumption. Per-capita demand for gasoline would be between 7%-17% higher without the carbon tax by 2011. The carbon tax changed the way people drive.
- The carbon tax also affected natural gas use. One analysis suggests that tax reduced residential natural gas demand by 15% and commercial natural gas demand by 65%.

Box 1: Fast Facts About BC's Carbon Tax

- Implemented in 2008, BC's carbon tax was the first in North America.
- The tax is currently set at $35 per tonne and will rise by $5 a year until 2021.
- Economic analysis shows that annual GHG emissions in BC would be between 5% and 15% higher if it had not put its carbon tax in place.
- Economic analysis suggests the carbon tax had only a very small impact on the BC economy.

Q&A: Why have BC's emissions continued to go up if the carbon price is working?

Still, the emissions news from BC isn't completely rosy. In recent years, BC's total GHG emissions have actually *increased*. Two main factors are at work.

First, the tax was "frozen" at $30 per tonne in 2012 after steady increases for the previous few years. As a result, businesses and individuals had a weaker incentive to make long-term investments to reduce emissions than they would have had with a slowly rising carbon price. For example, gasoline consumption fell between 2008 and 2013 when the carbon price was rising but rose by 7% between 2013 and 2016 when the price was frozen.

Second, even though BC's total GHG emissions have increased in recent years, they are almost certainly lower than they would have been *in the absence of the tax*. BC's strong economic (and population) growth has contributed to more overall energy use and therefore GHG emissions.

Similarly, declines in energy prices over time encouraged energy use, partially offsetting emissions reductions from the carbon tax.

The $30 per tonne tax caused emissions to grow less quickly than they otherwise would have. But a higher carbon price will be required to drive deeper emissions reductions in the future.

Q&A: What were the economic impacts of BC's carbon tax?

The BC carbon tax appears to have had at most a very small impact on economic growth. Some analysis finds no significant economic impact, while other studies suggest that the economy grew only slightly more slowly as a result of the carbon tax than it otherwise would have.

Growth nonetheless remained strong. Indeed, since 2008, British Columbia's economy has outperformed the rest of Canada. This difference doesn't mean that the carbon tax is the *reason* for BC's higher growth — indeed, it almost certainly isn't — but it does reinforce that the tax likely wasn't a significant barrier to BC having a strong economy.

In addition to relatively strong economic growth, BC's carbon tax has not negatively affected its overall job market. One economic analysis (again, a study that carefully isolated the effects of the carbon tax) found that while some emissions-intensive industries did see job losses between 2007 and 2013, the carbon tax also led to the creation of 10,000 jobs in less emissions-intensive industries (for example, service industries) that would not have otherwise existed.

> **In other words, BC's carbon tax didn't lead to fewer jobs—it shifted jobs to different industries, with a slight overall increase. As part of a necessary long-term transition away from carbon-intensive energy systems, this shift is exactly the pattern that carbon pricing is designed to produce.**

California's cap-and-trade system is reducing emissions — and the economy is thriving

Box 2: Fast Facts About California's Cap-and-Trade System

- California implemented a cap-and-trade program in 2012.
- Emissions are falling in California and will fall faster as the program ramps up.
- California is projected to reduce its GHG emissions to 1990 levels by 2020.
- There is no indication that the cap-and-trade system has hindered economic growth in California.

California introduced a cap-and-trade system in 2012. Under the program, the state sets a cap on how many GHGs its largest industrial emitters can produce and gives them permits, or "allocations," that allow them to produce GHG emissions.

The minimum price for emissions permits started at $10 per tonne (around $13 Canadian) and will increase at a rate of 5% per year until 2020. Over time, the emissions cap, and therefore the number of permits, will decline, so permit prices will likely increase. The carbon price (permit price) is currently just over $15 per tonne (around $19 Canadian).

The cap initially applied only to electricity producers and manufacturers. In 2015, the cap-and-trade system expanded to include fuels like gasoline and diesel and now applies to 85% of California's GHG emissions.

> **The cap falls every year, as required by legislation. From 2015 to 2020, the cap fell just fast enough to allow California to meet its target of reducing GHG emissions to 1990 levels by 2020.**

In 2014, California linked its cap-and-trade program with Quebec's, so companies in the two jurisdictions can trade permits with each other. In 2018, Ontario joined this linked cap-and-trade system.

Q&A: What can Quebec and Ontario learn from California's experience?

Is the system working? Yes, but modestly, at least in the short term. From 2012 to 2015, California's emissions fell by only 2%. A few factors help explain this outcome. First, the cap initially applied to only a few sectors. Second, the cap did not initially need to fall very fast for California to meet its 2020 emissions targets. Starting in 2020, however, the cap will start to fall faster, so we expect that GHG emissions will also start to fall more quickly.

The system's challenges have offered lessons. Some observers worry, for example, that there are too many permits in the system, especially in the longer term. But the design of the California system at least partially addresses this concern by establishing a minimum permit price. Even if there is a glut of permits in the market, the price of carbon won't fall below this threshold, thus maintaining the economic incentive for households and businesses to reduce their emissions.

Q&A: How about California's economic performance?

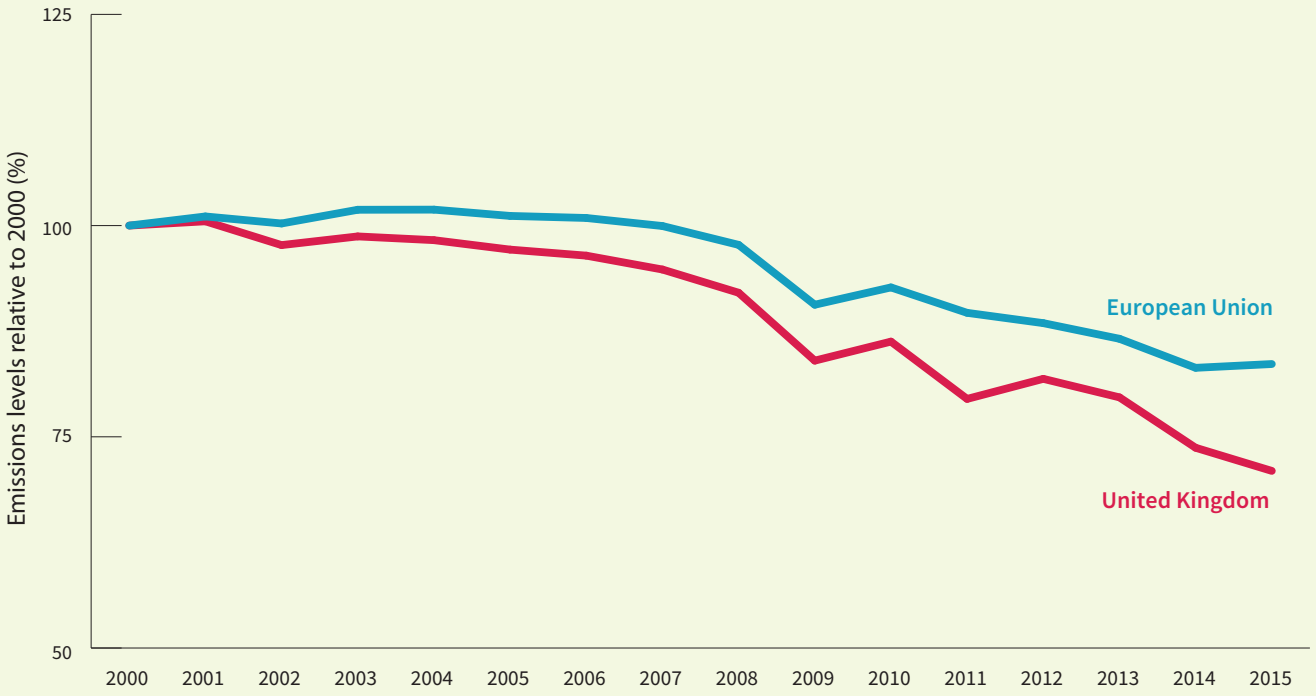
Again, there is no evidence that cap-and-trade has harmed growth in the Sunshine State, which has remained robust. Since the 2008 global economic crisis, California's economy has consistently outperformed the rest of the American economy, a trend that continued after 2012, when the cap-and-trade system was implemented.

The UK has rapidly reduced its emissions with a hybrid carbon-pricing system

The United Kingdom uses a hybrid carbon-pricing system, with elements of both cap-and-trade and a carbon tax.

Since 2005, the UK has participated in the European Union's cap-and-trade system, which has a current permit price of less than £10 per tonne (about $18 Canadian). Since 2001, the UK has also had a domestic "Climate Change Levy," which is a tax on electricity, gasoline, and other fuels supplied to firms. In 2013, the UK started increasing its domestic carbon tax to support the EU's cap-and-trade system. The UK's carbon tax differs from BC's in a few key ways. For example, different sectors in the UK pay different levels of carbon taxes, whereas BC's carbon tax is economy-wide.

