Institutions, Infrastructure and Energy Transitions: Climate Change, Electricity and Federalism in Canada

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Introduction

The electrification of industrial processes, transportation and space heating are widely seen as essential to wider efforts at decarbonization.[1] In Canada's case, the constitutional, legal and institutional landscape around electricity infrastructure and resources and their roles in the process of decarbonization is complex, and presents a series of major political and technological challenges

Under Canada's Constitution, the provinces hold exclusive jurisdiction over electricity generation and systems. In most provinces the major electrical utilities are provincially owned vertically integrated monopolies. The mix of generating technologies varies widely from province to province. Some provinces' systems, like those of British Columbia (BC), Manitoba, Quebec and Newfoundland and Labrador, are overwhelmingly hydroelectric. Other provinces and territories, including Alberta, Saskatchewan, Nova Scotia and the Territorial north (Nunavut, and the Yukon and Northwest Territories) remain heavily dependent on fossil fuels or, as in the cases of Ontario and New Brunswick, nuclear energy.[2]

First elected in 2015, the current Liberal, federal government's climate strategy seeks to both decarbonize the electricity sector itself, and to advance electrification as a key decarbonization strategy for other sectors. However, the federal government has no direct control over Canada's major electricity systems. Provincial interest in the decarbonization of their electricity systems varies from relatively strong support to outright hostility.

The resulting situation presents significant challenges in terms of the federal-provincial relationship around electricity generation and infrastructure, as the existing institutional and legal structures for policy coordination in the sector are weakly developed. The choices that governments make around the decarbonization of electricity systems also have significant implications for the achievement of wider sustainability goals in terms of costs and economic efficiency, non-carbon environmental risks and impacts, energy and intergenerational justice, reconciliation with Canada's Indigenous Peoples, and global security.

The following chapter examines the Canadian federal government's attempts to advance the decarbonization of the electricity sector itself and enable it to support the decarbonization of other economic activities. The chapter looks specifically at the roles of regulatory instruments, including the proposed Clean Electricity Regulations (CERs), and elements of federal government's 'Clean' Industrial Strategy, as reflected in its 2021-2023 budgets, and other measures.

Canada's performance in this context is assessed in terms of three criteria:

- Effectiveness in the decarbonization of the electricity sector itself and in strengthening the capacity of the sector to support the decarbonization of other sectors and activities.
- The efficacy of institutions in facilitating effective policy coordination and implementation between the federal government and the provinces. Ideally these efforts would be expected to display characteristics of cooperative or collaborative federalism,[3] where different levels of government work towards shared goals by implementing policy measures within their respective jurisdictions and authorities, or even pool resources and capacities to advance common objectives.
- The extent to which Canada's approach to decarbonizing the electricity sector advances wider sustainability goals, or embeds potentially serious negative trade-offs between decarbonization and other dimensions of sustainability.

With respect to the final criteria, the decarbonization of energy and electricity energy systems is seen as an essential component of the wider project of advancing sustainability. At the same time, it is important to recognize that decarbonization does not constitute sustainability in and of itself. Rather, decarbonization needs to be pursued in the context of the wider range of outcomes sought through sustainability transitions. In an energy context Winfield, Hill and Gaede[4] have articulated these outcomes in terms of the principles outlined in Figure 1.

Figure 1: Principles of Energy Sustainability and their Foundations.

Principle	**Foundations**
Maintain Ecological, social and cultural integrity	All perspectives; cultural and social dimensions highlighted in Indigenous perspectives and values
Intragenerational justice and decolonization	Brundtland; Indigenous rights and values; sustainability assessment; energy democracy and justice
Intergenerational justice	All perspectives
Community and relationships	Indigenous values; energy justice and democracy
Energy democracy and governance	Sustainability assessment; energy justice and democracy; Indigenous values
Complexity and interconnectedness of human and non-human systems	Indigenous perspectives; systems thinking
Precaution, adaptation, and avoidance of catastrophic risks	Systems thinking; sustainability assessment; Indigenous values
Economic and resource efficiency and opportunity	Economic perspectives; sustainability assessment; Indigenous values
Shared responsibility for geopolitical risks	Energy justice

Implicit in such approach to energy systems transitions is a need to be sensitive to risk of "carbon tunnel vision"[5] - the exclusive pursuit decarbonization at the expense of other important sustainability goals. Attention needs to be paid to the risks of choices around decarbonization pathways leading to potentially serious negative trade-offs among other dimensions of sustainability. Choices that cause substantial losses in relation to sustainability goals, or that replace one problem with other serious, but different, problems, should be avoided to the greatest extent possible. Rather, transitional pathways should seek to advance the full range of sustainability goals in a mutually supportive manner.

