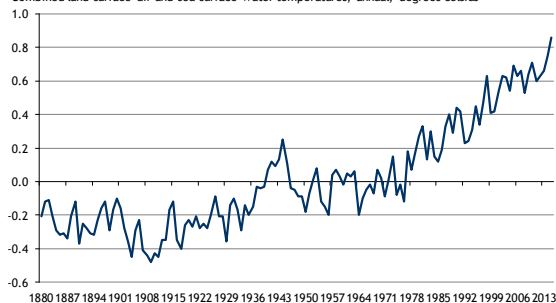


**CURRENT ANALYSIS**

September 2016

**Chart 1: Global temperature deviation from 1951-1980 average**

Combined land-surface air and sea-surface water temperatures, annual, degrees celsius



Source: RBC Economics Research, NASA

**Further action needed on carbon pricing**

- Canada’s annual carbon emissions are lower than prior to the 2008-09 recession, however they remain far higher per capita than the world average and are projected to rise into the foreseeable future (2030).
- More stringent policy is required for Canada to achieve the target of reducing greenhouse gas emissions to 30% below 2005 levels by 2030.
- Establishing a well-designed carbon price in the form of a cap-and-trade system or carbon tax is essential for efficiently reducing emissions over time.
- Some of the key principles for a good carbon pricing system: the price must be stringent; implementation should be gradual; coverage should be broad; and pricing should be integrated with other policies.
- Climate change presents environmental, social and financial challenges to the Canadian and global economy while creating opportunities for innovation and policy action.

Global action to address climate change is gathering pace and scope. During the 2015 United Nations Climate Change Conference in Paris, Canada pledged to reduce its greenhouse gas (GHG) emissions along with 185 other countries who together account for 96% of global emissions<sup>1</sup>. Canada is targeting emission levels 30% below 2005 levels by 2030 and in pursuit of this goal, federal and provincial governments have undertaken a host of regulatory actions and a number of provinces have created carbon pricing systems<sup>2</sup>. While these policies have contributed to lower emissions in recent years, if the goal is to be met further action is needed. Along with regulation and investment in green infrastructure and innovation, a key tool in the policy arsenal is an increasingly stringent and comprehensive carbon price.

**The importance of action on climate change**

Evidence is accumulating that humanity is having a sustained and growing impact on the earth’s climate. According to the Intergovernmental Panel on Climate Change (IPCC), from 1880 to 2012 the average global temperature rose by 0.8°C, or nearly halfway to the 2°C increase that governments have set as a long-run target for the maximum allowable temperature rise (Chart 1)<sup>3</sup>. Moreover, the first half of 2016 was the planet’s warmest half-year on record, with an average temperature 1.3°C warmer than the late nineteenth century. Globally, increasing temperatures have been linked to changes in global precipitation patterns and crop yields, shifting deserts and monsoons, ocean acidification, and more extreme weather events, all of which have a negative impact on the environment, human health and the world economy.

As a northern country, Canada is expected to face particularly large environmental changes as a result of climate change. According to the Canadian Government, the annual average surface air temperature in Canada rose by 1.7°C

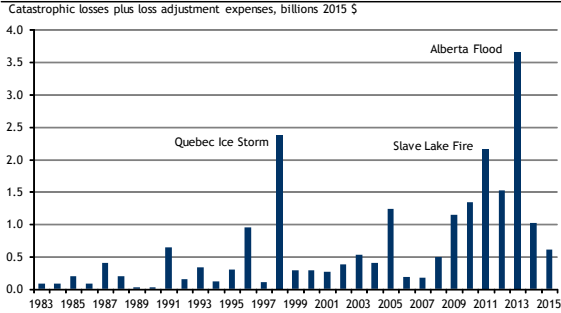
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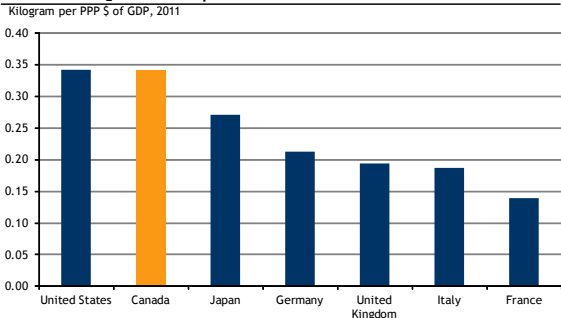
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**Chart 2: Insured catastrophic losses in Canada**



