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Pursuing Deep Decarbonization in Canada: Advice from Canadian Scholars

Sarah Burch

Key Points

- The challenges to a low-carbon transition are largely social and political rather than technical.
- Current national greenhouse gas reduction targets, if adopted globally, would not deliver the goal of constraining warming to less than 2°C.
- In order to contribute meaningfully to both domestic and international climate change mitigation efforts, Canada must pursue three pillars of decarbonization: energy efficiency, electrification and switching off diesel.
- A creative, ambitious program of decarbonization experiments, led by a variety of actors and implemented at different scales, should be undertaken to trigger more transformative shifts toward a low-carbon future.
- A just transition to a low-carbon future is one that is equitable, inclusive, adaptable and holistic.

Introduction

Navigating the bumpy terrain between climate change rhetoric and action is a challenging task, seeming to shift by the day as evidence emerges for both lacklustre performance and promising innovations around the world. For example, despite a spectacular push toward solar and wind power as part of its *Energiewende* (or energy transition), Germany's emissions reductions have stalled — in part because renewables are replacing another low-carbon energy source (nuclear), and also because the country's transportation sector has been slower than its electricity sector to achieve significant reductions (The Economist Intelligence Unit 2017). Meanwhile, in a swift reaction to US President Donald Trump's announcement that he intends to pull out of the Paris Agreement, Sweden pledged to reach net-zero greenhouse gas emissions by 2045 (Wright 2017) and has enacted specific policies, including an aviation tax, incentives for low-emission vehicles, tax increases on high-emission vehicles and investment in the low-carbon transition in Swedish industry (Government of Sweden 2017). Total greenhouse gas emissions in Sweden declined by around 25 percent between 1990 and 2015 (Swedish Environmental Protection Agency 2017).

For its part, Canada's total greenhouse gas emissions increased by around 18 percent between 1990 and 2015 (Environment and Climate Change Canada 2017). In the latter part of this period, emissions began to gradually decline (by around 2.2 percent between 2005 and 2015), but commitments have been made to reduce emissions

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by 30 percent below 2005 levels by 2030 (Government of Canada 2016). In 2015, however, the federal government triggered a massive shift in Canada's domestic position on the issue at the Paris Conference of the Parties to the United Nations Framework Convention on Climate Change. Canada committed to taking the steps necessary to limit warming to less than 2°C, and to making every effort to constrain this warming to the even more ambitious target of 1.5°C.

A fundamental tension exists in the Canadian conversation about pathways to this low-carbon future: can we reach our climate change targets and also develop our fossil fuel resources? Implicit in the national discourse about the intersection of our historically resource-based economy and the challenge of decarbonization is the message that Canadians do not have to make choices: we can decarbonize domestically while still benefiting from the global market for conventional and non-conventional fossil fuels. Extensive citizen dialogues as part of the Generation Energy process,¹ however, challenge the logic and wisdom of this assumption.

The position of the federal *Mid-Century Long-Term Low-Greenhouse Gas Development Strategy*, which began a national conversation about what a long-term transition to a low-emission society might look like, is that meeting these more distant 2050 targets (of 80 percent below 2005) is possible using existing technologies (Environment and Climate Change Canada 2016a). The resulting report argues that research and development, technological innovation and increased private sector investment will help to reduce the costs of this transition.

It is clear that Canada is at a crucial moment in the national conversation about the challenges and opportunities presented by decarbonization. What could (or should) Canadian communities look like in a low-carbon future? What responsibility does Canada have, by way of both its fossil fuel exports and its low-carbon technological or social innovation, for spurring decarbonization outside of its borders? What steps must be taken to accelerate innovation, refine or transform governance processes and trigger a more informed debate that responds to complex issues, values and priorities?

Beginning in December of 2016, a team of scholars convened in Ottawa to consider these

¹ See www.nrcan.gc.ca/20093.

questions under the auspices of Sustainable Canada Dialogues (a collective of scholars led by Catherine Potvin, professor of biology at McGill University).² The team consisted of leading researchers from every province and representing diverse fields, ranging from energy economics and engineering to sociology, law and political science. This policy brief captures the highlights of the process and the product of that collaboration, a report entitled *Re-energizing Canada: Pathways to a Low-Carbon Future*, which focuses specifically on the policy recommendations endorsed through a consensus-based process.