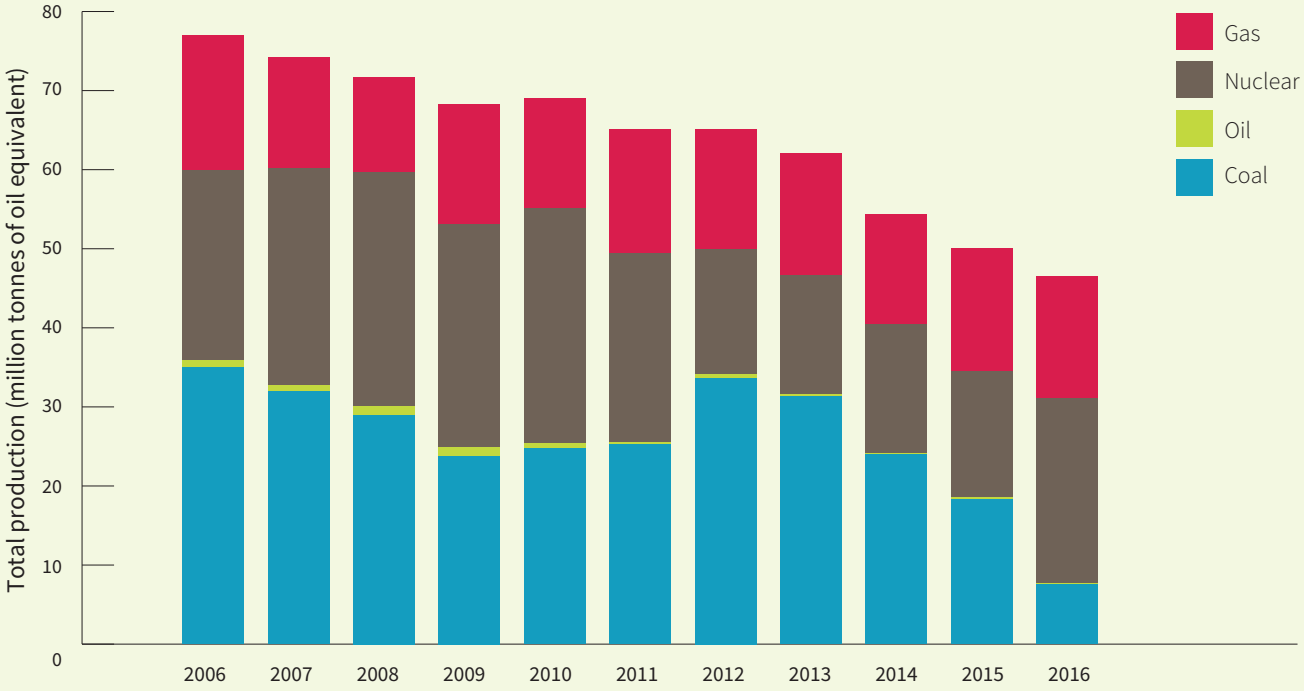
Figure 1: GHG Emissions Trends in the UK and the EU (2000 levels = 1.00)



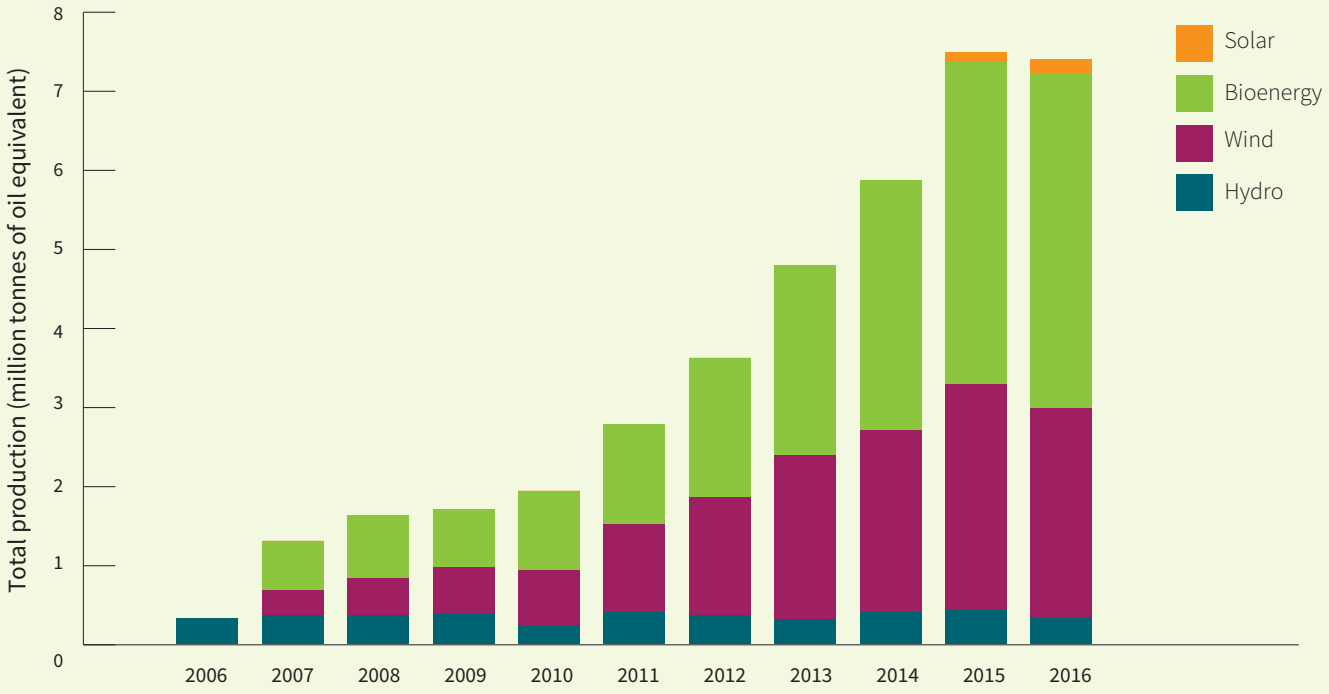
Source: Eurostat, 2017

Figure 2: Electricity Production by Source for Large UK Producers

Non-renewable electricity production by large UK producers



Renewable Electricity Production by Large UK Producers



Source: UK Government, 2017

Box 3: Fact Facts About the United Kingdom's Hybrid System

- The UK uses a hybrid system combining a carbon tax with cap-and-trade.
- UK industries pay over £20 per tonne for GHG emissions; households are exempt.
- Emissions in the UK have fallen sharply over the last several years, particularly in the electricity sector.
- The UK's economy has grown at a comparable rate to the EU's economy.

The UK's domestic carbon tax is now £18 (around $33 Canadian) per tonne, and creates incentives additional to those created by the EU's cap-and-trade system. In other words, domestic industries pay both carbon prices. For example, if the EU permit price were £8 per tonne, UK industries would pay a total carbon price of £26 per tonne (around $47 Canadian). If the EU permit price were to fall to zero, UK industries would still pay £18 per tonne for their GHG emissions.

Since 2000, the UK has seen a sharp decline in its total GHG emissions, and the drop has become steeper over the last few years. As Figure 1 illustrates, the UK's emissions have fallen faster than those in the rest of the EU, which has a cap-and-trade system but (for most countries) no additional carbon tax.

Q&A: How did carbon pricing affect how the UK produced and used electricity?

One sector in which the UK's climate policies, including the carbon tax, have been particularly noticeable is large-scale electricity generation.

Electricity emissions have fallen by more than 30% over the last ten years. The carbon tax has played a key role.

According to one estimate (which isolates the effect of the carbon tax), production facilities that paid the UK's Climate Change Levy reduced their electricity consumption by 23%. In addition, the tax was far more effective at reducing emissions than other programs that companies had the option to adopt instead of paying the carbon tax.

Carbon taxes also affected the *way* in which electricity is generated in the UK. Though other policies have also affected these outcomes, several recent studies cite carbon pricing as the main cause for the rapid decline of coal-fired electricity. Figure 2 shows the data: faced with a carbon tax, large electricity producers have begun producing more electricity from renewables and less from fossil fuels. As a result, the UK is producing fewer GHG emissions from electricity (and also less electricity overall).

The UK case also highlights some challenges. The UK is slowly decarbonizing its electricity sector but is now more reliant on imported electricity. In 2016, 5.8% of the UK's electricity was imported, mostly from France and the Netherlands. While France uses mostly nuclear power, the Netherlands is still largely reliant on fossil fuels. Therefore, while the UK has reduced emissions significantly from its electricity sector, some of these emissions simply shifted to the Netherlands as a result of their weaker climate policies.

Q&A: How did the hybrid system impact the UK's economy?

In the years following implementation of its carbon tax, the UK's economy performed very well by current European standards. In per capita terms, the country's economy grew faster than in similarly sized European countries, including France, Italy, Germany, and Spain. In the last decade, however, the UK's economic growth has been slower than in many of its neighbours, due in large part to the financial crisis of 2008, and more recently, to the economic uncertainty created by the prospect of the UK's exit from the European Union.

4. Why does carbon pricing work?

Why do higher carbon prices lead to lower GHG emissions? The underlying logic is based on an essential economic truth: *prices influence behaviour*.

Prices affect choices throughout the economy

First, think about prices of *other* goods and services. If the price of cauliflower increases, many people choose broccoli instead. If the price of parking increases, many people choose instead to take the bus or subway to work. If the price of winter beach vacations increases, many people choose instead to have local holidays. An increase in cigarette taxes helped to reduce the number of smokers. The same kind of response holds for choices all through the economy.

Here's a specific example from history: in the 1970s, the world price of oil spiked significantly on two occasions, both of which led to sharp increases in gasoline prices in Canada. In response, drivers' choices changed. In the short term, people drove less. In the medium term, fuel-efficient vehicles became more popular, so people might have driven the same amount, but they used less gasoline while doing so. The reason was simple: buying a more fuel-efficient car meant saving money. People (and businesses) like to save money when they can and when they have options to do so. Prices influenced behaviour.

> **Carbon pricing affects *many* different choices. It increases the costs of any activity (driving, flying, heating, etc.) based on how much carbon dioxide it produces. But that doesn't mean that anyone and everyone simply pay a higher cost. After all, individuals and businesses have choices. Those choices give them ways to *avoid* paying the carbon price. And in fact, that's exactly the point.**

An example: carbon prices affect driving choices

To illustrate why carbon pricing works, let's consider our choices around driving and how carbon pricing can affect them. The carbon price will make gasoline a little more expensive. How might *your* driving behaviour change as a result?

Most drivers have options in how they respond. Some seek opportunities to carpool. Others take the bus or train to work instead of driving. Others take more dramatic action like buying a smaller car — some even get rid of their car altogether (thus saving money on fuel plus many other car-related expenses). Others move closer to work. Some people might not change their behaviour at all, choosing instead simply to pay the carbon price on their unchanged gasoline usage.

> **Evidence shows that these kinds of decisions actually happen. Two UBC economists found that BC's carbon tax reduced demand for fuel by 7%, and that a little less than half of those reductions were from changes in driving habits.**

Similarly, evidence from Denmark finds that a 10% increase in the price of fuel causes the average driver to reduce driving by 3%. In other words: prices influence behaviour.