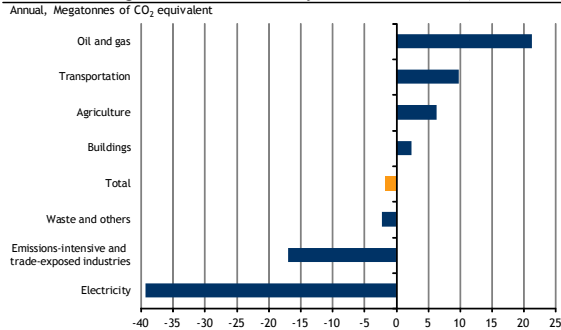
Source: Insurance Bureau of Canada, RBC Economics Research

**Chart 3: CO<sub>2</sub> emissions per dollar of GDP**



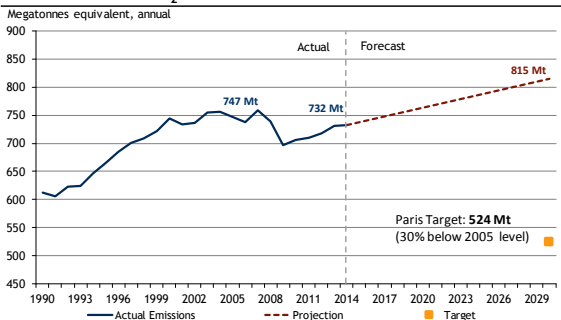
Source: RBC Economics Research, World Bank

**Chart 4: Change in GHG emissions by sector 2000-2014, %**



Source: RBC Economics Research, Environment and Climate Change Canada

**Chart 5: Canada CO<sub>2</sub> Emissions**



\*Including the impact of land use change and forestry  
Source: RBC Economics Research, Environment and Climate Change Canada

from 1948 to 2012, approximately double the global average, and extreme weather events have become more common and costly<sup>4</sup>. Insured catastrophic losses have increased rapidly since the 1980s and this increase has been linked to climate change (Chart 2)<sup>5</sup>.

**Canada’s carbon footprint now and in the future**

In 2014 Canada emitted 732 megatons of carbon dioxide equivalent GHGs into the atmosphere<sup>6</sup>. While this represents only a small share of world emissions, Canada’s emissions on a per capita basis are among the world’s highest. Canada’s relatively large carbon footprint is due to its size, climate, and economic structure. In 2014, 12% of Canada’s GHG emissions were associated with heating or cooling buildings and the transportation sector produced a further 23% of total emissions reflecting Canada’s high standard of living, large landmass and low population density. Canada’s resource-based economy is also highly carbon intensive. The oil and gas sector generates 26% of overall emissions and a further 10% of emissions are produced by trade-exposed and emissions-intensive sectors such as mining, smelting and refining, cement, and chemical production<sup>7</sup>. The upshot is that while the carbon intensity of Canada’s economy — carbon emissions per dollar of GDP — is low relative to many emerging markets, it is among the highest in the industrialized world (Chart 3).

In an effort to contain and ultimately reverse emissions growth, provincial and federal governments have introduced a mix of regulatory measures and carbon pricing systems. At the federal level these included setting standards for vehicles and electricity production and spending on renewable energy and clean innovation. Provincial actions have involved mandating an increased share of electricity generation from renewables and, in several jurisdictions, putting a price on carbon. These actions have yielded substantial reductions in emissions, particularly in the electricity sector. Between 2003 and 2014, policy action by the Ontario government shuttered the province’s coal-fired electricity units. This contributed to a large decline in Canada-wide GHG emissions from coal-fired electricity generation (Chart 4)<sup>8</sup>. The 2008-09 recession also contributed to reduced emissions from most sectors as economic activity declined. Especially hard hit was the emission-intensive and trade-exposed sector which includes many manufacturing industries.

The result of regulatory action and the recession was a drop in emissions in the late 2000s, however, emissions began to grow in the years following and according to a 2014 Government of Canada projection, overall GHG emissions will rise by 9% by 2030 relative to their 2005 levels, a far cry from the Paris target (Chart 5)<sup>9</sup>. The drivers of renewed growth in GHG emissions are principally the oil and gas sector, where emissions continue to grow due to rising production from the oil sands, and buildings as population growth drives increases in the construction of housing and commercial structures. Meeting GHG emission targets will require further action by government to reduce emissions and an increased reliance on well-designed carbon pricing systems is the least costly way to induce renewed emission declines.



