Beyond bromides: It's time to implement climate change policies that work

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This brief proposes a package of federal policy proposals for driving a low carbon economy and meeting the Government of Canada's international commitments to reduce greenhouse gas emissions.

The proposals address energy use and greenhouse gases from transportation, the built environment and from federal government activities. Additionally, we propose practical approaches for fostering energy self-sufficiency in Indigenous communities, targeting federal infrastructure investments for reducing carbon intensity and we discuss the need for a pan-Canadian electrical grid as means to increasing the rate of uptake of renewable energy across Canada.

We also provide a proposal for the establishment of a Low Carbon Economy Trust (LCET) that will coordinate with, and supplement existing Canadian institutions in order to focus Canada's collective energies to drive technological, behavioural, and systems innovation for the reduction of greenhouse gas emissions and adaptation to climate change.

The proposed policies proposed in this brief have been created with the following principles in mind:

- Are fully within the federal government's jurisdiction;
- Are standards and regulations based —legally binding rules rather than voluntary measures;
- Are outcomes based and technologically neutral. They focus on setting performance standards and objectives, leaving regulated parties to determine how those standards and objectives are to be met;
- Implicitly rather than explicitly price carbon. Each measure will require behavioral or technological change in order for the regulated party to become compliant. These changes have a cost which is essentially the price of achieving the standard or meeting the requirement of the regulation – an implicit carbon price;
- Are economically efficient:
    - They result in real reductions in greenhouse gases;
    - They are progressive in that they do not penalize those who can least afford it;
    - The minimize deadweight losses caused by free-riders;
    - They drive long-term innovation which reduces the cost of compliance; offers longer-term cost savings; and induces broader economic development;
- Are modeled on policies adopted in other jurisdictions that have proven to be effective and economically efficient;
- Support, complement, and enhance existing provincial policies and measures to address climate change;
- Are administratively feasible and build long-term knowledge and institutional capacity within the federal government to identify, evaluate and implement additional policies and measures to reduce greenhouse gas emissions and mitigate climate change.

Readers will note that we offer limited recommendations regarding greenhouse gas emissions from the oil, gas, and coal sectors, for the following reasons,.

Where the federal government adopts policies that drive low carbon alternatives in key energy consuming sectors we expect a material reduction in the aggregate demand for fossil fuels. That is to say, with energy consumptive sectors on low carbon energy trajectories, the reduced demand for fossil fuels obviates the need for additional regulations in the oil and gas sector.[1]

Our views in this regard should be uncontroversial. Consider the findings of the Government of Canada's own Policy Horizons think-tank:

> The world's energy landscape is transforming rapidly as the cost of renewable-based electricity, particularly from wind and solar, declines to become competitive with or lower than the price of electricity generated by fossil fuel and nuclear power plants. Power utilities and companies are increasingly choosing to increase their generating capacity using renewable sources rather than fossil power as the perceived problems of intermittent supply from solar and wind are addressed with better supply and demand management using a combination of integrated smart grids and battery storage. The price of batteries is falling precipitously leading to their application at local and grid-level scales in the power supply system as well as facilitating significant electrification of transportation. The shift to an electricity-dominated global energy mix will be accelerated as decreasing costs combine with increasing government and private sector concerns over climate change, energy security and air pollution, particularly in developing countries where the need for additional energy capacity is greatest. In combination, these drivers could lead to renewable-sourced electricity replacing fossil fuels as the dominant form of primary energy used in the global economy for most industrial, commercial and personal activity[2].

With regard to exports of fossil fuels, ever since Canada's ratification of the Kyoto Protocol it has repeatedly tried to position natural gas as a low carbon substitute for coal and as such, gas exports as a legitimate GHG mitigation strategy. On the world stage this positioning has been repeatedly rebuffed. Rather, we propose that Canada apply any national price on carbon to all fossil energy produced in Canada whether for domestic use or export. We also propose that Canada should enter into bilateral agreements with importing countries on the GHG emissions impact of imported fuels from Canada. Where these can be demonstrated to displace more carbon intensive fuels, there would be the opportunity to transfer mitigation credits to Canada, in exchange for rebates on carbon prices levied on exported fuels.

With respect to coal, we recommend that in light of Ontario's coal shut-down and Alberta's recent requirement for coal fired power plants to be emissions free by 2030 (or failing that to shut down), current federal coal regulations should be amended to establish the same requirement across Canada (a move that would only affect four coal fired power plants[3].

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[1] That is beyond controlling process emissions (e.g. fugitive methane) from oil and gas producing activities.

[2] Executive Summary: *Canada In a Changing Global Energy Landscape*. March 3. 2016 Policy Horizons Canada (Horizons)

[3] This federally mandated phase-out would need to be financially supported by the federal government in order to minimize the economic dislocations associated with transitioning away from coal-fired power produced in Point Aconi and Trenton Nova Scotia, Belledune, New Brunswick and Shand, Saskatchewan.

In the next section we briefly expand on the concept of implicit carbon pricing and discuss the relationship between conventional carbon pricing (e.g. carbon taxes and cap and trade mechanisms) and performance-based regulation.

More than a one-trick pony: The federal role in reducing greenhouse gases

The social cost of carbon and meaningful carbon prices

By convention, an economically efficient carbon tax is set at the social cost of carbon (SCC) – that is, a tax that approximates the monetized value of the expected future damages associated with emitting one tonne of greenhouse gas emissions in the context of technically achievable reductions.

While US Government currently uses a SCC value of $37/tonne CO_2e this is increasingly considered to be low. More recent assessments propose much higher SCC ranging from $55/tonne CO_2e[4] to $900/tonne CO_2e[5]. These higher estimates are provided in the context of significant uncertainty regarding the potentially catastrophic future impacts of climate change and the increasing rate of technological innovation in low carbon energy [6].

Any effort to impose a pan-Canadian carbon tax in excess of $55/tonne CO_2e in the short term will be highly contentious and strongly opposed. Moreover, the "recycling" of revenues associated with such a carbon tax will be fraught with its own complex mix of economic and political considerations and the potential for government induced market failures[7].

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[4] Foley, Duncan K. and Rezai, Armon and Taylor, Lance (2013) The social cost of carbon emissions: Seven propositions. Economics Letters, 121 (1). pp. 90-97. ISSN 0165-1765

[5] Frank Ackerman and Elizabeth A. Stanton (2012). Climate Risks and Carbon Prices: Revising the Social Cost of Carbon. *Economics: The Open-Access, Open-Assessment E-Journal*, Vol. 6, 2012-10. http://dx.doi.org/10.5018/economics-ejournal.ja.2012-10

[6] The SCC is a function of the discount rate that is a percentage applied to the value of damages incurred in the future to provide their value in present dollar terms. $1B in climate change damage incurred 100 years from now has a present value of $607M at a 1% discount rate. The same damage has a value of $8M at a 5% discount rate. The discount rate is the source of subjectivity as it is essentially a value statement about the benefit of avoiding the release of greenhouse gases in the future.

[7] As an example, the policy experiment of subsidies for particular technologies and energy efficiency practices has for the most part been an abject failure. Consider subsidies for home energy efficiency improvements where it has been found that, "…around 70 percent of expenditures under the Canadian subsidy and tax credit programs represented free riding…the cost effectiveness of the programs in terms of greenhouse gas reduced was at least $100/t CO2, and potentially as high as $800/t CO2, depending on the assumptions made. Further, we find that a substantial majority of the grants were received by middle- and high- income households, such that the grant had a regressive effect on the distribution of income. We conclude that such grants are not an optimal way to improve residential energy efficiency." Rivers, N., Shiell, L. July 2014. *Free-Riding on Energy Efficiency Subsidies: the Case of Natural Gas Furnaces in Canada*. Department of Economics Faculty of Social Sciences University of Ottawa

Given that Canada's largest jurisdictions have implemented some form of carbon pricing through either carbon taxes or cap and trade mechanisms (albeit with resulting carbon prices that are well below even the most conservative estimates of the SCC), the federal government must play a critical complementary role in setting policies that reduce emissions as rapidly, cost-effectively, and equitably as possible.

These policies primarily involve the use of regulatory standards to drive technological innovation, which we discuss next.

Regulatory standards and the shadow carbon prices they cast

> *Experts show that the carbon pricing policy in California, which Quebec has now joined, will have almost no effect by 2020. Ninety percent of that state's current and projected reductions are attributed to innovative, flexible regulations on electricity, fuels, vehicles, buildings, appliances, equipment and land use. Even Scandinavian countries, famous for two decades of carbon taxes, mostly used regulations to reduce emissions. For example, the greatest CO2 reductions in Sweden happened when publicly owned district heat providers were forced to switch fuels.*
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> *Want an effective climate policy? Heed the evidence*
> Mark Jaccard, Policy Options
> February 02, 2016

Standards such as those for energy efficiency and carbon intensity of products ranging from lighting and appliances to buildings and fuels put an implicit "shadow price" on carbon – they involve regulated entities bearing costs to meet regulatory standards.

Shadow prices borne of regulatory standards are not static – in competitive markets they decrease over time. As regulated individuals seek opportunities to reduce the costs of meeting the standards, their efforts spur investments in efficiency, innovation and new technology, and drive changes in behavior and decision-making.