Understanding the institutional and policy landscape: Electricity and Federalism in Canada

In Canada, electricity systems evolved from relatively bottom-up public and private initiatives at the local level, mostly around the development of hydroelectric resources. From the beginning of the 20th Century through to the 1970s, provinces moved aggressively to consolidate control over major hydroelectric resources and develop larger projects, principally through provincially owned Crown corporations. The development of hydroelectric megaprojects was seen as an economic strategy in its own right, and to underpin wider industrial policies based on access to cheap and abundant hydroelectricity. [6] In Ontario and New Brunswick nuclear megaprojects were pursued between the 1960s and 1990s on a similar basis, but with less economic success.[7] Other provinces, lacking significant hydro resources, but with access to abundant local supplies of coal (e.g. Alberta, Saskatchewan and Nova Scotia) focused on the development of large coal-fired generating systems. Alberta is unusual in that the development of the province's electricity system remained in the hands of private and municipal utilities, rather than a provincial Crown corporation.

Given the centrality of electricity resources to provincial economic strategies, the provinces have asserted strong control over electricity. This is reflected in Section 92A of Canada's Constitution Act, which was added as part of the 1982 Constitutional patriation and reform package.[8] Section 92A gives the provinces exclusive jurisdiction over the "development, conservation and management of sites and facilities in the

province for the generation and production of electrical energy" and the "raising of money by any mode or system of taxation in respect of: (b) sites and facilities in the province for the generation of electrical energy and the production therefrom."

These provisions are generally seen to give the provinces exclusive jurisdiction over their electricity systems, including technological choices and system and market structures. With the exception of nuclear projects, the provinces are also the primary environmental regulators of electricity projects, including the oversight and approval of site selection, water use, waste management and the authorization of releases of pollutants into the environment.

Unlike in the United States, where the federal government played a significant role in the development of electricity resources, and interstate and regional interties, the inwards provincial economic development focus on electricity has meant that interprovincial connections are only weakly developed. Similarly, the role of the federal Canadian Energy Regulator is limited to the approval of interprovincial and international power lines. It does not supervise interprovincial markets in the manner of the US Federal Energy Regulatory Commission (FERC). Rather the focus of provinces with large hydro export capacity, such as BC, Manitoba and Quebec, has been on north-south connections to neighbouring state and FERC regulated regional markets.

The direct role of the federal government around the planning and operation of electricity systems has consequently been limited. That said, there are significant potential points of intervention through which Ottawa can and has influenced provincial decision-making around electricity. The federal government did, for example, play a major role in facilitating and supporting the development of the CANDU nuclear reactor system, and the promotion of CANDU power reactor projects in Ontario, Quebec and New Brunswick[1] as well as internationally.[9]

The federal government does hold potential regulatory authority over the development of electricity projects via its Constitutional jurisdiction over Sea Coasts and Inland

[1] 20 reactors in Ontario: Pickering (8 (2 retired)), Bruce (8) and Darlington (4)); Quebec (1 reactor (Gentily-2 – retired 2012)); and New Brunswick (1 reactor (Pt. Lepreau),

Fisheries (s.91(12)), and Navigation and Shipping (s.91(10)). Specifically federal approvals are required for projects that may interfere with fish habitat or navigation, with obvious implications, for example, for hydroelectric projects. The federal Parliament has used its declaratory power under s.92(10)(c) of the Constitution Act to place all matters related to nuclear energy under federal jurisdiction. All nuclear related projects and activities are subject to oversight and approval by the federal Canadian Nuclear Safety Commission. [10]