Why do drivers make these choices? Because of the relative costs of the various options available. If making a different choice is easy (perhaps because a driver lives close to public transit) then it has low costs (for example, in terms of the time required). By letting drivers choose how to respond (or not), a carbon-pricing policy lets individuals — rather than governments — identify the most preferred approaches to reducing GHG emissions.

Carbon prices can also affect vehicle choices

Changes in driving behaviour probably aren't the only — or even the most important — way drivers respond to a higher carbon price. Over time, the policy will also affect the vehicles they purchase.

Let's consider four Canadians in very different circumstances who share the need to buy a new car:

Alex

My gas costs are really high, since I commute daily from my home in the suburbs to work downtown. I don't have good public transport options.

A

Barbara

I use my car all of the time, including for work, which takes me out of the city and onto bumpy, snowy roads.

B

Charlotte

I mostly use my car for running errands. I prefer to cycle when I can. I like having the latest technologies.

C

Derek

Every weekend I drive long distances to visit my partner who lives 3 hours away.

D

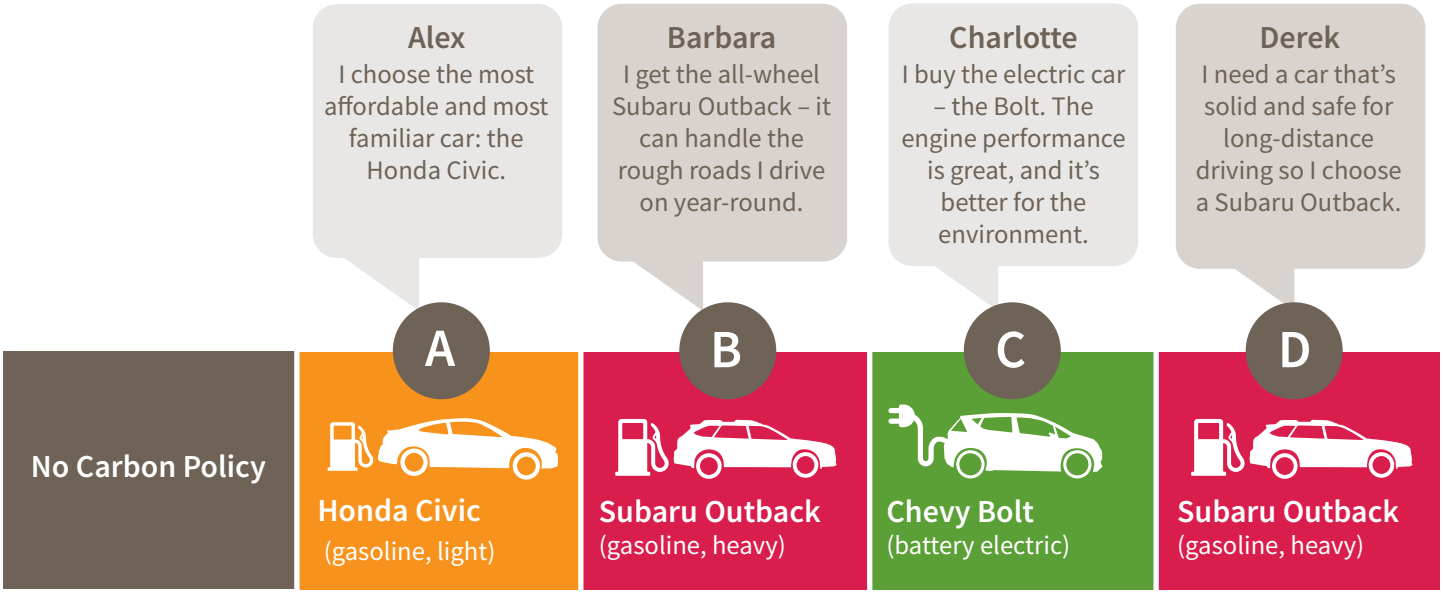
Different vehicles have different fuel economies. This means they produce different amounts of GHG emissions, so they also have different carbon costs under a carbon price. Our four individuals have choices when it comes to buying a new vehicle. The carbon price can affect which vehicle they choose and thus the GHG emissions they ultimately create while driving that vehicle.

To unpack these vehicle choices, let's consider the four options for a new vehicle in Table 1. We can see that different vehicles have their own advantages and disadvantages, both financial and non-financial (precise numbers will vary; think of these rankings as illustrative).

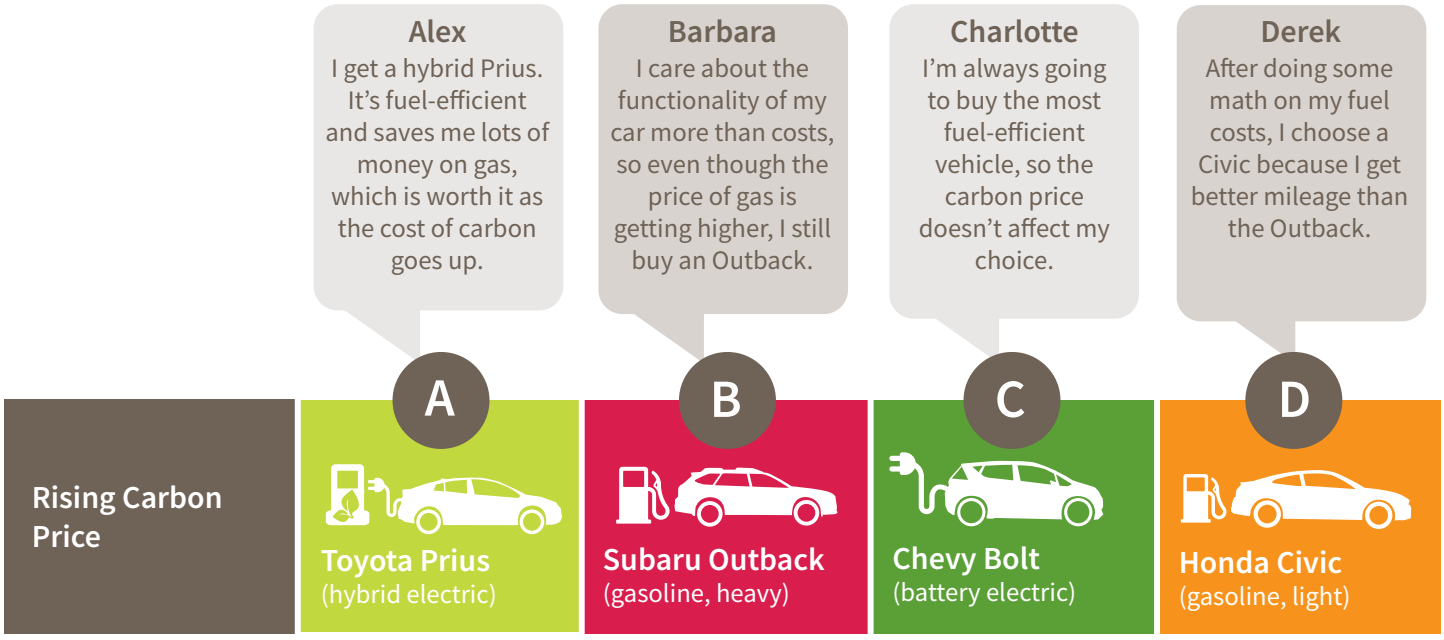
Table 1: Characteristics of Vehicles

	GHG Emissions/km	Purchase Cost	Maintenance Costs	Fuel Costs	Intangibles
Subaru Outback (gasoline, heavy)					Off-road and loading functionality
Honda Civic (gasoline, light)					–
Toyota Prius (hybrid electric)					–
Chevy Bolt (battery electric)					Limitations to range; new technology risk; performance

Which vehicles do our four drivers prefer? Let's think about that question in three different contexts. Begin in the situation ***without*** carbon pricing, in which case producing GHG emissions is costless to the individual. In this case:



Now consider the choices under a carbon price that rises over time. Emitters will therefore pay for the carbon emissions they produce. In this case:

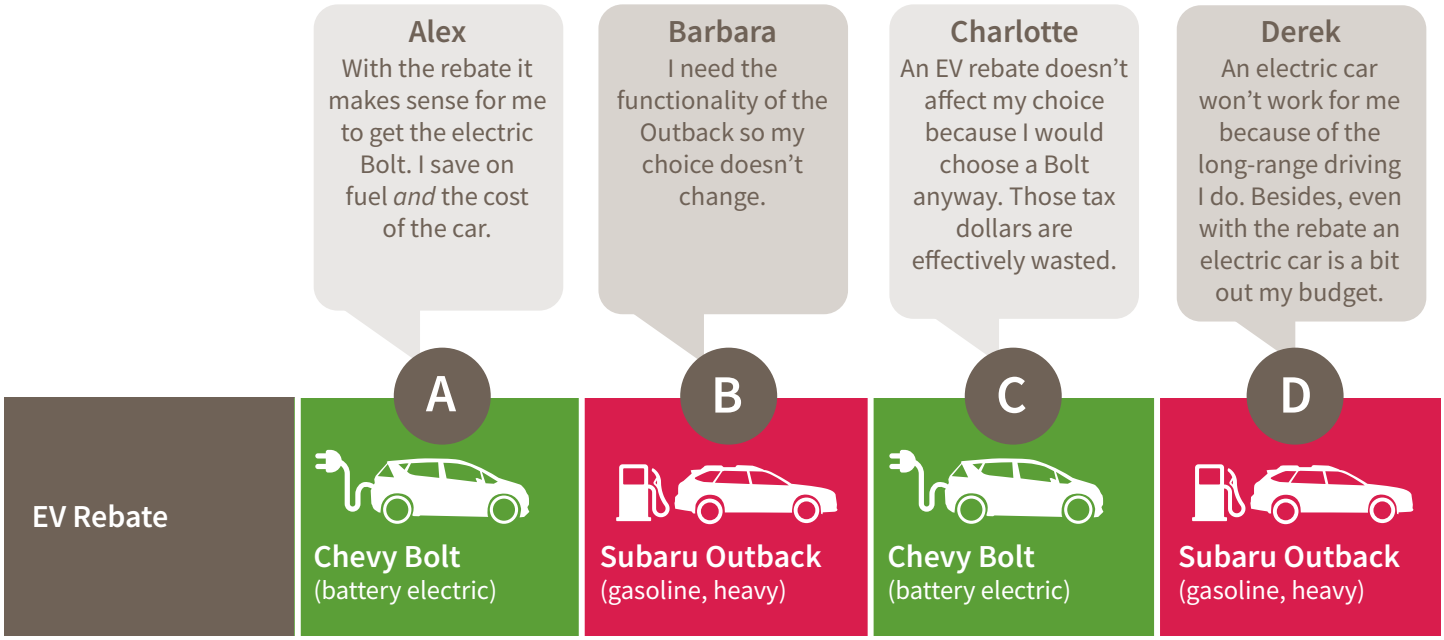


In our example, the carbon price affects vehicle choices of two of the four drivers. It causes them to choose more fuel-efficient vehicles to save money on gasoline. It also therefore reduces GHG emissions, relative to the scenario without the carbon price.