Additionally, while the shadow prices associated with these policies may be initially much higher than those that might be experienced under an explicit carbon tax or under cap and trade, they do not bear the public perception challenges of policies that put an explicit price on carbon

As an example, the phase out of coal fired power generation and switch to gas fired base-load generation in Ontario has an estimated effective shadow price of \$140-\$200/tonne CO_2e reduced[8]. Had reducing toxic pollutants and greenhouses from coal fired power generation in Ontario been framed as requiring a new environmental tax on coal fired power rather than as its outright phase out, it is likely that Ontario would still have coal fired powered generation today.

In light of the foregoing discussion, the policy proposals that follow build on this view of the federal government as a catalyst for innovation through the setting of performance standards.

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[8] In 2007 the Ontario Power Authority estimated that switching from coal to natural gas for base-load power generation in Ontario would add anywhere from \$0.07-\$0.10/kWh to the \$0.05/kWh associated with coal fired base load power generation. *What Is Happening to Ontario Electricity Prices?* Sustainable Prosperity: Background paper. Donald N. Dewees Department of Economics, University of Toronto March 2012.

Given that coal power generates about 1 tonne CO_2e /MWh and natural half that (.49 tonnes/MWh) the switch to gas from coal has an effective shadow price of \$140-\$200/tonne CO_2e reduced.

Moving to nearly zero energy buildings

Buildings are responsible for 12% (86Mt) of Canada's greenhouse gas emissions.[9] Yet even today new construction in Canada is generally not very energy efficient. For example, the average Canadian home uses 170 kWh/m2/year for heating and cooling. New homes, built to meet slightly stronger building codes, use 150 kWh/m2/year. An Energy Star home, built to meet voluntary energy efficiency guidelines, uses 100 kWh/m2/year.

In contrast, to have a building certified as a passive house (a super-efficient voluntary standard) requires a maximum energy usage of 15 kWh/m2/year. In other words, a passive house uses 90 percent less energy for heating and cooling than a regular, newly constructed Canadian home.

Improving the energy efficiency of Canadian homes offers an opportunity to both reduce greenhouse gas emissions while potentially offering homeowners financial savings.

Other jurisdictions, including the European Union and California have recently upgraded building codes to require advanced energy efficiency in new construction, known as "nearly zero energy" and "zero net energy" respectively. These changes herald a critical turning point in the future of construction. Canada's current Model National Building Code lags far behind these global leaders (though the City of Vancouver recently committed to emulating the EU and California standards).

European Union

The EU Energy Performance of Buildings Directive (EPBD - 2002/91/EC) is the main European legislative instrument for improving the energy efficiency of Europe's building stock.[10] This directive was updated in 2010, to impose the following requirement:[11]

> *"Member States shall ensure that by 31 December 2020 all new buildings are nearly zero-energy buildings; and after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings."*

A nearly zero-energy building will vary by climate region but is defined in Article 2 of the revised EPBD as:

> *"a building that has a very high energy performance …. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby."*[12]

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[9] Environment and Climate Change Canada. 2016. Greenhouse Gas Emissions by Sector, https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=F60DB708-1

[10] European Commission. 2016. Nearly zero energy buildings. https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings/nearly-zero-energy-buildings

[11] Energy Performance of Buildings Directive, updated by Directive 2010/31/EU.

[12] The EPBD stipulates that "The energy performance of a building shall be determined on the basis of the calculated or actual annual energy that is consumed in order to meet the different needs associated with its typical use and shall reflect the heating energy needs and cooling energy needs (energy needed to avoid overheating) to maintain the envisaged temperature conditions of the building, and domestic hot water needs." Annex I, Article 1.

In order to address emissions from existing buildings, the EU's Energy Performance of Buildings Directive also creates a requirement to set minimum energy performance levels when a major renovation takes place, including for building envelope elements that are retrofitted or replaced. Finally, energy performance certificates are to be included in all advertisements for the sale or rental of buildings.

California

California amended its Building Energy Efficiency Standards in 2008 to require that all new residential buildings be Zero Net Energy (ZNE) by 2020, and all new commercial buildings by 2030.[13] As in the EU, the California law also establishes energy efficiency upgrade requirements for buildings that undergo renovations. In 2013 and 2016, California enacted new standards to move incrementally towards the zero net energy targets. The standards established in 2019 will take the final step for residential construction and renovation.[14]

The Economics of Nearly Zero Energy and Zero Net Energy Buildings

Both the EU and California have concluded that current technologies related to energy savings, energy efficiency and renewable energies are sufficient.[15] A study of nearly zero energy buildings in 20 European countries found additional costs of an average 11%.[16] According to the California Energy Commission, the 2016 Building Energy Efficiency Standards will increase the cost of constructing a new home by an average of about $2,700, but will save $7,400 in energy and maintenance costs over 30 years. In other words, when factored into a 30-year mortgage with a 5 percent interest rate, the standards will add about $11 per month for the average home, but will save consumers roughly $31 on monthly heating, cooling, and lighting bills.[17]

The costs of nearly zero energy and zero net energy buildings can be expected to decline over time with economies of scale and construction experience. These advanced, super-efficient construction standards will also:

- Drive investment in innovation throughout the construction supply chain;
- Catalyze improvements in building monitoring and performance measurement (i.e. smart buildings); and
- Contribute to growing demand for small-scale renewables.

[13] California Code of Regulations, Title 24, Part 6.

[14] California Public Utilities Commission. 2016. 2020 Planning and Information for California ZNE Homes. http://www.californiaznehomes.com

[15] Ecofys. 2013. Towards nearly zero-energy buildings. Report prepared for the European Commission. https://ec.europa.eu/energy/sites/ener/files/documents/nzeb_executive_summary.pdf

[16] H. Erhorn and H. Erhorn-Kluttig. 2014. Selected examples of nearly zero-energy buildings. http://www.epbd-ca.eu/wp-content/uploads/2011/05/CT5_Report_Selected_examples_of_NZEBs-final.pdf

[17] http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2016_Building_Energy_Efficiency_Standards_FAQ.pdf

Recommendation

Strengthen Canada's Model National Building Code to:

(1) Incorporate EU/California nearly zero/net zero standards for new construction as of 2025; and
(2) Require mandatory energy efficiency upgrades when renovations are undertaken, as of 2020.

This will provide provincial governments with a model that can be adapted for their legally binding building codes. Action is urgently needed to begin the multi-year process of educating developers, architects, designers, engineers, builders, and suppliers about the impending changes. Financial incentives should be offered to provinces to motivate their early adoption of the revised Model Code. Alternatively, federal funding for energy efficiency retrofit programs could be made contingent upon provincial adoption of the revised Model Code.

In order to ensure that the transition to a nearly zero/net zero building code, all new federal and federally financed building construction should be required to meet these standards as of 2018 (e.g. social housing, housing on reserves). This would assist in the education, training, and supply chain development necessary to meet the new standards. It would also provide a critical learning experience to identify and overcome implementation challenges.

Reducing greenhouse gases from transportation

Transportation is responsible for 23% (170 Mt) of Canada's greenhouse gas emissions.[18] Reducing these emissions will require a portfolio of government regulations and policies beyond those already in place. In particular, Canada needs to drive a shift towards low emission and zero emission transport modes, increase the use of cleaner fuels, invest in public transit, and motivate denser, mixed-use communities.

Other jurisdictions, including the European Union and California, have stronger regulatory and fiscal instruments in place to spur the shift towards low and zero emission vehicles. Building on best practices elsewhere, we propose a number of policy measures that in concert lay the foundation for a dramatic lowering of the transportation sector's GHG emissions and other environmental impacts within a decade.

Low Carbon Fuel Standard (LCFS)

Low carbon fuel standards were initially adopted to support biofuels production. Corn ethanol, first used as an additive to gasoline in order to battle urban ozone problems, was rebranded as a low carbon fuel. Biodiesel from soy soon joined the portfolio of fuels designated as low carbon. This has led to a continuing confusion between renewable fuels and low carbon fuels[19].

[18] Environment and Climate Change Canada. 2016. Greenhouse Gas Emissions by Sector, https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=F60DB708-1

[19] Unfortunately, the two are not the same and controversy over the actual lifecycle emissions of these fuels continues. These renewable biofuels range from having no GHG benefits (e.g. North American corn ethanol) to ~50% GHG reduction (e.g. Brazilian sugar-cane ethanol). The production of these first generation biofuels has significant negative impacts on food markets and local ecosystems. Second generation biofuels such as cellulosic ethanol and algal diesel

Rather than arbitrarily categorizing fuels, a LCFS is an intensity target (measured in grams of CO2e per MJ of energy) for fuels, with the benefit of being technology neutral. LCFS needs to be based on lifecycle assessments that have a carefully defined boundary and encompass all steps from production to consumption. LCFS should be defined to be increasingly stringent through time, providing clear signals to fuel producers and vehicle manufacturers for their investments and technology development pathways.

A key benefit of this approach, employed by California and British Columbia, is that it acts like the rising floor of a GHG mitigation policy. As LCFS standards grow tighter, the emission rates of all vehicles fall. This strategy is robust to economic downturns, longer-lived vehicles and falling Vehicle Kilometers Traveled (VKTs). Under all circumstances, the specific emissions associated with transportation of people and goods will fall. Finally, LCFS can begin to address the thorny issue of how to reduce emissions from air and maritime transport. Neither is adequately regulated under current climate policies, but ultimately will need to be controlled.