The federal government's authority over criminal law has been interpreted by the Supreme Court of Canada to encompass the regulation of severe threats to human health and the environment.[11] Specifically, substances added by the federal cabinet to the List of Toxic Substances (Schedule 1) under the *Canadian Environmental Protection Act* (CEPA)[12] have been determined to meet this test. Among the substances added to CEPA Schedule 1 are all of the major pollutants related to fossil-fuel fired electricity generation. These include: conventional air pollutants, such as sulphur and nitrogen oxides and particulate matter; heavy metals, including mercury and arsenic; and the six United Nations Framework Convention on Climate Change (UNFCCC) greenhouse gases, notably including carbon dioxide and methane. As such, the generation, use and release into the environment of these substances can be regulated by the federal government under CEPA.[13]

The Supreme Court has also determined that the federal government's 'backstop' carbon pricing system, which applies to larger electricity facilities, is a constitutionally valid exercise of the federal Parliament's general authority (s.91) to legislate for the "Peace, Order and Good Government of Canada" (POGG).[14]

Modern Treaties with Indigenous Peoples, starting with the 1975 *James Bay and Northern Quebec Agreement,* have facilitated the development of hydroelectric resources, although such projects have also be the sources of significant conflicts between Indigenous Peoples and provincial governments. The recognition of Aboriginal and Treaty Rights in the 1982 Constitution Act (s.35), and subsequent court decisions regarding Indigenous Rights have established requirements for federal and provincial governments to engage in "meaningful and substantive" consultation with Indigenous

Peoples when contemplating activities that may affect their rights or interests.[15] These developments have substantially changed the legal and constitutional landscape around major energy projects relative to the period up to the mid-1970s, when Indigenous rights, interests and concerns were simply ignored or overridden.

Many remote Indigenous communities have off-grid electricity systems of their own. These are usually owned and operated by provincial or territorial utilities, and are diesel powered. Remote Indigenous communities have been emerging as significant sites of technological, social and policy innovation, as they attempt to reduce their dependence on expensive and polluting fuels that have to be delivered by air, barge or over seasonal ice roads.[16]

Electricity and decarbonization

The relationship between electricity systems and climate change in Canada have only moved into focus over the past decade. Up to that point, the primary environmental concerns around electricity related to the impacts and risks associated with specific technologies: cost, waste management, and catastrophic accident risks related to nuclear energy projects; landscape and watershed impacts, as well as the effects on Indigenous Peoples, of large hydro projects; and air pollution, particularly acid rain and smog precursors and heavy metals, related to fossil fuel, and especially coal-fired, generation.

Major regulatory initiatives had been undertaken in relation to coal-fired generation in Ontario in the 1980s for the purposes of acid rain control. A phase-out of coal-fired generation in that province, where it had constituted twenty-fire per cent of generating capacity, was completed between 2003 and 2013. Although often described as the single most significant action taken by any North American government to date to reduce GHG emissions, the GHG impacts of the Ontario coal phaseout were a secondary consideration to smog-related public health concerns.[17]

The combination of Ontario's phase-out coal fired generation and the US Obama Administration's initiatives to reduce GHG emissions from the electricity sector, had prompted the then Conservative federal government of Stephen Harper to adopt

regulations in 2012 under CEPA limiting emissions of GHGs and other pollutants from coal-fired generating plants to effectively require the phase-out of unabated (i.e. without carbon capture, utilization and storage (CCUS)) generation from these facilities. The Harper government was generally seen to be otherwise hostile to action on climate change issues, having withdrawn Canada from the UNFCCC Kyoto Protocol.[18] In that context, by some estimates, the phase-out under the regulations would not have been completed until the 2060s, at the expected technical end-of-life of all existing and planned coal-fired generating facilities.[19]

A federal Liberal government, led by Prime Minister Justin Trudeau, was elected with a Parliamentary majority in October 2015, in part on the basis of an election platform that promised strong action on climate change.[20] The arrival of the Trudeau government federally, and the May 2015 election of an New Democratic Party (NDP) government in Alberta led by Rachel Notley, underpinned for the December 2016 Pan-Canadian Framework on Clean Growth and Climate Change (PCF).[21]

The PCF was agreed to by all of the provinces and territories except Saskatchewan and Manitoba, and laid the groundwork for the implementation of a national 'backstop' federal carbon pricing system, to apply in those provinces and territories without carbon pricing systems of their own.[22] The federal backstop system, consisting of a consumer carbon levy applied to heating and transportation fuels, starting at $15/tonne and an Output Based Pricing System (OBPS) which applied to industry facilities that emit more than 50,000 tonnes CO2e/year, would begin to be implemented in April 2019.[23] Ontario, Quebec, BC and Alberta, representing 80 per cent of Canada's population, were initially exempt from the federal backstop, given that each had its own carbon pricing system.