While our example here is illustrative, it's not far from reality. Those same UBC economists, for example, found that on average, the mix of vehicles driven in BC would have been 4% less fuel-efficient had BC not implemented its carbon tax. The carbon price will not affect every vehicle purchase, but it *will* affect some. Over time those choices that reduce emissions add up. In other words: carbon pricing works because *prices influence behaviour*.

The great advantage of a carbon-pricing policy is the flexibility it provides. It lets individual Canadians or businesses make their own choices about how to respond — or not — to the price, based on the costs of doing so. That flexibility keeps the costs of those emissions reductions low.

In contrast, consider a third policy scenario. Governments sometimes try to reduce GHG emissions by providing cash rebates for consumers' purchases of low-emission, electric vehicles. Let's see our four drivers' vehicle choices in this case:



We compare the outcomes across the three policy scenarios in Table 2. The EV rebate does lead to some emissions reductions because it causes Alex to buy the Bolt. But because it promotes a *specific* technology, the rebate has narrower impacts than the carbon price: Derek has no incentive to buy the Outback instead of the Civic, so the EV rebate does not affect his behaviour at all.

Furthermore, the EV rebate has costs that the carbon price doesn't. Charlotte, for example, gets the rebate *even though she would have purchased the Bolt anyway*. Those taxpayer dollars are effectively wasted. The result? The rebate reduces GHG emissions at a higher cost than putting a price on carbon. Recent analysis from the Ecofiscal Commission found that EV rebates in Quebec reduce GHG emissions at a cost around $400 per tonne, while BC's carbon tax is currently reducing emissions at less than $35 per tonne.

Table 2: Comparing Vehicle Choices Under Three Alternative Policies

	1. No climate policies	2. Rising carbon price	3. EV rebates
A Alex	Honda Civic	Toyota Prius	Chevy Bolt
B Barbara	Subaru Outback	Subaru Outback	Subaru Outback
C Charlotte	Chevy Bolt	Chevy Bolt	Chevy Bolt
D Derek	Subaru Outback	Honda Civic	Subaru Outback

Carbon prices drive innovation

The story of why carbon pricing works still isn't done. Carbon pricing will have another lasting effect: it will create long-term incentives for the innovation of low-emissions technologies.

A good carbon-pricing policy doesn't just price emissions in the present and drive emissions reductions today, it also creates expectations for higher carbon prices in the future. In response, innovative engineers and entrepreneurs have strong and rising incentives to develop technologies that reduce GHG emissions even further.

> **As new technologies emerge, additional options for reducing emissions become available. As a result, the costs of reducing emissions gets lower and lower over time. As an additional benefit, those innovators might be able to sell their products and ideas internationally, helping to reduce emissions elsewhere.**

In the context of our vehicle example, as the costs of batteries decline, so too will the costs of electric vehicles. That means a steadily rising carbon price will shift more vehicle choices. In the future, carbon pricing is likely to cause Alex and Derek to choose electric vehicles rather than gas-powered or hybrid options. Similarly, electric trucks and Sport Utility Vehicles will become available, and at more affordable prices, which means a carbon price might also affect Barbara's choices.

Carbon prices affect choices all across the economy

To be clear, our vehicle example is just a parable. It considers four hypothetical individuals in the context of a single choice. But the lessons from this simple example have general implications for carbon pricing.

First, the choice of vehicle is only one of thousands of choices that businesses and individuals will make about their behaviour, purchases, and investments. Just as a carbon price will change the trade-offs around vehicles, it will affect choices around home insulation, fuel use in industrial processes, and investments in pension plans.

Some methods of reducing GHG emissions will help businesses or households save money by allowing them to avoid paying the carbon price. Just as importantly, some decisions won't be affected by the price. If an action to reduce emissions is very expensive, the carbon price will not require businesses or individuals to take that action. And that's OK: the idea is not to force anyone to take specific actions (like some regulations might do) but rather to let prices change incentives and let incentives affect choices. *Households and businesses always face choices*.

> **The idea is not to force anyone to take specific actions. Rather, it's to let businesses and individuals choose options that work for them.**

Over time, we need deeper emissions reductions. That's why a rising carbon price is so important. As the carbon price increases, it will affect more decisions, resulting in more emissions reductions. But even a carbon price of $100 per tonne won't force actions that cost $200 or even thousands of dollars per tonne. A predictable and gradually rising path for the carbon price will let individuals and businesses plan for the future, again keeping costs down.

Second, millions of other Canadian consumers and businesses will also face that same choice. Every one of them will have their own context and preferences. Some will have more opportunities to reduce GHG emissions inexpensively. Others might have different opportunities, or fewer opportunities. And that's exactly the point: those that have low-cost alternatives will respond to a carbon price in the way that makes most sense for them. As a whole, this means we can realize the lowest-cost ways to reduce GHG emissions throughout the economy, without forcing anyone to take the high-cost actions.

> **When designed well, carbon pricing applies to all emissions in the economy and all emitters — individuals as well as businesses. This broad coverage creates a common incentive for everyone to reduce emissions in low-cost ways.**

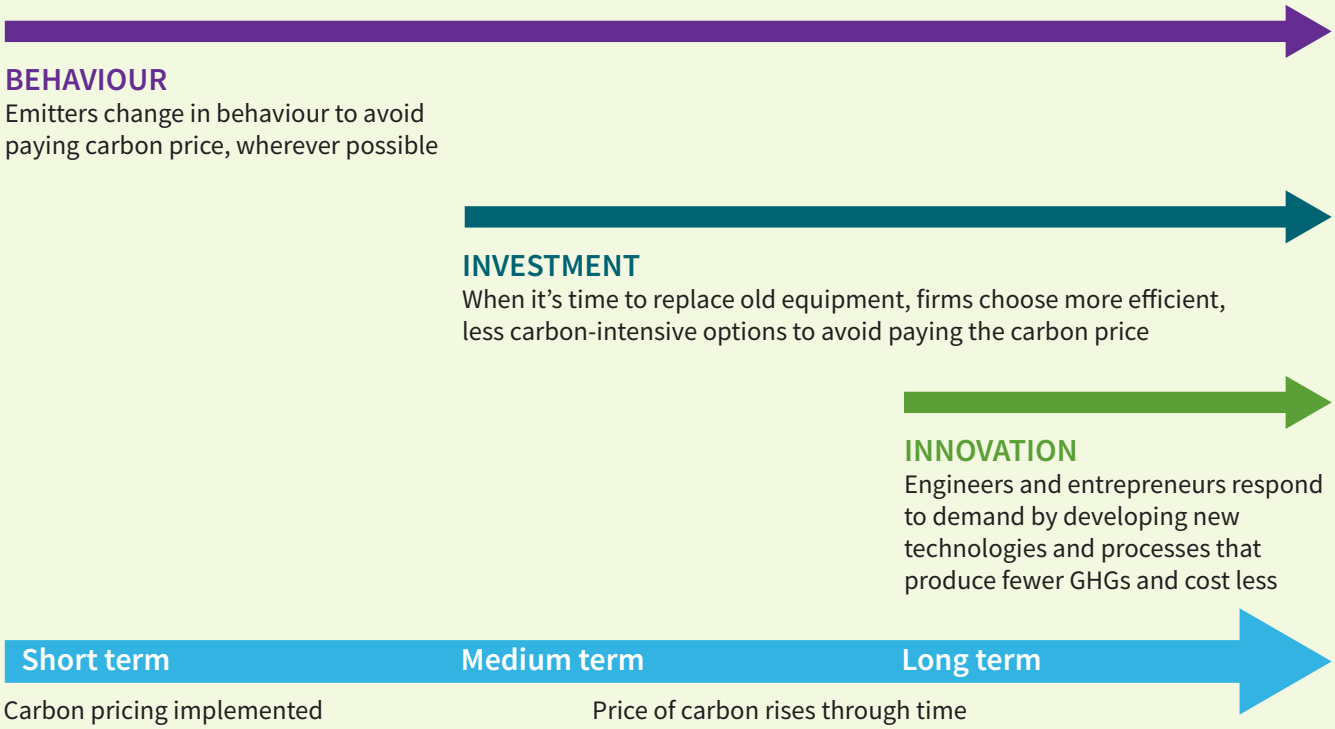
In short, we can extrapolate our example across all GHG emissions in Canada. Carbon prices affect choices. That's why a price on carbon can efficiently drive emissions reductions, and why it already has done so in British Columbia, California, the UK, and elsewhere, as we saw in Section 3.

5. When does carbon pricing work?

The impacts of carbon pricing aren't instantaneous, and we shouldn't expect immediate results. But nobody should conclude that carbon pricing doesn't work just because things don't change dramatically in the short term. Monitoring the GHG impact of carbon pricing is like watching paint dry.

Our story of driving and vehicles illustrates why carbon pricing works. But it also illustrates *when*. Figure 3 sketches a timeline for when businesses and individuals respond to carbon pricing.