Zero Emission Vehicle Mandate

Since 1990, California has required vehicle manufacturers and retailers to achieve rising market shares for zero-emission vehicles (ZEVs), partial-zero-emission vehicles (PZEVs), and ultra-low emission vehicles (ULEVs).[20] The original targets were 2% of vehicles sold in 1998 to be ZEVs and 10% in 2003. Revisions to the rules over the years have adjusted the targets and created credits for PZEVs and ULEVs. California's performance-based regulation does not dictate a particular technology, such as electric, hydrogen fuel cell, or biofuel. Those choices are up to manufacturers, retailers, and consumers. Manufacturers are allowed to trade amongst themselves to meet the target, leading to more economically efficient outcomes.[21] Implementation of the regulation has been flexible, increasing the PZEV/ULEV targets in exchange for lowering the ZEV targets. At least nine other states have adopted California's ZEV regulations (Oregon, Connecticut, Maryland, Massachusetts, Maryland, New Jersey, New York, Rhode Island, and Vermont).

Today the rules require manufacturers to sell certain numbers of zero emission vehicles, hybrids (conventional and plug-in), and ultra-clean gasoline vehicles. In 2016, the California targets are 3% ZEV and 12% PZEV/ULEV. By 2025, 15% of new vehicle sales in 2025 are to be ZEVs. California's ZEV mandate has reduced GHG emissions, improved air quality, and spurred technological innovation and improvements, and will continue to do so in the years ahead.[22] California leads the US in clean vehicle innovation, as measured by new patents secured.[23]

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could potentially lower lifecycle GHG emissions without adverse impacts on food availability or ecosystems. However, these technologies are not yet ready for widespread commercialization.

[20] California Air Resources Board. 2016. http://www.arb.ca.gov/msprog/zevprog/zevprog.htm

[21] M. Jaccard. 2016. "Effective climate change regulation: Let's transform Canadian cars" Policy Options, http://policyoptions.irpp.org/magazines/may-2016/effective-climate-change-regulation-lets-transform-canadian-cars/

[22] ICF International. 2016. Half the Oil: Pathways to reduce Petroleum Use on the West Coast. http://www.ucsusa.org/sites/default/files/attach/2016/01/ICF-Half-the-Oil-CA-WA-OR.pdf

[23] Union of Concerned Scientists. 2014. Driving Progress, Fueling Savings. http://www.ucsusa.org/sites/default/files/attach/2014/09/Driving%20Progress%20Fueling%20Change.pdf

A recent analysis by Mark Jaccard's research group at Simon Fraser University indicated that a similar ZEV/PZEV/ULEV standard in Canada requiring vehicle manufacturers and retailers to achieve market share targets of 10% by 2020 and 70% by 2030 would reduce annual emissions from this sector by 40%.[24]

Quebec recently introduced legislation that will create ZEV requirements that appear to be similar to the California approach, with manufacturers required to meet quotas or purchase credits.[25] Media reports indicate that Ontario is also planning to introduce some form of ZEV program. A national approach would offer the benefits of consistency and certainty and would thus be preferable to a patchwork quilt of provincial regulations.

Vehicle Excise Tax Fee-bate Program

The costs of PZEV and ZEV vehicles are higher than the costs of conventional gas and diesel burning vehicles. This has limited the market share of these vehicles, despite sporadic government subsidies intended to boost sales. A more systematic approach is needed.

Dozens of European countries, the US, and Canada employ a vehicle excise tax to encourage sales of more fuel efficient vehicles – known in the US as the Gas Guzzler tax and in Canada as the Green Levy. While similar in theory, there is a wide gulf in the levels (and effectiveness) of these taxes. Canada's Green Levy, in effect since 2007, is the weakest of them all, with the highest threshold for triggering the tax (>13L/100km) and the lowest tax rate (starting at $1,000 and rising to a maximum of $4,000). The American tax applies to vehicles consuming>10.5L/100 km ($US 1,000) and rises to a maximum of $US 7,700 (fuel consumption >18.8L/100 km).

By comparison, European vehicle taxes begin at higher fuel efficiency thresholds and escalate much more rapidly to discourage the sale of new high GHG emitting vehicles.[26] This is a key step towards reducing transport sector emissions in the long run. More than 20 European countries levy vehicle taxes based on the cars' CO2 emissions or fuel efficiency including: Austria, Belgium, Croatia, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Latvia, Luxembourg, Malta, the Netherlands, Norway, Portugal, Romania, Slovenia, Spain, Sweden and the United Kingdom. Even the European automobile manufacturers have endorsed the trend towards CO2-related car taxation.[27] In Norway and the Netherlands, the excise tax for a new vehicle that consumes >12L/100km is greater than $50,000. In Finland and Portugal, the tax on such a vehicle would be at least $20,000. A purchaser of this car in the United States would pay US$1,700 under the Gas Guzzler Tax, while Canada's Green Levy would not apply.

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[24] M. Jaccard. Feb 2016 "Want an Effective Climate Policy? Heed the Evidence" Policy Options. http://policyoptions.irpp.org/issues/want-an-effective-climatepolicy-heed-the-evidence/ and May 2016: Effective climate change regulation: Let's transform Canadian cars: http://policyoptions.irpp.org/magazines/may-2016/effective-climate-change-regulation-lets-transform-canadian-cars/

[25] Bill 104, An Act to Increase the Number of Zero-emission Vehicles in Quebec in Order to Reduce Greenhouse Gas and Other Pollutant Emissions.

[26] Organisation for Economic Cooperation and Development. 2014. Comparisons of CO2-Related Tax Rate Differentiation in Motor Vehicle Taxes (Paris: OECD, 2014).

[27] European Automobile Manufacturer's Association. 2015. Overview of CO2-based Motor Vehicle Taxes in the EU. http://www.acea.be/publications/article/overview-of-co2-based-motor-vehicle-taxes-in-the-eu

France employs a fee-bate system based on carbon emissions. When a new vehicle's CO2 emissions exceed 130 g/km, a graduated fee is paid to a maximum of €8,000. A discount is granted for the purchase of vehicles when CO2 emissions are 110 g/km or less, with a maximum rebate of €6,300 (20 g/km or less). An additional bonus of €200 is granted when a vehicle at least 15 years old is scrapped.[28]

It is clear from the preceding comparisons that the Green Levy should be modified to be more effective. A fee-bate system—similar to that employed by France—could be designed to offer the optimal combination of effectiveness, efficiency, and equity. A key component is providing incentives to both manufacturers and consumers to return older vehicles to certified recycling programs.

Public Transit and Car-sharing

It has long been established that the presence of a reliable and efficient public transit system can dramatically reduce private use of vehicles. Public transit quality of service depends on urban density and high adoption rates. The former is the domain of municipal planners, but the latter can be encouraged through expanding the current tax regulations to allow all public transit fees to be expensed. There is a way for the federal government to influence density—by using it as a criterion for the allocation of federal infrastructure dollars. Just as in 2005-2006 Ottawa required municipalities to have sustainability plans in order to qualify for a share of the gas tax, in 2016 Ottawa could require municipalities to establish fixed urban boundaries and densification strategies in order to qualify for green infrastructure funding.

The emergence of car-sharing services has offered a new mode of public transportation in urban areas. Car-sharing demonstrably reduces personal trip distances, as well as reducing vehicle ownership. Furthermore, it is estimated that the intrinsic characteristics of car-sharing vehicles (newer, more efficient, right sized) allow the same trips to be completed with an average of 30% less GHG emissions compared to the average of the Canadian fleet of personal vehicles. Membership fees for car-sharing should also be tax deductible.

Trucking, Rail, Shipping, and Aviation

Trucking, shipping, aviation, and rail services are the enablers of trade and unification of the Canadian market. By their very nature, the fleet of trailer tractors, ships, planes, and locomotives is robust and long-lasting. This has led to a large gap between the achieved GHG efficiency of the fleet and the performance of today's commercially available models. The barrier to investment in these new vehicles is the company balance sheet. Heavy duty vehicles of all types able to meet pre-defined lifecycle tailpipe emissions per tonne-km of service should be classified as a "current expense" rather than a "capital expense" for CRA tax purposes.

The turnover of the commercial on-road, off-road, shipping, aviation, and rail fleets of Canada will release a large number of vehicles from service here. A federal inspection program can be used to ensure high-emitters are scrapped and well-maintained vehicles are released for sale in secondary industrial markets. This fleet of vehicles will perform far better than those in operation in most developing countries. The program will thereby improve GHG and environmental impacts both in Canada and abroad.

[28] European Automobile Manufacturer's Association. 2015. Overview of CO2-based Motor Vehicle Taxes in the EU. http://www.acea.be/publications/article/overview-of-co2-based-motor-vehicle-taxes-in-the-eu

The policy could target annually increasing fraction of registered vehicles to meet the stipulated service GHG efficiency. This regulation can then be revised in a decade to reflect the best available technology at that time.

Recommendations

Five priority actions are recommended to reduce GHG emissions from the transport sector include:

(1) Establishing a low carbon fuel standard
(2) Introducing national ZEV/PZEV/ULEV regulations for light duty vehicles to build on the recent ZEV initiatives in Ontario and Quebec;
(3) Adjusting Canada's Green Levy to provide a fee-bate system wherein excise taxes on inefficient vehicles subsidize the purchase of zero emission and low emission vehicles;
(4) Expanding tax incentives for public transit and offering similar incentives for car-sharing; and,
(5) Providing a tax incentive to accelerate fleet turnover in the trucking, shipping, aviation, and rail industries.