The Tyranny of Targets and the Challenge of Transformation

Carbon is woven through the Canadian economy, identity and way of life. Given an abundance of space and ample inexpensive resources, our cities have sprawled, locking in car-dependent, low-density lifestyles. Greenhouse gas emissions, furthermore, are governed not only at the federal level, but also by provinces and municipalities, creating a patchwork of jurisdictions (Curran 2010) that highlights the need for policy coherence and consistency across these multiple levels (Burch et al. 2014).

We must take a step back and assess three crucial links in the chain that run from good intentions to meaningful action. First, it should be determined whether the specific actions that each jurisdiction is planning add up to deliver both short- and longer-term targets. Even in provinces such as British Columbia, which was once a recognized leader

in climate change policy, suites of specific policy actions might get us only around 73 percent of the way to stated targets (if perfectly implemented, of course) (Government of British Columbia 2008).

Next, it must be assessed whether the various provincial greenhouse gas reduction targets then add up to deliver on the commitments made federally. The Sustainable Canada Dialogues team, as part of the *Re-energizing Canada* report, determined that provincial targets may total to deliver Canada's near-term target of a 30 percent reduction in emissions below 2005 levels by 2030, but Canada is spectacularly underprepared to deliver on the longer-term, more transformative target of an 80 percent reduction in emissions by 2050 (see Figure 1).

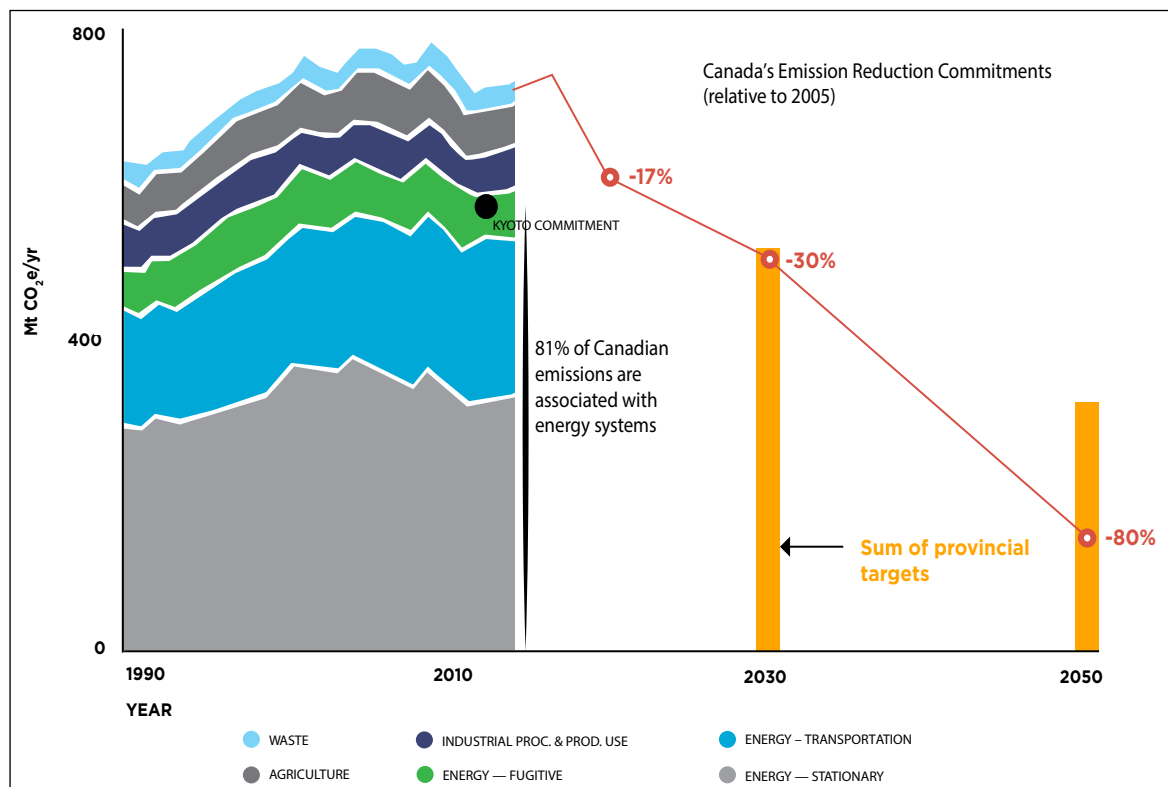
The final question in the chain from aspiration to reality follows from the second: will these federal commitments be sufficient to deliver on the international mandate to limit warming to no more than 2°C or even 1.5°C? This is the subject of a flurry of analysis and commentary, as it suggests the need for both societal and technological transformations (Patterson et al. 2018). In the Canadian context, we must consider what it means to transform Canada's energy system toward one that is fundamentally low carbon. This is the domain of the *Re-energizing Canada* report and will be the subject of the remainder of this policy brief.