Figure 3: Timeline for Responding to Carbon Pricing

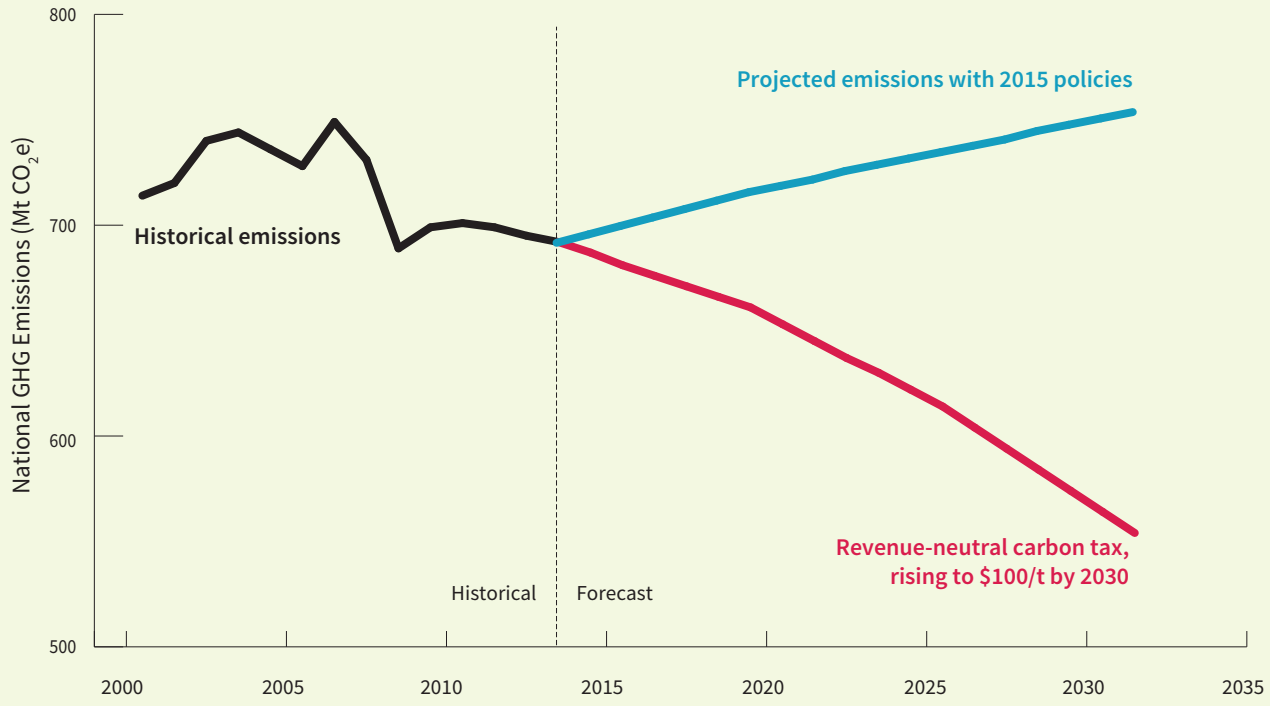


The gradual impact of a steadily rising carbon price helps to keep adjustment costs low. Replacing old equipment before it is necessary can be expensive. Carbon pricing gives businesses and individuals choices as to when to make these investments. The gradual transition gives everyone time to respond to the policy and plan their investments accordingly.

All these gradual changes add up across the economy and over time.

Achieving deep GHG reductions at lowest cost is a long-run objective. Carbon-pricing policies in Canada are still young, with modest impacts so far. But gradual impacts from actions taken now accumulate into enormous impacts over time. And as carbon prices steadily increase, emissions levels will decrease, and cumulative emissions reductions will continue to grow. Our analysis from a previous report, shown in Figure 4, shows how a rising carbon price can drive large GHG reductions over time. Notice that, in this example, all the revenues raised by the carbon tax are used to finance cuts in other taxes — which makes the carbon tax revenue neutral.

Figure 4: Projected Emissions Reductions from a Pan-Canadian Carbon Price Rising to $100 per tonne



Source: Economic modelling from Navius Research, 2015

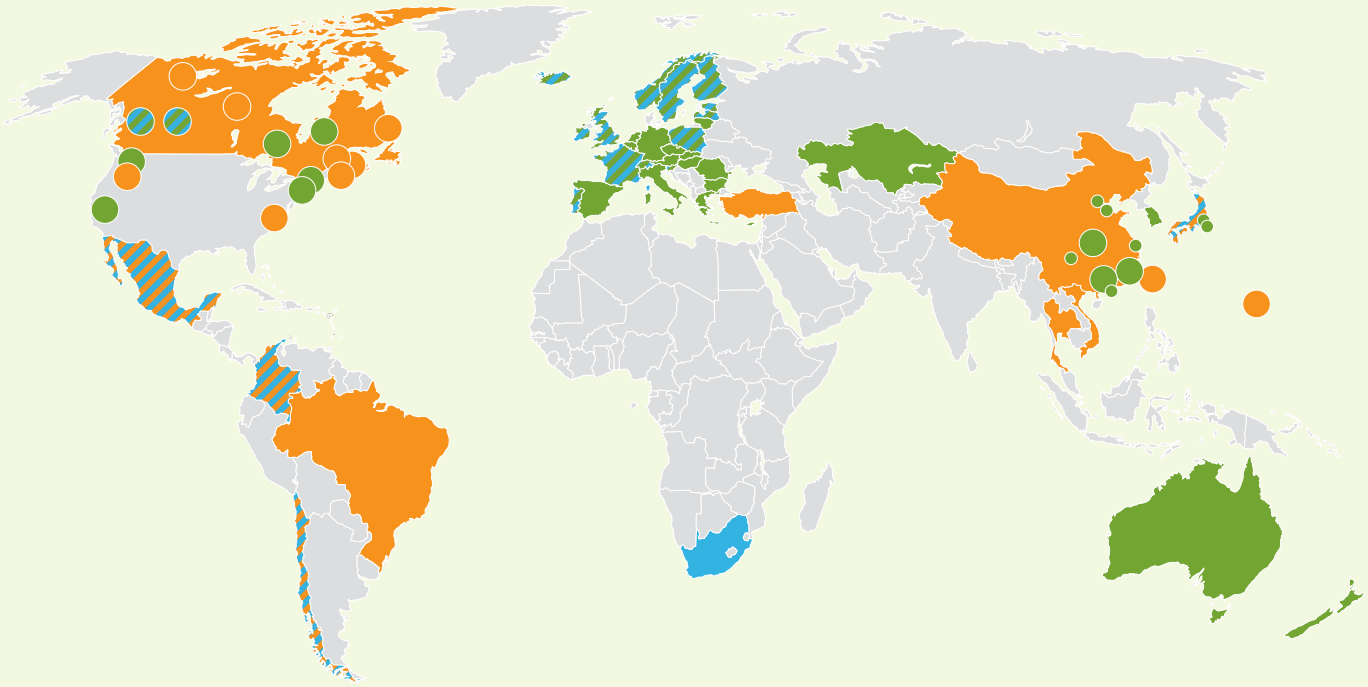
6. Who supports carbon pricing?

Support for carbon pricing comes from a remarkable range of perspectives.

Carbon pricing is spreading across the world

Many jurisdictions are implementing various kinds of carbon-pricing policies. Carbon pricing has spread to every continent, as Figure 5 illustrates. Countries, provinces, and states are choosing the type of carbon pricing that suits their unique circumstances — and learning and improving as they go. China is one of the latest countries to get on board. It launched its first cap-and-trade system in late 2017.

Figure 5: State of Carbon Pricing Around the World, 2017



- ETS implemented or scheduled for implementation
- Carbon tax implemented or scheduled for implementation
- ETS or carbon tax under consideration
- ETS and carbon tax implemented or scheduled
- ETS implemented or scheduled, tax under consideration
- Carbon tax implemented or scheduled, ETS under consideration

Note: An Emissions Trading System (ETS) is another term for a cap-and-trade system.

Source: World Bank, Ecofys and Vivid Economics. 2017. State and Trends of Carbon Pricing 2017. Washington D.C.

Carbon pricing has some unexpected advocates

Support for carbon pricing is broader than you might expect. Here is a sample of the kinds of people that have advocated carbon pricing as the best way to reduce GHG emissions *and maintain a strong economy at the same time*.

Henry Paulson

A tax on carbon emissions will unleash a wave of innovation to develop technologies, lower the costs of clean energy and create jobs.

Henry Paulson is a former CEO of Goldman Sachs and served as Secretary of the Treasury under President George W. Bush from 2006 to 2009.

Christine Lagarde

The transition to a cleaner future will require both government action and the right incentives for the private sector. At the centre should be a strong public policy that puts a price on carbon pollution.

Christine Lagarde has been Managing Director of the International Monetary Fund since 2011. She has also served as France's Minister of Economic Affairs and Minister of Finance.

Greg Mankiw

I view [a carbon tax] as a conservative approach to dealing with climate change. The alternative to giving the people the right incentives and letting them make free choices is to regulate their behavior… If we give people the right incentive with the carbon tax, then a lot of those regulations will become unnecessary.

Greg Mankiw is an economics professor at Harvard University. He was the Chair of George W. Bush's Council of Economic Advisors from 2003 to 2005, and later an advisor to presidential candidate Mitt Romney.

Jerry Brown

You have an incredible mechanism that protects our economy and reduces greenhouse gases... cap-and-trade is the way forward.

Jerry Brown is the Governor of California, having served from 1975 to 1983 and again from 2011 to the present.

Preston Manning

For any economic activity, especially the production of energy, we should identify its negative environmental impacts, devise measures to avoid, mitigate or adapt to those impacts, and include the costs of those measures in the price of the product. It's the idea behind using carbon pricing to reduce greenhouse gas emissions.

Preston Manning founded both the Reform Party of Canada and the Canadian Reform Conservative Alliance. He served as Leader of the Official Opposition in the House of Commons from 1997 to 2000.

Steve Williams

Climate change is happening. We think a broad-based carbon price is the answer.

Steve Williams is the CEO of Suncor, Canada's largest oil producer.

Angela Merkel

It would be best if damaging emissions had a price worldwide. A global carbon market would be an incentive for the most efficient production possible, while ruling out a distortion of competition.