The standards, fees, and policies outlined in this note will need to be carefully crafted to ensure an integrated package. The costs of ZEVs, PZEVs and ULEVs as well as low carbon fuels are expected to decline over time with economies of scale and continued innovation. Using flexible regulations to spur higher market share of low carbon fuels and high efficiency vehicles will also

- Provide economic opportunities for Canadian energy producers and motor vehicle manufacturers to be at the forefront of the global shift towards low carbon transport systems; and
- Contribute to substantial improvements in human and ecosystem health as a result of declining air pollution.

Canada needs more electron pipelines

The cost of renewables is down; the issue is connecting them to demand

As price of wind and solar energy continues to decrease dramatically, the barrier to their increased adoption is not the cost of production[29]. Rather, the challenge is integration of intermittent resources into an existing infrastructure of reliable supply of electricity and a mismatch of when and where supply is available and demand needs to be met. Solving this problem locally would mean massive investment in energy storage and the specter of more hydroelectric dams as backup power. Solving the power production and consumption disconnect nationwide addresses local interconnection concerns while serving four objectives:

a) Reduction of need for hydro-electric dams and avoidance of the associated environmental damage;
b) Increase system resiliency; and

[29] Between 2010 and 2015, the average price per kWh of a utility-scale PV project has dropped from about $0.21 to $0.10/kWh and the total cumulative installed solar power (including PV and CSP) in the U.S. today has grown to approximately 28 gigawatts (GW). US DOE SunShot analysis on PV markets and technologies.

c) Increase connectivity between remote energy resources currently stranded far from loci of demand
d) Far deeper penetration of intermittent renewable resources than would be possible on a regional basis.

A High Voltage DC (HVDC) transmission system for Canada

A federally sponsored High Voltage DC (HVDC) transmission system would span the country allowing far greater penetration of intermittent supply by allowing integration of supply across Canada. It would also dramatically reduce the effective distance from any resource to demand centres, reduce or eliminate the need for storage of intermittent local supply while facilitating private investment in renewables by improving market liquidity by allowing delivery of power on an as produced basis.

The role of the Federal government in fostering this connectivity is to invest in the long-term greening of the nation's electricity infrastructure. An HVDC grid spanning the nation would cost around $10 B and serve as the foundation of an electricity market that integrates what is a patchwork of generation and distribution systems across Canada into an integrated system.

This grid will increase the inherent value of existing subsections of the grid that are already of great environmental and economic value. Consider that in the East, linking the Maritime Provinces to Quebec and Labrador's plentiful hydro resources allows elimination of fossil-based power generation and significant savings to electricity consumers in those provinces. Extending the Maritime Link project to New Brunswick (mainly powered by coal, and the main source of PEI's electricity) and PEI (which has diesel and heavy oil peaking plants) could be achieved in short order. Similarly, in the West, linking BC to Alberta facilitates early retirement of Alberta's fossil power plants (potentially decreasing the costs of those retirements to Alberta energy consumers on a delivered energy basis) while permitting BC's hydroelectric dams to serve as backup to far greater wind and solar investments.

Extension of the grid between Saskatchewan and Manitoba permits the former to abandon coal-fired power plants and addresses the barrier to significant wind and solar resources in the Southern Prairies and Hudson's Bay that would have no interconnection (i.e. are stranded) to power consumers otherwise.

A national grid is the foundation for harvesting the substantial renewable energy potential of our country without the need for investment in expensive energy storage or ecologically damaging hydroelectric dams.

Currently, investment in power transmission in Canada are made by a patchwork of provincially regulated private and public companies and utilities. Under this proposal for a Federal sponsored national HVDC grid it is the Federal government that would invest in the grid and would establish a uniform set of rules for interconnection and transmission fees across all provinces which would serve to harmonize the existing distribution patchwork into a pan-Canadian network.

Such an initiative would addresses the regulatory uncertainty associated with widely inconsistent regional regulation. It would overcome the barriers posed by insufficient investment in transmission capacity and inter-provincial conveyance of power that currently pose daunting challenges to investors interested in expanding renewable energy capacity in Canada.

A national grid will improve reliability of supply, smooth out intermittency of renewables, give investments in renewables access to distant markets and accelerate reduction of GHG emissions in Canada.

Federal infrastructure funding as tool to reduce the carbon intensity of Canadian infrastructure, spur innovation and create green jobs

Context: Economic and Climate Policy Coherence

The Liberal election platform promised almost $60 billion in additional infrastructure spending over the next ten years, in three categories:[30]

1. **Public transit** (almost $20 billion)
2. **Green infrastructure** (almost $20 billion): local water and wastewater facilities; clean energy; climate resilient infrastructure including flood mitigation systems; and infrastructure to protect against changing weather
3. **Social infrastructure** (almost $20 billion): affordable housing, seniors' facilities, early learning and child-care, and cultural and recreational infrastructure

At the same time, tackling climate change is a major priority for the Government of Canada. In the simplest of terms, the carbon intensity associated with investments made in each category above will shape the low carbon trajectory of Canada's economy, create green jobs and demonstrate federal leadership on climate policy and action.

In using discretionary and conditional disbursement of monies the Canadian government has a powerful tool for shaping low carbon intensity purchasing decisions.

Such conditional transfer payments have been established as a valid exercise of Ottawa's spending power under s. 91 of the *Constitution Act*, enabling the federal government to achieve policy goals in areas beyond its legislative jurisdiction. Perhaps the most compelling and relevant example is the decision, made by the Liberal government under Prime Minister Paul Martin, to allocate a share of the federal gas tax to municipalities.

The Gas Tax Fund: An Innovative Federal Transfer Payment

The Gas Tax Fund offers a useful demonstration of how federal spending, through the imposition of conditions upon provinces, territories, municipalities, and First Nations, can be used to advance federal policy objectives in areas beyond Ottawa's legislative reach.[31] At the turn of the 21st century, there was growing recognition of the fact that Canadian municipalities lacked

[30] Liberal Party of Canada. 2015. *Real Change: A New Plan for a Strong Middle Class*.

[31] A. Juneau. 2012. "The Federal Gas Tax Transfer to Municipalities: An Insider Perspective." *Public Sector Digest*, Summer 2012: 48-51. http://www.bdo.ca/en/Library/Industries/public-sector/Documents/The-Impact-of-New-Accounting-Standards-on-Canadas-GNPOs.pdf

adequate resources to maintain and improve their infrastructure, while at the same time, the federal government wanted to place greater emphasis on sustainability.[32]

Between 2005 and 2006, the federal government negotiated gas tax agreements with all 13 provinces and territories.[33] There is also a funding envelope for First Nations. The funds are allocated on a per capita basis, with minor tweaks to address the very small populations in PEI and the three northern territories and some minor variations in Nova Scotia and British Columbia. The funds were initially back-end loaded, enabling municipalities to develop solid investment plans (year 1: $600 million, year 2: $600 million, year 3: $800 million, year 4: $1 billion, year 5: $2 billion). Municipalities can pool, bank and borrow against this funding, providing significant financial flexibility.

The federal government's objectives were to design the gas tax transfer in a way that was administratively simple, did not result in provinces clawing back their support, and resulted in additional investments in sustainable infrastructure.

Accountability was also a vital consideration: funding recipients were required to file an annual expenditure report, an outcomes report, and an audit report. The conditions imposed upon the gas tax transfers included:

- A list of eligible types of infrastructure projects;
- A list of eligible expenditures; and
- Mandatory development of integrated community sustainability plans.

The Gas Tax Fund was continued by the Conservative government, and is legislated through to 2024 at close to $2 billion per year (indexed to inflation).[34] However, the strict requirements related to spending on green infrastructure have been undermined, the eligible activities that can receive funds expanded[35] and accountability measures weakened[36].

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[32] When Prime Minister Paul Martin created his first Cabinet in 2003, he appointed John Godfrey as parliamentary secretary for cities. Godfrey was then promoted to Minister of State for Infrastructure and Communities and led the gas tax negotiations for the federal government.

[33] E. Adams and A. Maslove. 2009. "Innovations in Transfer Payments to Local Governments: The Case of the Gas Tax Fund," Canadian Political Science Association 81st Conference, May 28-29, 2009.

[34] See s. 161 of *Keeping Canada's Economy and Jobs Growing Act*
161. On the requisition of the Minister set out in Schedule I.1 of the *Financial Administration Act* with respect to the Office of Infrastructure of Canada, there may be paid out of the Consolidated Revenue Fund for each fiscal year beginning on or after April 1, 2014, in accordance with the terms and conditions approved by the Treasury Board, a sum of not more than $2,000,000,000 to provinces, territories, municipalities, municipal associations, provincial, territorial and municipal entities and First Nations for the purpose of municipal, regional and First Nations infrastructure.