The new federal government brought a renewed focus on the electricity sector, both as a source of GHG emissions itself, and as a potential contributor to GHG emission reductions in other sectors by facilitating their electrification. The Liberal government's first major move in this regard was to advance the required phase-out date for unabated coal-fired electricity generation to 2030. This 2016 revision of the federal regulations prompted limited objections from the provinces, given that coal fired generation was only a significant electricity source in a small number of provinces (Alberta,

Saskatchewan, and Nova Scotia). Ontario had already phased-out its coal-fired facilities. The NDP government in Alberta had committed to do the same thing as part of its 2016 Climate Leadership Plan, a process completed in 2024.[24] Nova Scotia had adopted a phase-out plan as well,[25] although extensions beyond the 2030 deadline were eventually made for that province and Saskatchewan.

Moving beyond the phase-out of coal-fired electricity, as required by the federal government's 2021 commitment to net zero GHG emissions by 2050 via the *Net Zero Emissions Accountability Act*,[26] would prove much more complicated both technologically and in terms of federal-provincial dynamics.

The advancement of the deadline under the coal phase-out regulations was undertaken in a context of supportive provincial governments moving in the same direction. The federal-provincial political landscape around climate change and electricity began to change dramatically as a result of a series of provincial elections from 2018 onwards. In June of that year the provincial Liberal government in Ontario, led by Premier Kathleen Wynne, suffered a crushing defeat at the hands of Doug Ford's populist Progressive Conservatives. The Wynne government had overseen the completion of the province's coal-fired electricity phase out, introduced a comprehensive climate change plan of its own, joined the Quebec-California cap and trade carbon pricing system flowing from the California-led Western Climate Initiative, and been instrumental the forging of the federal provincial consensus that underlay the 2016 PCF. The new Ford government immediately scrapped its predecessor's climate change strategy. This included ending participation in the Quebec-California cap and trade system. The federal backstop carbon price would then apply in Ontario as a result, despite the province's objections.[27]

In October of the same year the Liberal government of Premier Phillipe Couillard in Quebec, another key participant in the PCF consensus, was defeated by the populist Coalition L'Avenir Quebec (CAQ) led by Francois Legault. Although remaining in the cap-and-trade program with California, the Legault government would play far less of a leadership role in federal-provincial discussions around climate change than its predecessor.[28]

Rachel Notley's Alberta NDP government, another central participant in the 2016 PCF federal-provincial consensus, went down to defeat in May 2019 at the hands of the populist United Conservative Party (UCP) government led by Jason Kenney. The new government moved to dismantle the consumer carbon tax system introduced by the Notley government and to openly oppose the federal government's 'backstop' carbon pricing system. However, the commitment to a phase-out of coal-fired electricity was maintained, as was the industrial carbon pricing system introduced by the NDP. [29] The opposition of the new populist conservative provincial governments to the federal 'backstop' carbon pricing system would culminate in an unsuccessful legal challenge, led by Alberta, Ontario and Saskatchewan, of the federal government's constitutional authority to implement its pricing system, before the Supreme Court of Canada.[30]

With the disintegration of federal-provincial consensus around the PCF and climate change, the issue figured prominently in the October 2019 federal election, which resulted in a Liberal minority government. Significantly, the Liberals, along with the NDP, Bloc Quebecois and Greens—all demanding increased action on the climate--garnered 60 per cent of the total vote in the election. The Conservative opposition, in contrast was widely seen to lack a credible plan on climate change.[31]