Angela Merkel has served as the Chancellor of Germany since 2005 as leader of the country's centre-right Christian Democratic Union.

Bernie Sanders

A carbon tax must be a central part of our strategy for dramatically reducing carbon pollution, a view shared by economists on both ends of the political spectrum.

Bernie Sanders is a United States Senator. He was a Democratic Candidate in the 2016 presidential primaries.

Catherine McKenna

It is no longer acceptable to pollute for free and pass the bill to future generations. Putting a price on carbon is the most efficient way to reduce global emissions while encouraging sustainable and robust economic growth.

Catherine McKenna is a federal Member of Parliament and Canada's Minister of Environment and Climate Change.

Megan Leslie

Carbon pricing is needed to help reduce carbon emissions damaging our environment and contributing to wildlife declines across Canada and around the world.

Megan Leslie is the President and CEO, WWF-Canada.

Jim Yong Kim

The world's top priority must be to get finance flowing and get prices right on all aspects of energy costs to support low-carbon growth. Achieving a predictable price on carbon that accurately reflects real environmental costs is key to delivering emission reductions at scale.

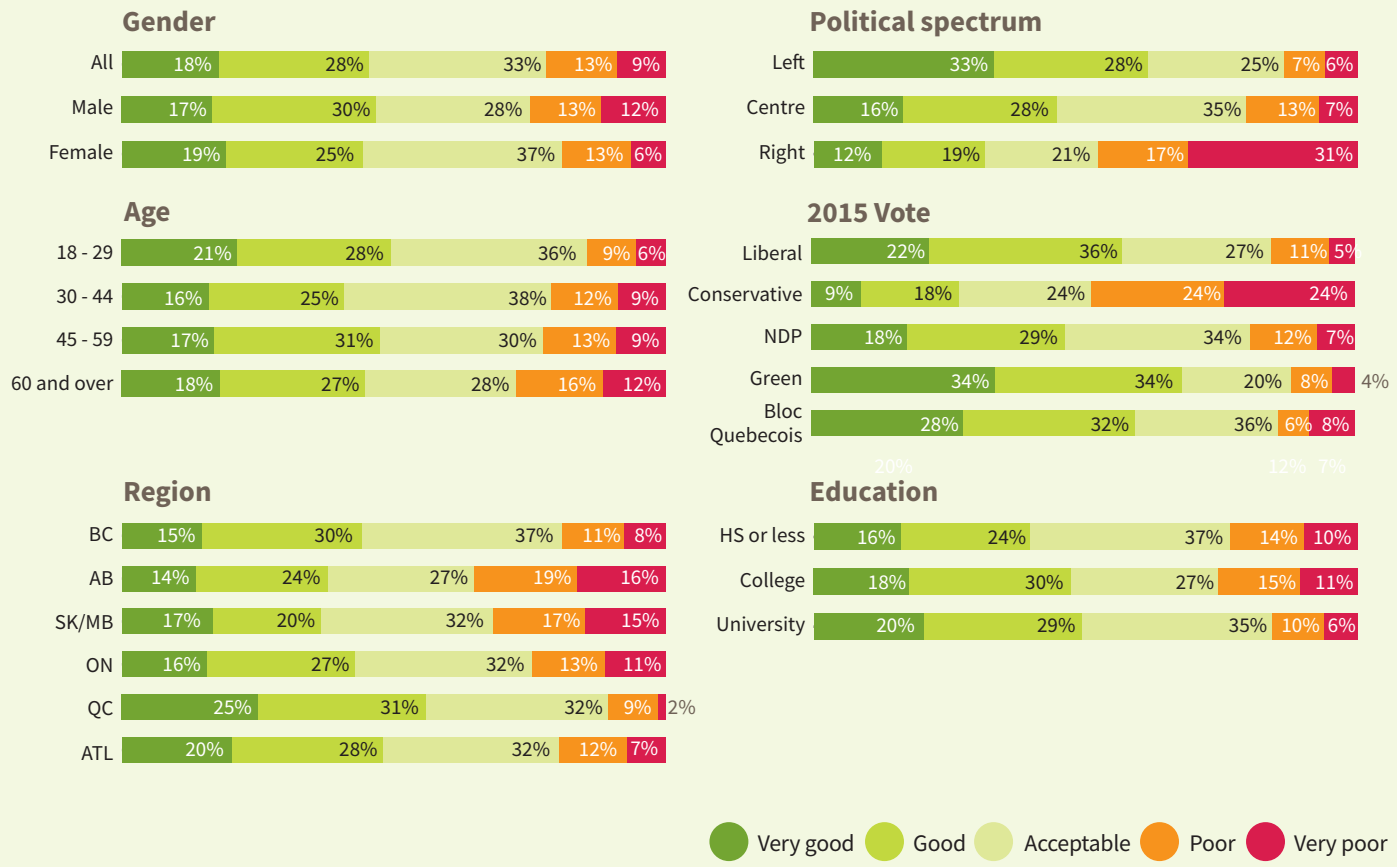
Jim Yong Kim has been the President of the World Bank since 2012. Previously, he was a physician, an advisor at the World Health Organization, and professor at Harvard Medical School.

Elon Musk

The fundamental problem is the rules today incent people to create carbon… So what can you do? Whenever you have the opportunity, talk to your politicians, ask them to enact a carbon tax.

Elon Musk is an investor and entrepreneur. He is the founder or cofounder of several companies, including Tesla, SpaceX, and SolarCity.

Figure 6: Canadians' Reaction to Carbon Pricing



Source: Abacus Data, 2018

Carbon pricing has support from Canadians

What about support among Canadians? Earlier this year, we commissioned polling on Canadians' attitudes toward carbon pricing. The results are instructive.

Despite some occasionally heated rhetoric, most Canadians support carbon pricing. Almost four out of five of those surveyed thought that carbon pricing was at least an "acceptable" idea, and 46% thought it was a good or very good idea. As Figure 6 illustrates, results vary somewhat by region. Opposition is strongest in Alberta, but 65% of Albertans surveyed still thought carbon pricing was at least an acceptable idea.

In addition, Canadian attitudes toward carbon pricing are slowly shifting. Compared to 2015, more Canadians think carbon pricing is a good or very good idea, and more people support it as a way to reduce emissions.

Not everyone who learns about carbon pricing will end up supporting it. And perhaps those who care about the environment are more likely to expend the effort to learn about carbon prices. At the very least, these results suggest that it might be a good idea for Canadians to learn a little more about carbon pricing and how it works.

7. How do policies put a price on carbon?

So how *does* carbon pricing work? How do policies put a price on carbon? Carbon pricing looks very different in the three jurisdictions we discussed in Section 3, but they're all based on the same idea. There are two basic approaches: carbon taxes and cap-and-trade systems. Variations of these two policies (and even hybrids) exist, but our focus here is on the basics of the policies, not their many details. We will look at carbon taxes and cap-and-trade systems in their simplest forms.

Carbon taxes *directly* set a price on carbon

A carbon tax sets the price on carbon directly. It applies to specific fuels based on how many GHGs are emitted when they are burned. Emitters pay a fixed fee to the government for every tonne of GHG emissions.

With this design, more carbon-intensive fuels have a higher carbon tax. In British Columbia, for example, the tax is currently set at $35 per tonne of GHGs. This translates to a little under 8 cents per litre of gasoline, a little over 9 cents per litre of diesel, and $1.77 per GJ (gigajoules) of natural gas. (One litre of diesel produces slightly more GHGs than one litre of gasoline, which explains why the tax per litre is slightly higher for diesel, but the tax per tonne of GHGs is identical for the two fuels.)

> **Businesses and individuals can choose to change their behaviour to reduce their GHG emissions, thus reducing the amount of carbon tax they pay. In extreme cases they can avoid paying the tax entirely if they can get to zero emissions. Leaving these decisions to businesses and individuals is exactly what makes carbon pricing work.**

Q&A: How are carbon taxes and cap-and-trade different?

What is the bottom line? Carbon taxes and cap-and-trade systems have more similarities than differences. Both policies put a price on carbon. Both create an incentive to reduce GHG emissions. Both provide incentives for the development and adoption of low-carbon technologies over time. Both policies can generate revenue that can be used to create other economic benefits, but there are also two important differences between the policy approaches.

First, carbon taxes and cap-and-trade systems provide certainty about different outcomes.

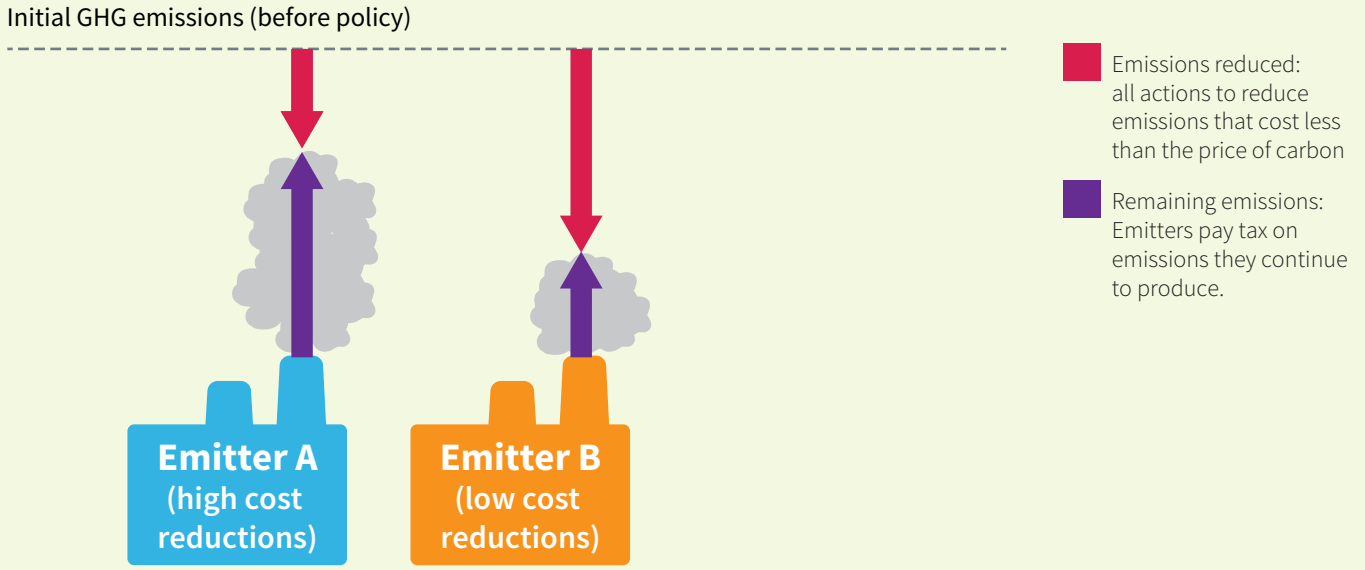
Under a carbon tax, we know what the price of carbon will be. But we don't know precisely how businesses and individuals will respond to the policy, what new technologies to reduce emissions might emerge, or how the economy will perform (independent of carbon pricing). As a result, a carbon tax doesn't guarantee a specific amount of emissions reductions. Modelling can be used to project GHG reductions these estimates cannot be certain.