## Principles for a good carbon pricing system

The essence of a carbon pricing system is that firms and households pay for the environmental consequences of their GHG emissions. A carbon tax or a cap-and-trade system introduces a price on GHG emissions leading firms and households to substitute away from carbon-intensive goods and services and incentivizes innovation to make existing economic activity less carbon intensive. The advantage of a carbon pricing system over regulation is that it leverages the market to give firms and households maximum leeway to reduce carbon emissions at the lowest cost while also raising revenues for governments. These revenues in turn can be used to foster innovation toward green technology, lower taxes, reduce debt or boost social spending.

**Table 1: Carbon Pricing Systems**

### Carbon Tax

A carbon tax is a charge on the volume of GHG emissions typically levied per tonne of CO<sub>2</sub> equivalent. The advantages of a carbon tax are that it is relatively easy to implement and that the price of GHG emissions is known giving firms and households certainty in their planning decisions and providing an ongoing incentive to innovate and reduce emissions.

### Cap-and-Trade

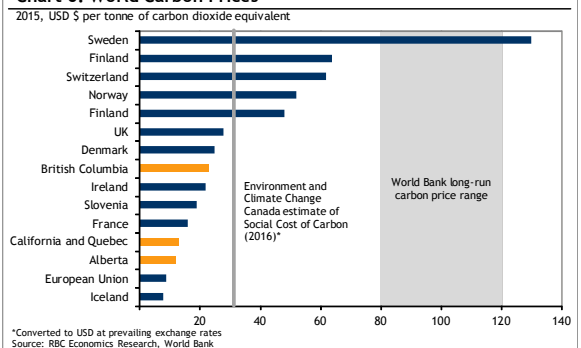
A cap-and-trade, or emissions trading, system sets a limit on the amount of GHG emissions by requiring covered emitters to buy emission allowances of which there is a fixed supply. These allowances are auctioned to emitters who can trade them in a market which establishes the carbon price. A cap-and-trade system delivers certainty in terms of emissions produced, but depending on auction results may entail a volatile carbon price and uncertainty in government revenues. Typically a cap-and-trade system includes a price floor on allowances to limit price volatility and, at least initially, a large share of freely given allowances to limit the burden on industry.

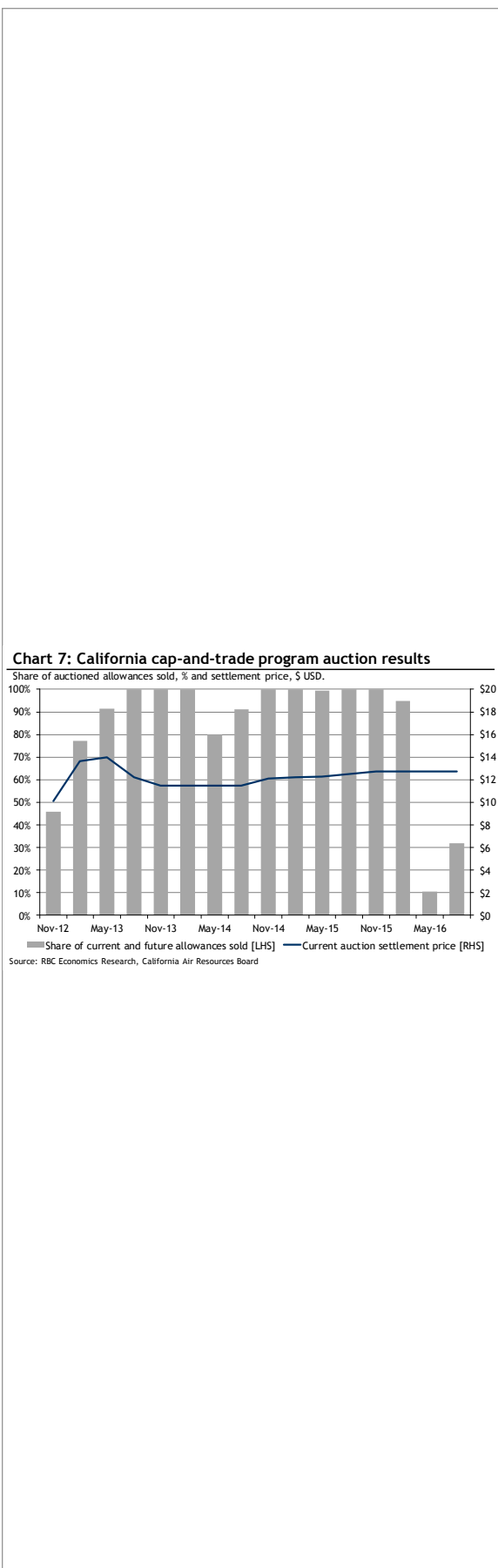
While both cap-and-trade and carbon tax systems can effectively set a price for carbon and incentivize emissions reductions, the more important factor is how the system is designed. In general, a carbon pricing system should incorporate the following principles<sup>10</sup>.