The December 2020 Health Environment, Healthy Economy (HEHE) paper[32] gave the clearest overall sense of the Trudeau government's intended approach to climate change. The paper made it clear that carbon pricing would remain at the core of the government's policies, with the backstop federal carbon price rising to $170/tonne by 2030. The government's intention, consistent with the advice of the Intergovernmental Panel on Climate Change (IPCC),[33] to revise its UNFCCC GHG emission targets from a 30 per cent to a 40-45 per cent reduction in GHG emissions relative to 2005 by 2030, and to seek a target of net zero emissions by 2050, was confirmed. These targets were subsequently embedded in legislation through the June 2021 *Net Zero Emissions Accountability Act*. With respect to electricity, the paper indicated the federal government's intention to pursue a net zero electricity grid by 2035, accompanied by programs for building energy efficiency retrofits and electric vehicle sales mandates.

The April 2021 federal budget, tabled amid the ongoing COVID-19 pandemic, and in the context of the Supreme Court of Canada's March 2021 decision in support of the federal government's authority to implement its 'backstop' carbon pricing system, laid the groundwork for Liberal government's platform in the federal election called for October. In addition to promises around the HEHE themes of building retrofits, EV mandates and charging infrastructure, the platform committed to a Clean Electricity Standard to bring the electricity grid to net-zero by 2035.[34] The outcome of the election was almost identical to that in 2019 – a Liberal minority government supported by three opposition parties with strong commitments to climate action.

The government's March 2022 *2030 Emissions Reduction Plan*, [35] outlined its specific plan to achieve its revised 2030 target for reductions in GHG emissions. The plan anticipated that major (>100mtCO2e/yr) reductions in emissions from the electricity sector, largely due to the phase-out of coal-fired generation, would account for the most significant contribution towards meeting the overall 2030 target. Beyond those initial gains, the federal government would take a multi-track approach in its pursuit of a net-zero electricity grid. This would combine a regulatory Clean Electricity Standard, to be made under CEPA, and extensive financial support for what it considered "clean" electricity. The latter would include a $25 billion tax credit (controversially including nuclear energy and CCUS for fossil fuel-fired facilities), in its 2023 budget, as part of a broader $80 billion "clean" industrial strategy intended to respond to the October 2022 US *Inflation Reduction Act*. Up to $20 billion in additional support for specific projects, including small modular nuclear reactors (SMRs) was to be provided through the federal Canada Infrastructure Bank, along with an aggressive federal strategy to promote SMRs. The 2021-23 federal budgets also included extensive support for CCUS, notably a $1.5 billion/yr tax credit program.[36]

The Clean Electricity Regulations themselves were published in draft form in August 2023. In effect, given the pre-existing coal phase-out regulations, the Clean Electricity Regulations would primarily apply to natural gas-fired generating facilities. Under the original draft regulations, by 2035 any electricity generating facility that used fossil fuels to generate 25 megawatts or more of electricity, and that sent more electricity to the grid

than it drew would not be permitted to emit more than 30 tonnes of carbon dioxide equivalent per gigawatt hour (CO2e/GWh) of production as an average over a calendar year. Implicit in this standard was a requirement that any fossil fuel fired facility would have to operate using carbon capture technology and, for gas-fired facilities, achieve a 90-to-95 per cent carbon capture rate. Gas-fired facilities coming into service after January 1, 2025 would have to comply with the standard by 2035, while facilities existing before that date would have up to 20 years to comply from their commissioning date, meaning that in the case of newly built facilities the standard would not apply until the mid-2040s. In order to provide system operators with some degree of flexibility, particularly dealing with critical peaks in demand and outages of other generating facilities, the regulations included provisions allowing for the operation of facilities up to 450 hours/yr above the required standard, and for unlimited “emergency” operations. [37]

The landscape around electricity decarbonization was complicated by emerging analyses suggesting that the achievement of the federal government’s overall net zero emission target by 2050 could require a two-to-three-fold increase in supplies to provide the electricity needed to decarbonize other industries, transportation and space heating.[38] This conclusion emerged in a context within which most provinces had seen slow or even negative demand growth over the preceding two decades. These trends had been a product of increased energy productivity and economic restructuring, despite positive overall trends in economic and population growth.[39]

The two new large hydro projects that had been developed during this period, the Site C project in BC and Muskrat Falls in Labrador, were widely seen as ‘white elephants’ for which there was likely to be insufficient demand to justify their costs.[40] A third large hydro project, the Conawapa project in northern Manitoba,[41] and proposed nuclear construction and refurbishment projects in Ontario had not been pursued for the same reasons.[42] Provincial utilities were not anticipating multi-fold expansions of generating capacity in their long-term plans.