Dimensions of a Low-Carbon Energy System

Canada's per capita demand for energy is among the highest in the world, similar to that of the United States and Australia, but more than double that of the European Union (International Energy Agency [IEA] Statistics 2016). No single sector of the economy is responsible for Canada's high per capita energy use and emissions. Canada is a large country with many natural resources, including oil, gas, minerals and agricultural and forest products, that require large amounts of energy to produce, extract and process. People in Canada tend to drive large vehicles long distances, live in spacious homes in a cold climate and move freight predominantly by truck rather than

2 The author is part of the Sustainable Canada Dialogues initiative, which produced the scholarly consensus report *Re-energizing Canada: Pathways to a Low-Carbon Future*. The lead authors are: Catherine Potvin, McGill University; Sarah Burch, University of Waterloo; David Layzell, University of Calgary; James Meadowcroft, Carleton University; Normand Mousseau, Université de Montréal; Ann Dale, Royal Roads University; Irene Henriques, Schulich School of Business, York University; Liat Margolis, University of Toronto; H. Damon Matthews, Concordia University; Dominique Paquin, Ouranos Consortium on Regional Climatology and Adaptation to Climate Change; Howard Ramos, Dalhousie University; Divya Sharma, McGill University; Stephen Sheppard, University of British Columbia; Natalie Slawinski, Memorial University. For a full list of contributing authors, see the Works Cited.

Figure 1: Canada's Greenhouse Gas Emissions (1990–2014 data) with Past, Current and Tentative Future Targets



Source: Potvin et al. (2017).

Note: Tentative future targets are shown in red. The yellow bars depict the sum of the provincial and territorial targets for 2030 and 2050.

by rail. In the context of international climate agreements, Canada is responsible for emissions from energy used domestically, including emissions associated with the production of energy for export. Below are three key elements of possible pathways to a low-carbon energy future identified in the *Re-energizing Canada* report.

Increasing Energy Efficiency and Conservation

There are many opportunities to promote energy conservation and improve energy efficiency. According to the IEA, “energy efficiency, as well as structural changes and targeted energy conservation, are critical instruments to reduce emissions while supporting...economic growth” (IEA 2016, 63).

Roughly one-third of domestic energy use is associated with fuel and electricity recovery and processing and distribution; another

one-third provides “useful” energy services and the final third is a conversion loss associated with the service technologies. The fraction considered “useful” energy is determined by lifestyle. For example, between 1990 and 2013, Canadians bought more light trucks or sport utility vehicles and the average house size increased (Office of Energy Efficiency 2016).

Energy efficiency measures also include making low-carbon options more readily available, as with safer and more convenient cycling infrastructure and relatively straightforward technology such as sensors that turn off lights when no one is in a room. Zero-tillage farming systems, for example, have been shown to reduce energy use, compared to conventional tillage systems, when annual crops are considered (Gulden and Entz 2005). Searching for energy-efficient products can orient future technological development, such as intelligent technologies and innovations in management.

Electrifying with Low-Carbon Electricity

The decarbonization of energy systems will require high-emitting provinces to transform their technologies for electricity generation. Even though 80 percent of Canada's electricity is low carbon, reliance on coal-fired power generation in some provinces leads to 2.6 tCO₂-eq (tonnes of CO₂ equivalent) of average per capita emissions associated with electricity generation (Environment and Climate Change Canada 2016b). National statistics hide important differences among regions. Understanding regional similarities and differences is crucial when considering the technology or policy options necessary to guide energy system transformations.