[35] Originally, eligibility was limited to public transit, wastewater infrastructure, drinking water, solid waste management, community energy systems, and local roads and bridges. Due to changes introduced by the Harper government, communities are able to spend the Gas Tax Funds on the original six categories plus a sweeping range of projects, many of which have no connection to environmental sustainability:

-capacity building
-highways
-local and regional airports
-short-line rail
-short-sea shipping
-disaster mitigation
-broadband and connectivity

This concept of conditional funding, as established through the approach to disbursing monies collected from the Gas Tax, can be more broadly applied to Federal infrastructure funding to reduce the carbon intensity of Canadian infrastructure.

The carbon intensity of infrastructure investments depends on the context in which those investments are made (e.g. as part of comprehensive public transit plans, community sustainability plans etc.); infrastructure design choices which determine the carbon intensity of operation (e.g. net-zero buildings); the carbon intensity of the materials used to build the infrastructure (e.g. recycled materials, low-carbon materials etc.); and in the additional reductions such investments may offer through increased utility (e.g. public transit and bike lanes decrease traffic congestion which in turn improves fuel efficiency of the vehicles that remain on the road).

Accordingly the federal government should establish comprehensive greenhouse gas intensity criteria and objectives by which infrastructure monies are disbursed. These criteria would be used to assess the carbon intensity of various infrastructure proposals as part of assessing their overall merit and cost[37].

Some examples of the interrelationship of these carbon intensity criteria are provided below.

Public Transit Infrastructure Funding

Funding for public transit is inherently climate friendly, to the extent that Canadians swap vehicle trips for transit trips. The key to effective and financially viable public transit systems is population density. Density enables transit operators to offer high frequency service at modest cost, resulting in higher levels of ridership. Thus municipalities such as Vancouver and Toronto, which have higher population density, have higher levels of transit ridership.

-brownfield redevelopment
-culture
-tourism
-sport
-recreation

[36] The 2016 Spring Reports of the Commissioner of the Environment and Sustainable Development: Report 1—*Federal Support for Sustainable Municipal Infrastructure* notes that,

> "Overall, we found that although the Gas Tax Fund has provided predictable funding to municipalities, Infrastructure Canada could not adequately demonstrate that the Fund has resulted in cleaner air, cleaner water, and reduced emissions of greenhouse gases. Infrastructure Canada did not implement the performance measurement strategy that it would have needed to determine whether the Fund was meeting its objectives, and to report on results to Parliament and the Canadian public. We also found that the Department did not consistently manage key accountability and reporting requirements. This makes it difficult for the Department to report back to Parliament about whether the funds have been managed appropriately and used for their intended purposes."

See: http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201605_01_e_41380.html#hd3c

[37] "Without a long-term federal vision that is based on reliable information about the condition of Canada's infrastructure, and without clear objectives, priorities, and performance measures, Canadians will not know what results to expect from the billions spent on infrastructure through federal programs or how well those programs are working to make communities sustainable for future generations. Ibid. Ref. 36

Successful transition to a public transit dominated transport system requires deep engagement of municipalities with affordable housing, high fees for use of private vehicles (e.g., parking, congestion charges) and strong rules to prevent urban sprawl. Investment in extension of public transit does not assure the intensity of service that ensures its self-sustaining development. It is therefore advisable that the federal government establish conditions requiring provinces and municipalities to use the legislative, planning and zoning tools at their disposal to ensure the many conditions that are prerequisites to broad adoption of public transit.[38,]

Green Infrastructure

Conditions can and should be applied to ensure maximum GHG reductions are achieved by federally funded projects. As an example, new wastewater treatment plants should be equipped to capture the biogas produced by the decomposition of organic material, as this is significant source of GHG emissions as well as a valuable substitute for fossil energy. . Waste management systems designed to capture methane and other high potency GHG emissions have low to negative marginal additional costs.

With respect to climate resilient infrastructure, Canada is advised to build upon President Obama's Executive Order 11988 on Flood Risk Management, which requires all federally funded construction projects to account for increased flood risks linked to climate change.[39] Builders should generally build to the projected elevation for 1 in 500 year floods, except for critical infrastructure, which should be built to 1 in 1,000 year floods.

Proactive risk management from extreme events requires strict regulations regarding development in vulnerable regions. The government should not bear the risk of urban developments too close to forests, floodplains and coastal regions at risk of inundation. The simplest prohibitive mechanism is withholding of mortgage insurance and federal aid in case of disasters.

Furthermore, Canada has a very poor record of risk transfer through deliberate flooding of less populated regions to save a more populated place. The US Corp of Engineers has developed an effective means of pro-active flood management with consultation and cooperation of different stakeholders. Canada should emulate their effort rather than repeat the tragedy that was precipitated in Manitoba in 2011.

Finally, adaptation should take place for each region according to its needs. The more resilient we become, the less the burden of emergency response management on various levels of government. Prescriptive measures (similar to new building codes) could be adopted to increase individual and regional resilience to extreme events. Investor Tax Credits could be used to promote private investment in risk management and address the absence of resources for effective programs at the municipal and provincial scales.

Social Infrastructure

Buildings account for roughly 12% of Canadian greenhouse gas emissions. Energy costs, and particularly electricity prices, are steadily rising, presenting a challenge to low-income and middle class Canadians. Construction technologies and techniques are available now that will

[38] In the Metro Vancouver region, public transit serves 23 municipalities, but it is only in the City of Vancouver that the service is financially viable. Higher density is the cornerstone of the virtuous circle that leads to affordable transit, frequent service, high adoption rates and hence lower VKT and lower private car ownership.

[39] Executive Order 11988 (Floodplain Management) was originally established on May 24, 1977, and was amended by President Obama in 2015. See https://www.whitehouse.gov/the-press-office/2015/01/30/executive-order-establishing-federal-flood-risk-management-standard-and-

reduce heating and cooling energy demand by 80-90%, with only minimal additional up-front costs. New building codes in California and the European Union require all new construction to meet these super-efficient standards. As of 2019 all new public buildings in the European Union must be net-zero energy.

It would be a wise investment and demonstrate climate leadership to require all new federal government buildings, and all federally funded buildings, to be net-zero or nearly zero energy buildings. This will lead to lower operating costs, lower greenhouse gas emissions, and the development of Canadian expertise in what is likely to be the future of construction in many regions of the world.

Recommendations

The decision to invest almost $60 billion in new green, transit, and social infrastructure could not only provide a much-needed boost to the economy, but also a tremendous opportunity to demonstrate federal leadership on climate change.

Conditions should be applied in each of the three program areas to ensure that all new infrastructure funded by the federal government contributes to reducing greenhouse gas emissions[40].

Show some leadership: A Low Carbon Energy Standard (LCES) for federal energy procurement

The federal government is amongst the largest consumers of energy in Canada.

Public Services and Procurement Canada (PSPC) purchases fuels on behalf of the federal government while individual government departments, crown corporations and agencies procure their own electricity.

A Low Carbon Energy Standard (LCES) would prescribe a reduced GHG emission intensity for all energy purchased by the federal government (comprising departments, crown corporations and agencies). The overall effect of an LCES would be to reduce emissions associated with the federal government's use of energy while driving demand for low carbon energy across Canada wherever there are federal facilities or operations.

A LCES performance standard is expressed as an overall maximum allowable level of GHG emissions per unit of energy purchased (CO_{2e} kilograms per GJ of energy).

LCES is similar to the Low Carbon Fuel Standards (LCFS) adopted by the State of California[41] and British Columbia[42]. However, while the California LCFS "… requires oil refineries and

[40] "Overall, we found that although billions of dollars have been allocated to programs with objectives to improve environmental sustainability, Canadians do not have a consolidated national picture of the extent to which these objectives have been achieved. We also found that Infrastructure Canada did not adequately consider environmental risks, such as climate change, in its program and project decisions." Ref. 36

[41] California Environmental Protection Agency, Air Resources Board. Low Carbon Fuel Standard: http://www.arb.ca.gov/fuels/lcfs/lcfs.htm

distributors to ensure that the mix of fuel they sell in the Californian market meets the established declining targets for greenhouse gas (GHG) emissions measured in CO_{2e} grams per unit of fuel energy sold for transport purposes,"[43] a LCES would address all fuels AND electricity purchased by the federal government[44].

A LCES for federal energy procurement has the following characteristics:

- **Is life-cycle based:** Any fuel or electricity supplied to the federal government will have its greenhouse gas intensity assessed based on the sum of emissions at all stages in each energy source's lifecycle[45], including the production (including extraction, processing and refining for fossil fuels and for electricity, the source fuel used to produce electricity and the emissions associated with its production), transportation, distribution and energy use;

- **Is a portfolio energy standard:** Achievement of the standard is assessed on the weighted average emissions intensity across the portfolio of fuels purchased by the federal government. As such, purchasing less carbon intensive fuels (e.g. solar electricity or low carbon liquid fuel[46]) can offset emissions associated with purchases of more carbon intensive fuels (e.g. petroleum based marine diesel oil);

- **Requires offsetting credits to be purchased in Canada.** Energy suppliers to the federal government may purchase certified/verified Canadian-sourced emissions energy-related offset credits to offset emissions associated with supplied energy exceeding the carbon intensity standard;

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[42] Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act http://www.bclaws.ca/Recon/document/ID/freeside/00_08016_01

[43] Ibid. 1.