### 1. The carbon price must be stringent

The first goal of a carbon pricing system should be to ensure that the long-run cost of carbon is high enough to incentivize emission reductions and spur long-term investments in clean technologies. For a cap-and-trade system, this means a binding and diminishing number of emission allowances over time and for a carbon tax it means a gradually escalating price until it equals the social cost of carbon emissions. A sufficiently stringent carbon price is a by-product of a cap-and-trade system whereas the appropriate carbon tax rate must be set by policy makers, though theoretically under both systems the required price should be similar. Estimates of this price vary, but Environment and Climate Change Canada has estimated that the social cost of carbon — the monetary cost of the global damage expected from climate change by an additional tonne of CO<sub>2</sub> emissions in a given year — is C\$41 per tonne in 2016<sup>11</sup>. The World Bank has calculated that a long-run global average carbon price of between \$80USD and \$120USD per tonne would be needed to induce the GHG reductions needed to cap the rise in global temperature at less than 2°C<sup>12</sup>. To date, only Sweden has adopted a carbon price that meets this long-run criteria and most jurisdictions that price carbon fall well short of it (Chart 6).

**Chart 6: World Carbon Prices**





## 2. Implementation should be gradual

Carbon pricing systems should be implemented gradually with well telegraphed phase-in periods to give firms and households time to adapt. Thereafter, carbon pricing systems should be permanent so firms and households incorporate the cost of carbon when making long-run investment and planning decisions. Long-term price visibility also helps to de-risk investments in clean technologies and innovation. Most global pricing systems have tended to operate this way. For example, when British Columbia’s carbon tax was implemented in 2008, the initial carbon tax was set at \$10 per tonne and increased by \$5 per tonne annually until it reached \$30 per tonne in 2012<sup>13</sup>.

Under a cap-and-trade system, the price of carbon is set by the market and can be volatile. This volatility inhibits long-term planning, can disrupt incentives to innovate cleaner technologies, and creates uncertainty in revenues raised. To mitigate this risk, cap-and-trade systems have tended to impose a minimum price on allowances. In California, the minimum allowance price was set at \$10 per tonne in 2012 and increases at a rate of 5% plus inflation annually. This price floor ensured that prices did not fall after the May 2016 auction at which only 11% of available allowances were purchased (Chart 7)<sup>14</sup>.

## 3. Coverage should be as broad as possible

Carbon pricing systems should cover as large a share of economy-wide GHG emissions as possible so market participants can identify the least costly ways of reducing emissions and to avoid policy privileging certain industries or sectors. In Canada, full and equal coverage of all emissions is frustrated by the large trade-exposed and emissions-intensive sector, that is, industries which would be put at a significant competitive disadvantage relative to firms in other jurisdictions if a carbon price was created. The risk is that policy will create carbon ‘leakage’ as firms either lose market share to jurisdictions which lack a carbon price, or relocate to those jurisdictions, resulting in a muted impact on global emissions while costing jobs and economic activity. The danger of leakage within Canada is receding as more provinces introduce carbon pricing systems and the federal government considers a nation-wide carbon price. However, as carbon prices become more stringent over time, the need to devise policies to maintain the global economic competitiveness of these sectors will become more acute. While mitigating this risk typically entails carving out exemptions to carbon pricing systems, these should be minimal and limited in duration. The larger the carve outs, the less effective the pricing system will be in inducing the needed emissions reductions. Free allowances and carve outs can result in firms locking in anticompetitive advantages over rivals and entrants.

## 4. It should be integrated with other policy

A carbon price is not a silver bullet and it should be a part of a larger climate change policy which includes targeted regulation and investments in infrastructure and innovation. Regulatory action can compliment a carbon price by targeting high-emission sectors and by expanding the reach of climate change policy beyond the scope of carbon pricing. Much of Canada’s pro-

gress in reducing emissions thus far stems from the shuttering of coal-fired power plants highlighting the effectiveness of regulatory action. Moreover, while pricing GHG emissions may be feasible in a broad-based way, some emissions are difficult to capture under a pricing system and a regulatory approach may be superior<sup>15</sup>.

A carbon price can compliment government policies to foster innovation and R&D through tax credits, intellectual property protections, and direct investment in technology<sup>16</sup>. A well-designed carbon price will induce demand for technologies to reduce GHG emissions as firms and households seek to avoid paying the carbon price<sup>17</sup>. This creates incentives for companies to invest in climate-oriented R&D. However, policies to support R&D such as tax credits or direct spending, especially in primary research or in areas not directly tied to emission mitigation, can unlock additional opportunities for technological breakthroughs which may be missed otherwise.