In contrast, with a cap-and-trade system, the cap provides a clear regulatory limit on the total amount of emissions. So emissions are known. But the market for permits — not a policy decision — determines the carbon price; it varies with changes in supply and demand. Modelling can be used to project how the carbon price will evolve over time but, again, these estimates cannot be certain.

Many cap-and-trade systems — for example, those in Ontario, Quebec, and California — reduce the uncertainty in the carbon price by establishing upper and lower limits for the price. Such limits make a cap-and-trade system more like a carbon tax.

Linking cap-and-trade systems across jurisdictions can yield additional benefits. GHG emitters covered by the cap-and-trade systems in Ontario and Quebec, for example, can buy and sell emissions permits among each other *and* from emitters in California. The result is that the permit market is larger than it would be if each jurisdiction prohibited trades with emitters in other jurisdictions. The bigger market provides more opportunities to adopt low-cost ways to reduce emissions. Current estimates indicate that if the Ontario and Quebec cap-and-trade systems had no access to the California system, the carbon price in the two Canadian provinces would be significantly higher than it now is.

Figure 7: How a Carbon Tax Works



The example here illustrates how it works:

1. Consider two emitters, **Emitter A** and **Emitter B**. Without a carbon tax, each produces the same amount of GHG Emissions each year.
2. Now, consider those same emitters under a carbon tax. **Emitter A** knows that it will pay the carbon tax on its emissions. But it also has choices: it can take actions to *avoid* those emissions by (for example) installing more efficient equipment or switching from diesel to electricity. **Emitter A** therefore takes every action to **reduce emissions** that cost less than simply paying the tax. In other words, **Emitter A** would rather pay $10 for an action that reduces a tonne of carbon dioxide than $30 in taxes on that tonne.
3. **Emitter B** is in the same situation. But every emitter has different context with different costs. Even though it started out with the same level of emissions, it has more options for low-cost emission reductions (perhaps it is an older facility; perhaps it still uses different technologies that are easier to upgrade). As a result, it **reduces emissions** even more than **Emitter A** to avoid paying as much of the carbon tax as possible.
4. This flexibility of when and how to reduce emissions means that total costs to the economy are lower than they would be under a regulation that simply required both firms to use specific technologies or achieve a specific level of emissions performance. By giving emitters choice, the carbon price lowers overall costs.
5. Finally, both emitters pay the carbon tax on their **remaining emissions**. Governments can choose to recycle this revenue back to the economy in various ways. They might reduce other taxes such as corporate or personal income taxes. They might invest in green technologies. Or they might give money to low-income households.

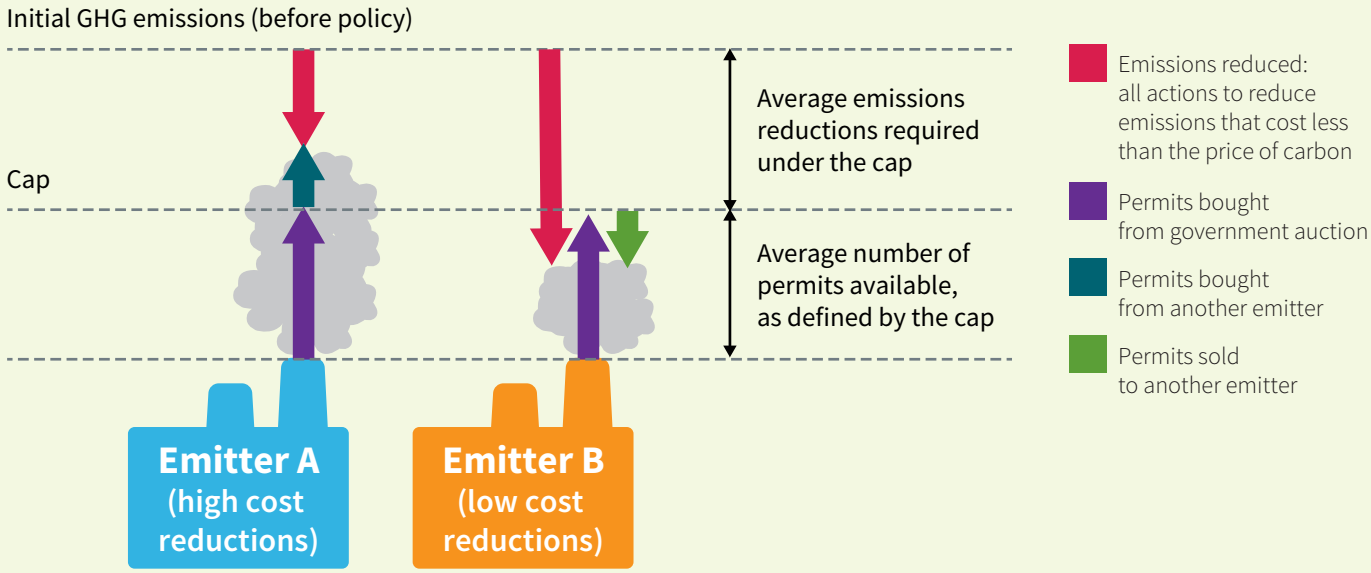
Cap-and-trade systems *create a market* that establishes a price on carbon

Cap-and-trade systems *also* create a carbon price but in an indirect way.

A government begins by establishing a maximum allowable level of GHG emissions in its jurisdiction; this is the **cap** on emissions. It then allocates emissions permits to industrial facilities, fuel distributors, and other large emitters, either by selling them or providing them for free. These businesses can emit GHGs only up to their total number of permits. The difference between the total amount of current emissions (without the policy) and the emissions "cap" determines the size of the reduction in GHG emissions.

Where is the carbon price in this picture? The key point is that businesses are allowed to buy and sell emission permits among themselves; this is the **trade** part of cap-and-trade. Firms that need more permits (so that they don't have to reduce their emissions as much) will demand them and purchase them from the market. Other firms that don't need all their permits (because they plan

Figure 8: How a Cap-and-Trade System Works



to cut their emissions) will supply and sell them to the market. This supply and demand for permits determines the market price of carbon. Trading in this market determines who will reduce emissions (and sell permits) and who will increase emissions (and buy permits).

The net effect of this pattern of emissions and trading is that GHG emissions get reduced by the required amount and at the lowest possible cost. Why? Because the firms that are able to reduce emissions at the lowest cost are the ones that will realize the most reductions; the firms that are able to reduce emissions only at a higher cost cut their emissions by less or not at all. All emitters in a cap-and-trade system have a profit-driven incentive to reduce their emissions, but they respond differently because of their different costs and technologies.

This example illustrates how it works:

1. Again, we consider two emitters, **Emitter A** and **Emitter B**. Each produces the same amount of GHG Emissions each year.
2. Now, consider those emitters under a cap-and-trade system. The **cap** is defined by the **total number of permits** available in the system: each emitter needs a permit for every tonne of GHG it produces. The cap is smaller than total current emissions, which requires the average emissions from our emitters to fall. Available permits can be sold or distributed for free. For the sake of this analysis, let's assume that both **Emitter A** and **Emitter B** get the same number of permits to start (**the average**).
3. **Emitter A** wants to avoid having to buy **additional permits**, so it **takes action to reduce its own emissions**. But it has only a few low-cost opportunities to do so. To minimize its costs, **Emitter A** reduces some emissions but also **buys some additional permits** from other emitters on the permit market.
4. **Emitter B** has more options for low-cost emissions reductions. In fact, given that the permits it holds are valuable (i.e., can be sold on the market), it makes sense for **Emitter B** to **reduce even more** and **sell additional permits for cash**.
5. Because our simple example only has two emitters, the permits sold by **Emitter B** are equal to the permits purchased by **Emitter A**. This is how larger markets work as well: the *price* of those permits will adjust such that the supply of permits is equal to the demand. The result: a price on carbon.
6. The outcome is the same as the carbon tax. Each emitter reduces emissions by taking all actions that cost less than the price of carbon. They hold permits for all remaining emissions, thus collectively meeting the **cap on emissions** for the economy as a whole.

These ideas bring us back to the purpose of this essay: our goal is to explain where and why carbon pricing *has* worked, and *how*. Before we get to our conclusions and recommendations, we'll address a few questions that may have popped up along the way.

8. Other FAQs about carbon pricing

Our focus has been the "who, what, when, where, why, and how" of carbon pricing, which reduces GHG emissions while supporting a strong economy. But other more detailed questions about carbon pricing also frequently arise. We address these questions (briefly) here, with links to deeper analysis.

Q&A: Does carbon pricing undercut business competitiveness?

Short answer: No. Well-designed carbon pricing can create incentives to reduce GHG emissions without damaging the international competitiveness of Canadian businesses.

What do we mean by competitiveness? It's the ability of a business to compete successfully against its domestic and foreign rivals. Regulations, wages, working rules, income-tax rates, the quality of workers, and market access are just a few of the many factors that affect competitiveness. Carbon pricing adds one more element to the mix. In Canada, carbon pricing only affects business competitiveness if the carbon price at home is higher than the one faced by rivals from other jurisdictions.