[44] California employs a LCFS for fossil fuels and separately subjects electricity (including imports into California) to cap and trade. Imported electricity is assigned a default carbon intensity (in CO2e/MWH) where that electricity is generated by any supplying facility with more than 25kt GHG emissions. In concert, the California LCFS and cap and trade as applied to electricity have the effect of a LCES. Since in the case of the Canadian federal government there is only one buyer of energy it makes sense to cover all fuels including electricity under one policy.

[45] Examples of existing life-cycle assessment protocols include but are not limited to: The *Oil Production Greenhouse gas Emissions Estimator (OPGEE)* as developed by Stanford University, with support from the California Air Resources Board; *Greenhouse Gas, Regulated Emissions and Energy Use in Transportation (GREET)*, is also known as Argonne National Laboratory's well-to-wheels model; U.S. Department of Energy National Energy Technology Laboratory; National Energy Technology Laboratory (NETL), (2008). *Development of Baseline Data and Analysis of Life Cycle Greenhouse Gas Emissions of Petroleum-Based Fuels.* Available: http://www.netl.doe.gov/energy-analyses/pubs/NETL LCA Petroleum-Based Fuels Nov 2008.pdf

[46] Meijer, P.J. et. al. 2015. *The Potential for Electrified Vehicles to Contribute to U.S. Petroleum and Climate Goals and Implications for Advanced Biofuels.* **Environmental Science & Technology**, DOI: 10.1021/acs.est.5b01691.

In addition to biofuels there are emerging net-zero carbon synthetic fuels. See: British Columbia Ministry of Energy and Mines. October 2015. *Fuel from thin air! Province supporting synthetic fuels project in Squamish. "*In this early demonstration, electricity would be used to capture CO2 directly from the air, and to split water and manufacture hydrogen. The two components would then be reacted to yield diesel or gasoline. When this synthetic fuel is burned in a car, truck or bus it would simply return the CO2 back to the atmosphere, powering transportation in a way that is fully carbon-neutral."

- **Provides credit for reductions in energy use and attendant emissions.** Allows the federal government to credit a portion of the emissions reductions associated with reduced energy use (as calculated on a 3 year rolling average by energy source reduced) against the portfolio standard.

- **The LCES standard becomes more stringent over time.**

Recommendation

The federal government should require the whole of government (departments, crown corporations and agencies) to adhere to a LCES for energy purchases.

In order to enable a LCES the federal government should:

- Assign the responsibility for developing a baseline energy inventory for the federal government[47] to the Low Carbon Economy Trust (LCET);
- Delegate the responsibility to verify and accredit carbon intensity claims of energy suppliers proposing to supply energy to the Government of Canada to the LCET;
- Delegate the responsibility for verifying Canadian offset credits being used by fuel suppliers to offset emissions associated with their energy supply to the LCET;
- Enable the LCET to provide PSPC and the whole of government with guidance regarding fuels, electricity procurement, and opportunities to reduce energy use; and
- Require the LCET to publish data regarding the Canadian Government's energy use and associated greenhouse gas emissions annually.

More than just installing solar panels - Indigenous energy autonomy and sustainable communities

Background

There are 253 off-grid Indigenous communities dotted across the provinces of British Columbia, Ontario, Quebec, Newfoundland and Labrador and in the northern territories of Yukon, Nunavut and Northwest Territories. These communities represent a population of 200,000 people and an estimated annual electricity demand of 1500 GWh. Eighty percent of these off-grid communities rely on diesel generation for provision of electricity, while the majority of the remainder rely on hydro with diesel as backup[4849].

[47] Similar to the Federal Comprehensive Annual Energy Performance Data as collated by the Federal Energy Management Program under the U.S. Office of Energy Efficiency and Renewable Energy. See: http://energy.gov/eere/femp/federal-facility-annual-energy-reports-and-performance

[48] Rezai, Maryam. August 2011. Canadian and BC Remote Community Profiles

[49] Some of these communities have already installed renewable energy capacity. A database cataloging Indigenous renewable energy projects can be found at: http://Indigenousenergy.ca/database/

An aspiration towards energy self-sufficiency through harnessing renewable resources

Despite cultural distinctions, Indigenous communities across Canada share a common aspiration of energy self-sufficiency through harnessing renewable resources. Such self-sufficiency serves three key objectives: harmony with long-held environmental values, self-determinacy and redirecting substantial fossil fuel expenditures towards economic and human development at home.

However, for these communities, "…the goals of affordable and reliable power cannot come at the expense of community control"[50]. Indigenous communities seek self-determinacy in two key respects, "One is the concept of energy self-sufficiency which is closely tied to communities materially supplying their own energy, and the other is the processes of decision-making and being able to control one's own affairs..."[51]

In this regard "…community energy projects are seen as a part of bigger projects of decolonization aimed at addressing different elements of the colonial system, be it eliminating dependence on colonial institutions, reinvigorating communities' ability to practise cultural and political self-determination, or ultimately addressing the injustices of the colonial system and its patterns of dispossession by returning resource governance decisions to the community level."[52]

While the objective of the Canadian government in "promoting" renewable energy in these communities is to reduce greenhouse gas emissions, the potential recipients of this promotion place greater emphasis on the political autonomy afforded by energy self sufficiency.

The aspiration towards energy autonomy is tied to a strong preference for renewable energy, less as a means to reduce greenhouse gases and more as a means to physically and politically disconnect from legacy paternal institutions (INAC) that provide partial support[53] for the diesel fuelling the generators.[54]

In aspiring to reduce greenhouse gas emissions associated with energy use in Indigenous communities, the Canadian Government must recognize that the context for action is one of, "…social justice and, more broadly, social sustainability issues…"[55]

Accordingly, it is Indigenous communities themselves that must prioritize self-sufficiency. At the outset it should be recognized that these communities might have priorities outside of the boundaries of pure energy self-sufficiency that extend to matters of broader community self-sufficiency and sustainability (e.g. housing, potable water etc.).

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[50] Rezaei, M., Dowlatabadi H., March 2015. *Off-grid: community energy and the pursuit of self-sufficiency in British Columbia's remote and First Nations communities.* Institute for Resources, Environment and Sustainability, University of British Columbia.

[51] Ibid.

[52] Ibid.

[53] Indigenous and Northern Affairs Canada provides funding for diesel fuel to generate 9MWH/household/year. The, often substantial balance of fuel consumption to support the community demand is paid out of band funds.

[54] Often these are assets "owned" by the community but in poor repair due to funding decisions at INAC. At other places, these are owned by the electricity utility, further exacerbating the sense of dependence.

[55] Ibid.

The role of the federal government thus becomes that of an enabler focused on fostering institutional capacity within Indigenous communities so they can realize both energy autonomy and overall community sustainability.

Recommendations

In the context of the above, specific actions the federal government should undertake include:

- Reassess, in open collaboration with the Assembly of First Nations and the governance of individual Canadian Indigenous communities, the First Nation Infrastructure Fund[56] (FNIF) and the Capital Facilities and Maintenance Program[57] (CFMP). The review

[56] FNIF supports a wide range of infrastructure projects that are on reserve, Crown land or land set aside for the use and benefit of First Nations.

FNIF was created as a complementary source of funding to the Capital Facilities and Maintenance Program for six eligible categories of infrastructures projects:

1 planning and skills development
2 solid waste management
3 roads and bridges
4 energy systems
5 connectivity
6 disaster mitigation

https://www.aadnc-aandc.gc.ca/eng/1100100010656/1100100010657

[57] "The Capital Facilities and Maintenance (CFM) program within Indigenous and Northern Affairs Canada is the main pillar of the Government of Canada's effort to support community infrastructure for First Nations on reserve.

The program's funding, which totals over $1 billion per year, is invested in four main areas: housing, education, water and wastewater systems, and other infrastructure (roads and bridges, fire protection, electrification, community facilities, etc.). https://www.aadnc-aandc.gc.ca/eng/1100100016395/1100100016396

The objective of the CFMP is to provide financial support to First Nations and other eligible recipients to:

7 invest in physical assets (or services) that mitigate health and safety risks in their communities;
8 ensure that assets meet established codes and standards;
9 ensure that assets are managed in a cost-effective and efficient manner that protects, maintains and maximizes asset life cycle; and
10 ensure that the above activities are undertaken in an environmentally sound and sustainable manner.

The CFMP is intended to assist First Nations in the planning, construction and/or acquisition, as well as operation and maintenance of community infrastructure and facilities including the following asset categories:

- Water supply, storage, treatment and distribution;
- Wastewater collection, treatment and disposal;
- Solid Waste collection and disposal;
- Elementary and secondary educational facilities;
- Housing;
- Roads and bridges;
- Fire protection including fire halls, fire trucks and firefighting equipment;
- Electrical power generation and distribution;
- Community buildings such as community/recreation halls and band offices;
- Bulk fuel storage and distribution (non-commercial use);
- Flood and erosion protection;
- Remediation of contaminated sites;
- Land acquisition for approved community expansion; and
- Connectivity

https://www.aadnc-aandc.gc.ca/eng/1425477312133/1425477531299#sec2

should take into account the findings and recommendations[58] of the April 2014 *Evaluation of the First Nation Infrastructure Fund;*

- Based on the assessment recast the FNIF and CFMP into a comprehensive national Indigenous Sustainable Communities Program that shifts the focus from the process of making capital investments to fostering Indigenous community self-sufficiency and autonomy in making those investments and ensuring their ongoing sustainment. Specifically:

    - Engage Indigenous communities across Canada in a planning process to convert their aspirations for energy autonomy and community sustainability into well-defined plans. This planning process would incorporate and contextualize existing community energy planning activities that have been undertaken[59] or are underway[60]; further to this,
    - Establish an expert panel to inform community planning;
    - Where feasible, build institutional capacity for planning within those communities such that the entire planning process can be assumed by Indigenous communities;
    - Develop capacity within Indigenous communities to specify and let tenders and evaluate bids for purchasing infrastructure;
    - Provide expertise to train Indigenous building trades to build housing to meet net zero-energy building standards;
    - Provide expertise to train individuals within communities to operate, monitor and maintain energy, water and building infrastructure and systems

- Identify communities that would most benefit from the development of comprehensive sustainable communities plans and pilot their development. These communities should

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[58] It is therefore recommended that INAC's Community Infrastructure Branch:

- Examine the feasibility of integrating the call for FNIF project proposals into the Department's annual Capital Planning application process.