Low-Carbon Alternative Fuels

Low-carbon alternative fuels are a central part of the energy transition, in particular to complement and eventually displace fossil-based diesel and jet fuel in heavy transport vehicles and airplanes. Aviation and heavy freight will continue to require fuels that have high-energy density by both volume and weight. It is important that combustion does not lead to a net increase in atmospheric CO₂ concentration. Fuels created from sustainably harvested biomass, electrochemical reduction of atmospheric CO₂ or electrolysis to produce hydrogen all hold promise but, to date, no pathways are economically viable or feasible at the scale needed to address the challenge (Bataille 2017).

Governing the Low-Carbon Energy Transition

While the technical dimensions of a low-carbon transition are often those that receive the most public attention (shared autonomous electric vehicles, for instance, or leading-edge green building technologies), the most intractable puzzle is not technical, but social and political. Transitioning to low-carbon energy involves a shifting constellation of private and public actors, through formal and informal mechanisms that can work to spur innovation across the country. Energy-system governance in Canada has traditionally been highly fragmented, with a variety of ministries and regulatory bodies responsible for different dimensions of the

energy landscape (Russel and Jordan 2009). Yet, as the IEA argued in 2015, “integration” — such as between district energy or electrical interconnections (for instance, between provinces) — is critical for cost-effective decarbonization. This suggests that enhancing policy coordination and cooperation among governments at all levels is a critical issue for managing the low-carbon transition (Greenwood 2012).

Six critical features characterize effective low-carbon energy governance in Canada:

- establishing a permanent framework for the provinces, territories and federal government to continue to work together at transforming energy systems;
- integrating the energy transition within the work of relevant ministries and agencies and ensuring horizontal coordination across departments;
- re-examining the finances and powers of municipal governments to ensure that they have the authority and financial resources to play their part in the low-carbon energy transition;
- considering reconciliation as a fundamental building block while developing clean energy partnerships with Indigenous peoples;
- adjusting the mandates of energy regulatory bodies at all levels to ensure that they are empowered to pursue a low-carbon transition while enforcing social, health and environmental safeguards; and
- creating frequent, iterative opportunities to learn and change course in light of emerging technologies, market dynamics and social practices, based on robust monitoring.

These features are unlikely to emerge naturally from current energy governance in Canada, but will require focused effort to deepen collaborative process design and more effective multi-level governance of this complex issue. Furthermore, governance mechanisms and policy tools must be flexible, transparent and collaborative in order to yield legitimate social acceptability and deepened trust among parties.

There is evidence that innovative participatory energy planning and visioning processes — both virtual and place-based, and led or hosted by local government or energy experts — can

achieve citizen learning and promote changes in attitudes (Salter 2015). The *Re-energizing Canada* report formed the foundation of just such a process, Generation Energy, which holds some promise to engage Canadians in a conversation about Canada's energy future.

Fields of Action

Given what we know of the key ingredients of decarbonized energy systems and the characteristics of governance that might enable a transition, as described above, the net challenge becomes identifying specific areas for action. Governance structures set the stage for ambitious and coordinated decarbonization actions, the mix of which will vary from province to province depending on the resources available and the public acceptability of various options. Even so, *Re-energizing Canada* identifies four fields of action that are relevant to the transition in all provinces and territories and which provide abundant co-benefits for social and environmental priorities other than climate change. These are:

- **Re-imagining the movement of people and goods:** Any realistic vision for a future sustainable society requires developing low-carbon means to transport people and goods over long and short distances. The transport system has been identified as the most promising demand-side sector for decarbonization (Miller and Sorrell 2014). Options to gradually eliminate fossil fuels include improving vehicle efficiency, using low-carbon fuels, increasing occupancy, developing alternative vehicle technologies, changing transport modes and reducing the need for transportation.
- **Cities as sustainability laboratories:** With almost 25 million people living in Canadian urban areas (Statistics Canada 2017) and urban populations expected to grow considerably, cities are demonstrating leadership and pioneering new tools and programs on low-carbon transitions (Bulkeley and Betsill 2005). The proximity between municipal governments and their constituents provides many practical opportunities for government to interact with businesses, community groups and citizens to mobilize energy