### Carbon pricing creates opportunities for firms and governments

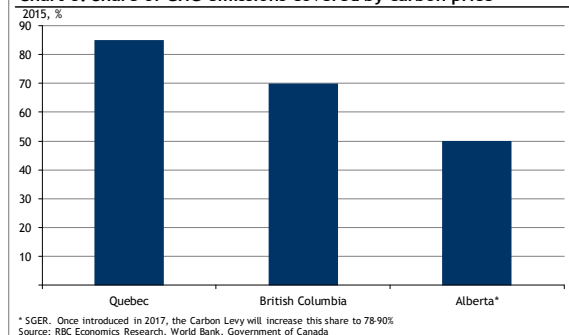
As carbon prices are introduced and become more stringent they will incentivize firms to develop and deploy GHG-reducing technology. The federal government has created further inducements in the form of tax measures and has spent over \$10 billion since 2006 improving energy efficiency, developing clean energy technologies and green infrastructure, and producing cleaner energy and fuels<sup>18</sup>. As carbon pricing gathers pace globally, the market for GHG-reducing technologies is expected to grow rapidly creating export opportunities for firms which successfully develop and commercialize clean technologies.

Carbon pricing also presents opportunities to governments who can use the revenues raised from a carbon pricing system to pursue social spending, reduce taxes, repay debts, or invest in infrastructure. When deciding how to recycle revenues, policy makers should be conscious of the tendency for carbon pricing systems to be regressive given that the lower your income the greater the share of your household budget will be spent on high-carbon products like gasoline and home heating fuels. The imposition of a carbon price without compensating reductions in taxes or increased social spending may impose the highest costs on those with the lowest incomes.

### Where carbon pricing stands today and where it is going next

To date, action on carbon pricing in Canada has come from the provinces. Alberta's carbon pricing system was introduced in 2007 and is called the Specified Gas Emitters Regulation (SGER). Unlike a carbon tax or cap-and-trade system, the SGER aims to reduce the carbon intensity (emissions per unit of output) of large regulated emitters. In 2015, the regulation was made more stringent by requiring greater efficiency gains to avoid fees. British Columbia's carbon tax sets the highest carbon price in Canada at \$30 per tonne. By levying the tax on fuels, the tax's coverage is broad based and it has been made revenue neutral by matching the tax's revenues with equal or larger reductions in other taxes. In its 2016 budget, the government of British Columbia forecast revenues of \$1.2 billion from its carbon tax for fiscal 2015/16 and \$1.7 billion in offsetting reductions in personal and business taxes<sup>19</sup>. Quebec implemented its cap-and-trade system in 2013 and linked it

Chart 8: Share of GHG emissions covered by carbon price



to California's system in 2014 as part of the Western Climate Initiative. It was expanded in 2015 to cover fuels giving it the widest coverage of Canada's carbon pricing systems (Chart 8). While initially industrial emitters exposed to foreign competition received many of their allowances free of charge to prevent carbon leakage, the number of these free allowances is set to decline over time to encourage additional emission reductions<sup>20</sup>. Ontario's Climate Action Plan launched in June 2016 and included a cap-and-trade system covering facilities generating over 25,000 tonnes of GHGs per year. As a result of these policies, over 80% of Canada's population and GDP are in provinces covered by a carbon pricing system.

Further action to price carbon is expected by governments in the coming years. In 2015, Manitoba joined the Western Climate Initiative and signaled their intention to create cap-and-trade system. Ontario plans to link their cap-and-trade system to Quebec and California and to collaborate on reporting mechanisms. Starting in 2017, Alberta plans to implement a carbon levy on fuels which will bring the vast majority of the province's emissions under a carbon pricing system<sup>21</sup>. Carbon pricing in Canada has rapidly expanded to cover a large share of the national economy, but to achieve needed GHG reductions these programs must become more stringent. To encourage the provinces to develop or expand their carbon prices, the federal government intends to establish a nationwide floor on carbon prices. When implementing or expanding carbon pricing systems, federal and provincial policy makers should ensure they are sufficiently stringent to induce GHG emission reductions, implemented gradually to give firms and households time to adapt, cover a wide share of GHG emissions while minimizing emission leakage, fairly distribute the burden of compliance and minimize the impacts on the most vulnerable, and supplement the system with a wider climate change policy.

## End Notes

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14. California cap-and-trade program (2015) "Summary of Joint Auction Settlement Prices and Results".
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