11 Expand existing management and oversight documents to ensure funded projects include: (a) identification of operations and maintenance funding sources that adequately meet the life-cycle cost of the asset; (b) identification of necessary training requirements; (c) disaster mitigation infrastructure design elements; and (d) an expanded eligible recipients list to allow for more flexible partnerships with the private sector, academia and Aboriginal organizations.

12 Engage the Professional and Institutional Development Directorate to (a) identify practical ways for Professional and Institutional Development to support community planning projects funded under the Planning and Skills Development category; and (b) to develop a strategy to align the Department's community planning and support activities.

13 Review the program's tendering policy and best practices across the regions to ensure an effective and consistent approach nationally.

14 Engage ecoENERGY in order to identify a strategy for sharing completed feasibility studies to support potential FNIF-funded energy projects and ensure information is accessible to regional front-line officers.

http://www.aadnc-aandc.gc.ca/eng/1414522582745/1414522638694#exe

[59] Sharing Knowledge for a Better Future: Adaptation and Clean Energy Experiences in a Changing Climate. 2010. Published under the authority of Minister of Indian Affairs and Northern Development and Federal Interlocutor for Métis and Non-Status Indians. See: https://www.aadnc-aandc.gc.ca/DAM/DAM-INTER-HQ/STAGING/texte-text/ss_enr_sharingPDF_1312295144407_eng.pdf

[60] As an example, Ontario's Independent Electricity System Operator (IESO) supports Indigenous communities to develop community energy plan through the Aboriginal Community Energy Plan (ACEP). See: http://www.aboriginalenergy.ca/sites/default/files/IESO%20Final%20ACEP%20Infographic_April%202015.pdf

reflect both leaders and laggards in order to build upon existing efforts towards community self-sufficiency (that typically have been focused on renewable energy projects) while focusing on Indigenous communities that have not yet started to work toward community sustainability and self-sufficiency.

In the next section we set forth a proposal regarding the Low Carbon Economy Trust that expands its focus beyond its original conception as a means to, "…provide funding to projects that materially reduce carbon emissions under the new pan-Canadian framework."

Canada's greenhouse gas change agent: A Low Carbon Economy Trust (LCET)

The public sector has a role in driving innovation-led, carbon neutral and materially efficient growth in the pan-Canadian economy ("the low carbon economy"). Conceptually this involves using pooled public sector resources to drive innovation.

Practically this means establishing a Low Carbon Economy Trust ("LCET") that, as described at the outset of this brief, will coordinate with, and supplement existing Canadian institutions in order to focus Canada's collective energies to drive technological, behavioural, and systems innovation for the reduction of greenhouse gas emissions, mitigation and adaptation to climate change.

The proposed Trust discussed below incorporates objectives, activities, and an attendant institutional design that will be the most effective in:

- Supporting and facilitating the implementation of federal and provincial greenhouse gas reduction and mitigation policies; while,
- Driving innovation, growth and investment in Canada's economy.

Ideally, where there is a price on carbon, a carbon standard to be met, or other regulatory requirements to reduce emissions, the LCET and its institutional partners (i.e. other federal departments and agencies, provincial departments and agencies, municipalities and academia as focused on greenhouse gas reduction and mitigation) would be able to offer resources to drive a dynamic response to those policies through the development, demonstration and dissemination of new technologies, products, processes and services.

At its best, publicly driven innovation in applied science and systems creates new market niches and technological paradigm shifts.

Consider that the public funding of the basic and applied science that developed into the Internet, improved lithium batteries and cellular technology enabled the creation of the smartphone[61]. The smartphone incorporates a wide range of publicly funded applied science to yield a tool that has displaced fax machines, cameras, hard mail, landline telephones, radios, newspapers and encyclopedias thereby revolutionizing how and where society accesses information, communicates and transacts.

[61] Mazzucato, Mariana. 2014. *A Mission-Oriented Approach to Building the Entrepreneurial State*. Prepared for Innovate UK.

"The low carbon economy" is no different. It too requires a public sector catalyst.

Like the smartphone that emanated from publicly funded applied science, commercialized low carbon technologies, services or circular-economy[62] systems will not only dramatically reduce climate change related externalities associated with economic activity but will result in greater net wealth and prosperity.

A major barrier to green innovation is risk. To overcome this barrier the Trust will have to "socialize" much of the risk of developing and commercializing green technologies, new services or circular-economy systems.

A critical step in establishing the scope of activities that the Trust may engage in is to understand risk and the perception of risk as it pertains to innovation.

In long established, steady state and risk adverse industries, innovation is incremental and typically the product of the more pedestrian need to overcome short–term barriers to growth (market share) and profitability.

In some cases industries may have the resources and know how to leverage new technology but have little to no incentive to develop the technology in the first place (as the returns are speculative, or too low – even in the face of marginal carbon prices – or too far off).

In other cases, there are information failures whereby incumbent industries cannot fully appreciate the benefits associated with innovations that are occurring elsewhere or how to incorporate those innovations into existing business models.

Innovators face other hurdles associated with penetrating existing markets. Where an innovation threatens to disrupt long-standing market dynamics the reaction by market incumbents may be to block innovation by advocating for policies that blunt or prevent the innovation from flourishing (rent seeking). Thus the innovator is faced with additional barriers and risk.

For many nascent technologies there remains a funding gap between that deployed for supporting research and development and that required for commercialization. As noted by the Pembina Institute,

> "The "valley of death" is the gap in funding between R&D and commercialization preventing many promising clean technologies from reaching commercialization. One of the key steps is cost reduction from deployment – the learning/experience curve that all technologies go through where their costs are reduced dramatically just by making more of them. This is a chicken and egg problem — the only way to lower costs is to deploy technology at scale, but without support the only way to deploy technology is to lower costs.

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[62] A circular economy is resource efficient. It involves the management of two types of material flows:

- "Biological nutrients" designed to re-enter the biosphere safely and build natural capital (e.g. a paper printed with organic inks that can be composted and fully reabsorbed as nutrients in plant growth)
- "Technical nutrients", which are designed to circulate without entering the biosphere. (e.g. metals from consumer products such as vehicles and appliances that are recovered and recycled into the manufacture of new consumer goods)

See: http://www.ellenmacarthurfoundation.org/circular-economy/circular-economy/the-circular-model-an-overview

> This deployment period is critical for clean technologies that have higher upfront costs but lower lifetime costs than conventional alternatives. It costs significantly more to put steel into the ground than build a phone app. Without government support innovators would be unable to scale and reduce costs to become competitive."[63]

As such the Trust can play an important role in overcoming the risk associated with the creation of new technologies and services and to act as a catalyst to speed the deployment and dissemination of such innovation as it emerges.

However, even where there is little risk and evidently much to gain small and medium sized businesses (SMEs) in Canada have failed to take advantage of existing energy efficiency and fuel switching options that are available with existing technologies. It is estimated that 80% of energy efficiency improvements in this sector are still waiting to be realized.

In this regard the Trust needs to be able to seize immediate opportunities to drive energy efficiency and greenhouse gas reductions with "off the shelf" technologies and services by providing advice, expertise, and interest-free loans to SMEs.

In concert, the Trust's focus on overcoming the risk associated with innovation while concurrently identifying immediate opportunities for reduction of energy use and emissions will serve to foster a low carbon economy in Canada.

The Mission of the Low Carbon Economy Trust

Mission: Accelerate the transition to a low carbon economy by identifying, investing in, and disseminating solutions that enable Canadian businesses to meet the challenges introduced through ambitious federal, provincial, and municipal GHG mitigation policies.

The LCET strategic approach

The transformation from today's fossil fuel dependent economy to a low carbon economy is a massive economic undertaking. The Trust will need to be extremely strategic in deciding which areas of this transition represent the most effective focus for its limited resources.

Rather than a top down approach of selecting sectors for effort, the Trust should assess innovators based on how likely their technologies or services are to deliver outcomes consistent with the objectives of the Trust (e.g. transform energy and transport systems to low carbon intensity, create low carbon built infrastructure, reduce waste and close material loops, etc.). Once evaluated and approved, the Trust would use the tools at its disposal to assist in their development.