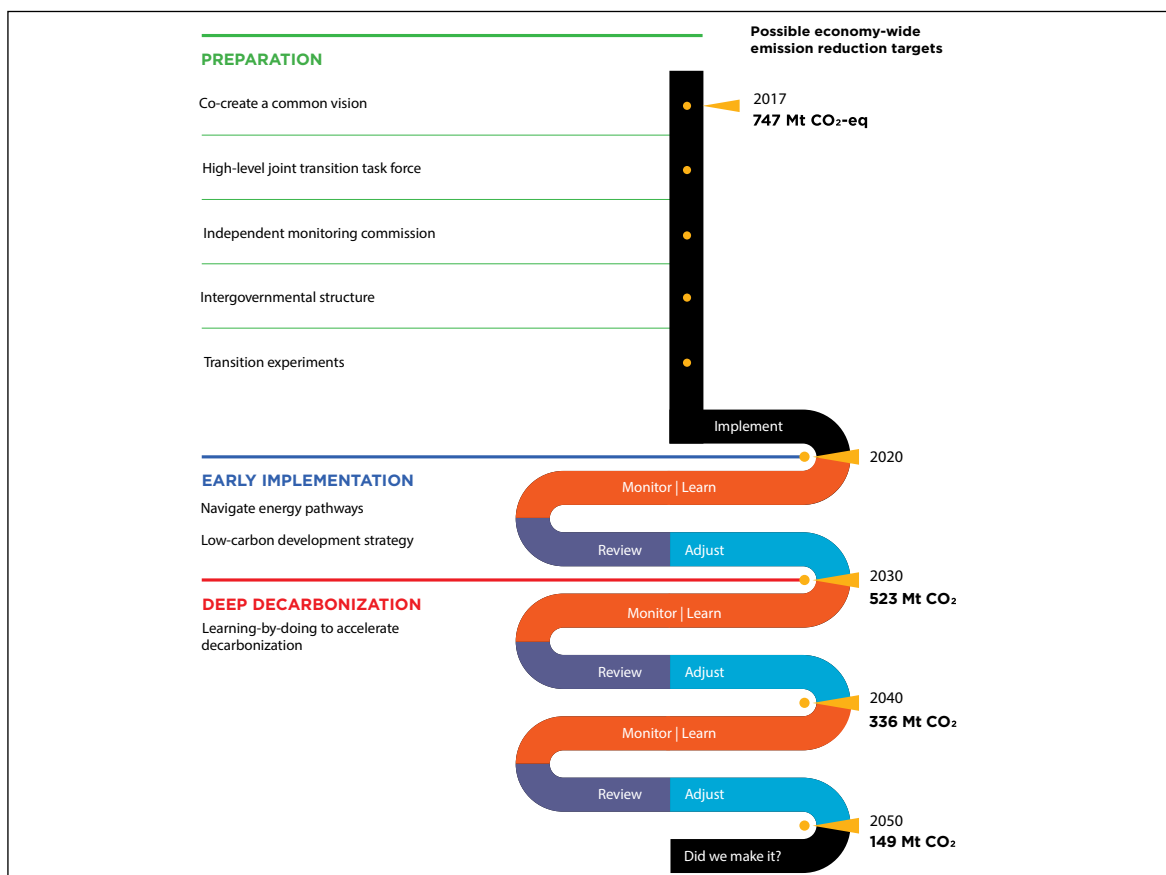
conservation through lifestyle choices and behavioural change (Sheppard et al. 2015).

The city “tool box” includes smart density, mixed-use neighbourhoods, public transportation, walkable local environments, reduced space allocated to cars, revitalized urban centres and remediated brown field sites, whole neighbourhood retrofits and protection and expansion of urban forest canopy and green infrastructure (The New Climate Economy 2014).