Competitiveness is a legitimate and important issue. But it's *not* a reason to avoid pricing carbon, for three reasons.

First, competitiveness pressures *created by carbon pricing* affect a relatively narrow part of the aggregate Canadian economy. Only sectors that both produce lots of emissions and compete in global markets are affected. They make up about 5% of GDP nationally, though this is not evenly spread across the country. In Ontario and BC, for example, less than 2% of GDP comes from such "exposed" sectors; in Alberta and Saskatchewan, however, the number is more like 18%.

Second, this "carbon competitiveness" issue is relevant only if Canada is way ahead of the pack internationally, meaning that we have carbon prices well above those in our trading partners. But we aren't way ahead: over 40 countries have some form of carbon pricing, and the number is growing every year. However, *some* foreign firms *do* compete with this 5% of the Canadian economy and come from jurisdictions with *lower* carbon prices. This is a problem we need to address. What should we do? This brings us to our final point.

Third, well-designed carbon pricing *can* effectively address the issue of business competitiveness. When competitiveness *is* an issue, recycling the revenues from carbon pricing can ensure that firms remain competitive and continue to thrive in their Canadian location. Carbon pricing can be (and should be) designed to provide *targeted*, *transparent*, and *temporary* support to "carbon-exposed" sectors. Several of these policies are already in place across Canada, including corporate income-tax cuts and emissions-performance standards.

Q&A: Is carbon pricing unfair for low-income households?

Short answer: No. Well-designed carbon pricing won't disproportionately affect low-income households.

Here's the concern: compared to higher-income households, energy tends to make up a larger share of lower-income households' total expenditures. Carbon pricing makes (fossil-fuel-based) energy more expensive. All else being equal, this would imply that those households are disproportionately affected by the carbon price, relative to high-income households. That's a legitimate concern, but good policy design can provide the solution.

Smart recycling of revenues can address these fairness concerns. For example, BC and Alberta mail rebate cheques to lower-income households. The combination of carbon pricing *and* the cheques ensures that low-income households aren't unduly affected relative to high-income households. (It actually makes them better off while still giving them an incentive to reduce their emissions.) In short, fairness concerns should not be an obstacle to implementing carbon pricing, as long as the policy is designed well.

Q&A: Can revenue recycling undermine carbon pricing?

Short answer: No. The primary objective of carbon pricing is to reduce GHG emissions, but it can also raise substantial revenues for the government. Once a carbon price is in place, the decision of what to do with the revenues is a related but separate issue. Revenue-recycling choices are a key part of designing smart carbon-pricing policies, and they have implications for the overall environmental and economic performance of a carbon-pricing policy. Done right, they will not undermine incentives to reduce emissions.

Let's work through a simple example to explain why. Rebate cheques to households are one way to ensure carbon pricing is fair for low-income earners. Here's the most important part: those rebate cheques don't depend on each earner's emissions levels at all. Let's assume that a carbon tax raises $100 million in a province with one million households. If all the revenue is rebated to households, each household would get a rebate cheque for $100. It doesn't matter how much carbon tax any one household pays — it still gets the same rebate. So, if the household were to reduce its

carbon consumption, it would pay less in carbon taxes *and still get the $100 rebate*.

In other words, the household's incentive to reduce carbon emissions is not affected by the rebate as long as the rebate is not related to the household's own emissions. Even if the cheque is larger than a household's carbon costs, it can save *even more* by reducing emissions. For each individual household, the credit and the carbon tax are independent of each other. The logic is exactly the same for supporting emissions-intensive industries to protect competitiveness and maintain incentives for these industries to reduce GHG emissions.

Q&A: What is the role of other policies? Can carbon pricing do it all?

Short answer: No. Carbon pricing is the simplest and most cost-effective way to reduce GHG emissions. But it can't do it all. Governments should consider three types of "non-pricing" policies as complements to carbon pricing: gap-filling, signal-boosting, and benefit-expanding.

Although carbon pricing can cover *most* of an economy's emissions, it is difficult to attach a price to *some* types of emissions. For example, emissions from forestry, agriculture, and waste come from many sources and can be tough to measure. Because of these gaps, relying on pricing alone will leave cost-effective emissions reduction opportunities unrealized. "Gap-filling" policies target these opportunities *and* can lower the overall cost of reducing emissions.

Sometimes carbon pricing doesn't work as well as it could because the price signal it sends is too weak to change household or business decisions. There are several reasons this might happen. One is that consumers don't always have all the information they need. "Signal-boosting" policies can help carbon pricing work better by addressing these other problems. For example, programs like *Energy Star* can help consumers identify which appliances use less electricity and produce fewer emissions. This makes it easier for consumers to follow the logic of the carbon price and make low-carbon decisions that will save them money for the many years they will own the appliances.

Other times, climate policy isn't just for the climate. Some policies might offer more than GHG mitigation. Better cycling paths and public transit can reduce car use *and* improve urban mobility. Shifting away from coal-fired electricity can reduce GHG emissions *and* improve local air quality. These "benefit-expanding" policies may be cost-effective when we consider positive outcomes *other* than reducing GHG emissions.

9. Conclusions

Well-designed policies that put a price on carbon can reduce GHG emissions and can do so in a way that doesn't undermine our economic prosperity.

Carbon pricing works. We have shown *where* carbon pricing has worked — in terms of both environmental and economic outcomes — in provinces, states, and countries that have implemented carbon-pricing policies. Experience in British Columbia, California and the United Kingdom provide real-world evidence of successful carbon pricing.

We have shown *why* carbon pricing works—using a simple example of how a carbon price might affect the vehicles we purchase, and why. Carbon pricing is all about incentives and flexibility. It reduces costs by preserving choice for individuals and businesses.

Carbon pricing is all about incentives and flexibility. It reduces costs by preserving choice for individuals and businesses.

We have shown *when* carbon pricing works by considering impacts in the short, medium, and long terms. Carbon pricing works gradually and incrementally over time. But over the long term, these effects accumulate enormously.

We have shown *who* accepts that carbon pricing works by looking at the breadth of jurisdictions across the globe moving forward with policies, as well as the support from a broad cross-section of individual policy voices.

Finally, we have shown *how* policies put a price on carbon by explaining cap-and-trade systems and carbon taxes. Both systems can work and are actually more similar than they are different.

Carbon pricing is about the "rules of the market," not specific outcomes

Our findings might be a little unexpected, and perhaps contrary to some of the many carbon-pricing myths floating around. The point of carbon pricing *isn't* to punish polluters. It is *not* to generate revenue (though it does do that). And it's definitely *not* about promoting specific "green" technologies.

Market prices should tell the truth about what carbon really costs us. Carbon pricing does that. And then it lets individuals and businesses respond in ways that work for them.

Instead, carbon pricing is about making the "rules of the market" work better, and letting individual producers and consumers make their own choices within that context. Market prices should tell the truth about what carbon really costs us. Carbon pricing does that. And then it lets individuals and businesses respond in ways that work for them. The overall result is that we get lower GHG emissions without harming the overall performance of the economy.

10. Recommendations

Canada has made enormous progress on carbon pricing over the last several years, but there is more to be done. We close off this essay with three recommendations.

RECOMMENDATION #1: Canadian provinces should rely on increasingly stringent carbon pricing policies to reduce GHG emissions

Carbon pricing already covers the majority of GHG emissions in Canada. Governments should continue to make carbon pricing the central plank of their climate policy, and they should add well-designed non-pricing policies only when carbon pricing alone can't do the job. This will ensure that Canada reduces GHG emissions at the lowest possible economic cost.

And the stringency of carbon pricing policies across Canada should continue to increase gradually over time. Canadian provinces can achieve the deeper emissions reductions required by steadily increasing the rates of carbon taxes or steadily reducing the number of permits in cap-and-trade systems. Higher carbon prices and lower caps will lead to deeper emissions reductions. The expectation of rising carbon prices will strengthen incentives for emitters to innovate and invest in low-carbon technologies. Steady, predictable increases in stringency will ensure that individuals and businesses have time to adjust and plan their long-term investments accordingly.

RECOMMENDATION #2: Policy makers and analysts should work to better communicate the realities of carbon pricing

We've come a long way in Canada. We have real, working examples of both carbon taxes and cap-and-trade systems. But pervasive myths about carbon pricing still cause too much of the debate to be based on poor information.

We appreciate that carbon pricing isn't always simple, especially when it comes to the important details of policy design. It is incumbent on all of us engaged in climate policy to communicate beyond a narrow group of technical policy experts. Carbon pricing affects all Canadians, so we need to help all Canadians understand the basics. That's why we wrote this essay — so please pass it on.

We can't afford to base important policy decisions on myths and misunderstandings; critics of carbon pricing ought to base their arguments on evidence. There is plenty of room to debate the different methods of carbon pricing, various approaches to revenue recycling, how fast the carbon price should rise, or what other climate policies may be necessary. But arguing that prices don't affect decisions is arguing against a large body of economic theory, against an enormous amount of empirical evidence, and most importantly, against most people's own experiences.

Having a better public conversation about carbon pricing can help us move forward.

RECOMMENDATION #3: Governments should carefully evaluate their carbon-pricing policies over time, especially in the medium term.

Nothing is more convincing than hard data. To *show* that carbon pricing works, governments should undertake careful, detailed analysis of how carbon pricing has performed in their jurisdictions. That analysis should isolate the effects of carbon pricing from other factors. It should explicitly show the impacts of the policy on GHG emissions and the economy by estimating what environmental and economic outcomes would have been in the absence of the carbon price. This robust data and analysis should be clearly communicated to the public.

And if, over time, evidence accumulates that existing carbon-pricing policies haven't worked as theory — and experience — suggests they will, governments should be prepared to revisit or redesign these policies as necessary.

Carbon pricing will be most effective *over time*. Our transition to a low-carbon economy will not occur overnight, but instead gradually, as firms and individuals develop and adopt new technologies. Evaluation and adjustment over time are important, but must also be tempered by patience.

11. References

Section 2

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