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[63] *Why governments are necessary for technological innovation, development and deployment* Sara Hastings-Simon April 21st 2016. http://www.pembina.org/blog/why-governments-are-necessary-for-technological-innovation-development-and-deployment

There is extensive activity across Canada related to reducing and mitigating greenhouse gases today. Many of this existing activity would be enhanced by the Trust as it coordinates its efforts with those of provincial and municipal agencies and other institutions.[64]

Canada will be much more successful in meeting its current and future climate mitigation and adaption ambitions through coordinated rather than uncoordinated aggregated effort. For the Trust to be successful, it needs to be able to evaluate existing programs, encourage replication of successful programs, and refocus the resources of less successful initiatives on Canada's low carbon economy development objectives.

LCET objects

In order to achieve its mission the Trust needs to be clearly mandated and tightly focused[65] with the assignment of the following objects:

- To fund applied science and advance technologies that are too risky or too early in the development process to attract private investment, with a focus on low carbon technologies with commercial potential[66];
- To facilitate partnerships and open access to emerging applied science at other agencies and institutions[67];
- To provide or facilitate (though relationships with banks and other financial institutions) "patient capital" that is willing to bear high risk: specifically seed funding and assisting in acquiring second round funding for promising technologies until they can be fully commercialized;[68,69,70]

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[64] This in contrast to the UK under the where, "…the current centralization of control and the lack of regional and local capability to coordinate, complement, and customise policies is reducing the net effectiveness of UK policies aimed at fostering innovation and unlocking growth opportunities in low carbon sectors." Uyarra, Elvira, Shapira, Phillip, Harding, Alan. 2016. *Low carbon innovation and enterprise growth in the UK: Challenges of a place-blind policy mix*. In Technological Forecasting and Social Change. 2016; 103(2): 264-272.

[65] As an example, the US Government's Advanced Research Projects Agency-Energy (ARPA-E) agency has four clear objectives:

15 To bring a freshness, excitement, and sense of mission to energy research that will attract the U.S.'s best and brightest minds;
16 To focus on creative, transformation energy research that the industry cannot, or will not support due to its high risk, but that has high reward potential;
17 To utilize an ARPA-like organization that is flat, nimble, and sparse, capable of sustaining for long periods of time those projects whose promise remains real, while phasing out programs that do not prove to be as promising as anticipated; and
18 To create a new tool to bridge the gap between basic energy research and development/industrial innovation.
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[66] Ibid.

[67] "Siemens Canada, NB Power and the University of New Brunswick (UNB) are providing local and global companies with a new testing platform to drive innovation and support business ideas for development and export to world energy markets." - See more at: http://blogs.unb.ca/newsroom/2016/01/28/nb-power-siemens-and-unb-launch-network-to-spur-innovation/#sthash.WDpgKrsy.dpuf

[68] The US, "The Small Business Innovation Research (SBIR) program is a highly competitive program that encourages domestic small businesses to engage in Federal Research/Research and Development (R/R&D) that has the potential for commercialization." https://www.sbir.gov/about/about-sbir#sbir-policy-directive

- To seek opportunities to couple the Trust's programs, services and investments with those of the private sector;
- To develop a business incubator program that assists emerging companies through demonstration projects, business advice, skills development, networking, etc.
- To provide a coordinating and clearinghouse function amongst existing institutions. The Trust will leverage existing expertise across the nation at many public and private institutions (e.g., building efficiency experts at NRC or industrial energy efficiency at BCHydro). Where solutions to challenges are already known, the Trust will provide for a clearinghouse to publicize and disseminate these solutions. Where solutions are not yet available, the Trust will identify appropriate investments to develop new knowhow and innovative solutions;
- To work with Canadian businesses and the public sector to lower their carbon emissions through increased energy efficiency, fuel-switching, process changes, and other solutions;
- To implement programs that seek to remove barriers to behavioural change that impede the widespread uptake of low carbon and high efficiency solutions; and
- To develop policy advice and recommendations regarding how governments can accelerate the transition to a low carbon economy.

Supplemental activities

Carbon intensity standards for goods and services are a cornerstone of an effective greenhouse gas reduction policy framework. Standards provide incentives for innovation and open doors to new technologies, ideas, and businesses that would be of little interest otherwise.

For example energy efficiency for major appliances in countries adopting national energy efficiency standards, "…have increased at more than three times the underlying rate of technology improvement." [71]

Meeting these standards and overall greenhouse gas targets requires affected parties to have confidence in the value of their investments in those technologies, ideas, and businesses and overall certainty in returns on their efforts.

Accordingly, to ensure effectiveness and facilitate a dynamic response to standards and targets, the Trust will undertake the following activities:

- Provide analysis and policy advice to the federal and provincial governments regarding product and service performance standards;
- Establish national protocols for measuring the carbon intensities of goods and services
    - Also undertake certification of products, suppliers, consultants such as auditors, and product environmental/life-cycle foot-printing
- Verify and accredit public and private investments that claim greenhouse gas reductions for the purposes of assessing eligibility tax relief under federal fiscal policies aimed at

[69] Sustainable Development Technology Canada (SDTC) Our mission is to work with entrepreneurs to help them bring their cleantech innovations to market. Our approach is characterised by *our willingness to take on risk.* https://www.sdtc.ca/en/about-sdtc/our-approach

[70] The ecoENERGY Innovation Initiative (ecoEII) , "…program's objective is to support energy technology innovation to produce and use energy in a cleaner and more efficient way." http://www.nrcan.gc.ca/node/17903/#eco

[71] Achievements of appliance energy efficiency standards and labelling programs: A Global Assessment. International Energy Agency 2015.

fostering investments in reducing greenhouse gas emissions (e.g. accelerated depreciation on R&D and capital investments and tax relief on interest accrued from loans made for infrastructure that will reduce greenhouse gases)
- Offer the federal and other levels of government advice on procurement of more energy efficient and low carbon products and services

All of the supplemental activities listed in the bullets above are technical and evaluative capacities the Trust will employ in undertaking its primary role as a catalyst for innovation.

Establishment, governance and accountability

Transition to a low-carbon economy is a multi-decadal pan-Canadian effort potentially impacting all aspects of socio-economic activity. The success of the Trust will depend on four factors:

a) Sustained funding at the appropriate level
b) Accountability but independence from government
c) Clear evaluation metrics; and
d) Transparent public reporting of their activities and performance.

In order to address these factors the Trust must be established, governed and held accountable in the following manner:

- Established under federal statute with specific objects, functions and accountabilities established in law
- Have the authority to enter regional agreements with the provincial and territorial governments. The agreements may include formulas for matching provincial/territorial funds and additional provincial/territorial conditions where the Trust is engaged with innovators in a given region or province;
- Be assigned minimum funding through the federal budget for a period of not less than ten years (this is challenging since the term of the government is only four years)
- Be required to hold the assigned federal monies in Trust only to expend or disburse those monies in accordance with administrative policies and practices established in its bylaws. In addition;
    - The federal government could reserve the right under statute to supplement this base funding allocation contingent on satisfactory evaluations. Such a funding formula ensures the Trust a minimum level of funding while also providing for the opportunity to develop at a pace that builds on experience and opportunities;
    - Require the Trust to provide funding for commercialization on an equity basis such that whatever returns are negotiated (cash or perhaps retention of IPR) from successfully commercialized innovations accrue to the Trust for cycling back into future opportunities for innovation;
- Be governed by a skills-based board with minority representation by appointees from federal and provincial governments. The directors should reflect expertise selected from academic and industry applied science, ENGOs, finance and public administration.
- Be accountable to the legislature via annual reports and subject to audit by the federal Auditor-General. Report its performance based on metrics established in regulation and/or the operating agreement between the Trust and the federal and provincial governments.

Conclusion – the transition to a low carbon economy

> "…diagnosing the ills of the status quo, and imagining better policy alternatives, at least in their broad contours, are often not especially controversial. However, the real challenges, in many cases, relate to getting from "here" to "there." Over time, existing policies develop their own encrustations of institutions, vested interests, adaptive preferences, and expectations that render the trajectory of getting from here to there a major part of the policy challenge.
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> *Michael J. Trebilcock* Dealing with Losers: The Political Economy of Policy Transitions *(Oxford University Press, 2014).*

For more than a quarter of a century, the Government of Canada has made commitments, introduced action plans, spent billions of dollars, and yet largely failed to reduce greenhouse gas emissions. We must learn lessons from both our failures and from successes here in Canada and elsewhere in order to move forward.

The transformation of an economy that was built on fossil fuels is an inherently challenging proposition because it involves having various sectors of the economy transition from familiar (and profitable) technologies and behaviors to ones that characterize those of a low carbon economy.

Although there is extensive evidence regarding the types of policies that are effective, efficient, equitable, and politically viable, there will be staunch defenders of the status quo and vested interests who seek to avoid, limit, or undermine serious and effective policy initiatives.

While there will inevitably be costs (and resistance) involved in this transition, the policies outlined herein are designed to minimize those costs, create market opportunities, and maximize innovation which is undoubtedly the best cost mitigation and prosperity maximization strategy available.

In a nutshell we want dramatically lower carbon emissions, catalyze sustainable economic activity and create a policy regime that signals to the market where to allocate its resources towards those ends.

As such, the recommendations put forward in this report are based on the best available scientific evidence, have demonstrated their effectiveness in other jurisdictions, and are essential elements of a pan-Canadian strategy to transform our society and our economy in the direction of a low-carbon future. We are confident that the adoption and implementation of these policies will mark a turning point in Canada's efforts to transform itself into a low carbon economy.