- **Supporting energy innovation in Indigenous communities:** Indigenous peoples have historically borne, and still bear, a heavy burden from resource development on their land, be it oil and gas extraction, dam building or mineral exploitation. Energy transition policy offers an opportunity to engage constructively with Indigenous peoples on a basis of equity, seeking partnerships that enable self-governance, building energy security, economic opportunities and sustainable communities. In the case of Indigenous community-based projects, issues of capacity, governance and revenue generation have been deemed critical to successful implementation (Balint 2006). Concepts of balance, respect and reciprocity are some of the principles that maintain cultural identity in the context of not only adaptation to contemporary social, environmental and economic challenges, but also reconciliation.
- **Engaging with industry, including the oil and gas sector:** Heavy industry in Canada is a large consumer of both electricity and combustible fuels, and the transition away from the consumption of fossil fuels in this sector is a challenging one. Priority options will include shifting toward natural gas co-generation, capturing and geologically storing CO₂ and exploring the economic and public acceptability issues related to nuclear-combined heat and power production.

A further tension exists between Canada's desire (and stated ambition) to decarbonize internally (that is, shifting Canadian communities onto low-carbon pathways by densifying cities, shifting to renewable energy, enhancing energy efficiency of buildings and vehicles and addressing industrial processes and agricultural emissions) and the abundant fossil fuel resources that are available to export internationally.

Figure 2: A Staged Approach to Energy System Decarbonization in Canada



Source: Potvin et al. (2017).

Taken together, these fields of action offer promising opportunities to pursue the transitions toward a deeply decarbonized economy. Each is a crucial piece of the puzzle, which will not fit together without a new approach to energy governance.

Policy Recommendations

The *Re-energizing Canada* report represents an innovative and important analysis of Canada's path forward on decarbonization, in that it avoids the common trap of framing this challenge as one that is mostly technical rather than social and political. The report grapples with the scale and magnitude of rapid, deep decarbonization, which the international scholarly community agrees is necessary to avoid the most severe impacts of climate change. As such, the policy recommendations that can be distilled from this

report employ what is known about the nature of transitions to decarbonized communities and the most crucial ingredients of change. These recommendations will support a multi-phase decarbonization process (see Figure 2) in Canada that is a long-term project, but with crucial first steps in the near term that can set us on a more sustainable course.

Co-create, develop and implement a country-wide vision for the low-carbon energy future. This entails maintaining and expanding the dialogue with Indigenous peoples, the provinces, the territories, municipalities and all citizens. While it can seem daunting, similar national efforts have succeeded in the past — including the profound transformation of our health-care system, which recognized the central role of the provinces while providing a common vision and set of principles. The federal government has a role to play in helping co-create a common vision, offering all Canadians opportunities to refine or adjust it as the low-carbon energy transition advances.

Adapt institutional arrangements and governance structures to ensure that the actions and directions taken drive a successful low-carbon energy transition. This would include assigning responsibility for advising on the energy transition at the federal level to a joint task force that reports directly to the prime minister and an associated, high-level Cabinet committee. This committee could bring together senior civil servants from energy, environment, economy, technology, transportation and other relevant portfolios to implement tactical planning at the federal level, respecting both the national and provincial visions. With large investments announced by the federal government to support the low-carbon transition, one of the key responsibilities of the task force will be to develop a monitoring, verification and reporting framework for projects to ensure that the investments serve to stimulate the low-carbon energy transition. A second key element of the task force's mandate should be to carry out a gap analysis of existing policies, develop additional policies as necessary and assess performance.

Accelerate the design and implementation of decarbonization experiments by providing funding for local initiatives that advance the low-carbon transition. These projects would pilot practical innovations — technologies, social practices and so on. The focus would be on novel, challenging and risky ideas that improve businesses and communities; deliver sustainability and low-carbon benefits; have the potential to deliver a significant return; offer fundamental rather than just incremental change; and are proposed by stakeholders from at least two societal sectors — business, public bodies or non-governmental organizations.

Understand climate actions as an essential element of low-carbon development strategies. Recognizing that the low-carbon energy transition needs to be accelerated, the Sustainable Canada Dialogues collective suggests that the federal government follow international examples and integrate its various policies into a broader low-carbon development strategy. This would provide a unifying context to the increasing number of actions and policies that are emerging, favouring coherence and leveraging between various initiatives. Low-carbon development strategies would move beyond the mid-century strategy in terms of both specificity and practicality. These strategies would set policies that are experimental and creative in nature and would address the concerns of a wide array of actors.

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