The non-regulatory aspects of the federal government’s approach around electricity, particularly its support for SMRs and CCUS, were relatively well received by the governments in provinces whose electricity systems were not hydro based, or who had

strong interests in developing these technologies. This was particularly the case for Saskatchewan and Alberta on CCUS and New Brunswick, Ontario, Saskatchewan and Alberta on SMRs.[43]

The proposed Clean Electricity Regulations themselves, on the other hand, prompted strongly negative responses from many provinces and utilities. The regulations were seen as likely to be costly, impractical, excessively stringent, and insensitive to the situation of heavily fossil fuel dependent provinces lacking major hydro-electric resources of their own.[44] None of the provinces in which fossil fuel-fired generation continued to play a significant role had seriously contemplated movement in the direction of a full fossil fuel phase-out and net zero emission electricity sector, particularly given their reliance on fossil natural gas-fired facilities as a replacement for coal-fired generation.

Alberta, for its part, launched a national public advertising campaign against the proposed regulations, imposed a moratorium on at the time booming new renewable energy development in the province in protest, and threatened further constitutional litigation against the standards.[45] Even among those sympathetic to the federal government's climate goals there were growing concerns about the federal and provincial emphasis on unproven, risky and potentially very costly SMR and CCUS technologies to achieve compliance, as opposed to a focus on energy productivity and renewable energy sources.[46]

In response to the objections from provinces and utilities, in February 2024 the federal government stated that it would revise its approach to the Clean Electricity Regulation. Instead of relying on a consistent national emission standard for electricity generation, standards are to be developed and applied on a facility-by-facility basis. No date has been provided for the adoption of revised regulations.[47]

Evaluation and discussion

The decarbonization of electricity systems in Canada presents significant institutional, political and technological challenges. This is particularly the case in the context of an overall net zero goal, which requires major expansions in electricity supply while

decarbonizing the electricity sector itself. These were directions which provincial utilities had not seriously contemplated prior to the early 2020s. The situation is further complicated by the near complete breakdown of the federal provincial consensus, reflected in the 2016 PCF, that existed on climate change policy between 2015 and 2018, and which still underpins much of the federal government's approach on climate matters.[48]

This chapter set out to evaluate Canada's approach to decarbonization of its electricity systems, key infrastructures in an overall energy transition towards net zero in terms of three criteria: effectiveness in achieving decarbonization; the performance of legal and governance institutions and processes around the decarbonization effort; and the consideration of the advancement of wider sustainability considerations and avoidance serious negative trade-offs among other sustainability goals in the pursuit of decarbonization.

Effectiveness in decarbonization

By far the most demonstrably effective measures taken by Canadian governments to date to reduce GHG emissions have been the phase-outs of coal-fired electricity generation in Ontario, Alberta, and to a lesser extent Nova Scotia. In all three provinces these efforts have produced major reductions emissions of GHGs, smog precursors, and heavy metals.[49] All of these initiatives were provincially led, although the federal coal-phase-out regulations played a significant role in reinforcing provincial directions and ruling out any backsliding towards coal.[50]

The effectiveness of electricity sector decarbonization efforts beyond the coal phase-outs is much more doubtful. The proposed federal Clean Electricity Regulations now appear to be on indefinite hold. There is little or no provincial leadership in the direction of phasing out gas-fired generation, or controlling GHG emissions from these sources. In fact, in some provinces, notably Ontario, the role of gas-fired generation, and its associated emissions, is expanding rapidly, and new gas-fired generating capacity being added.[51] There has been some recent renewed interest in Ontario[52] and Quebec,[53] around renewable energy. However, significant development of additional renewable energy sources, and the pursuit of improved energy efficiency and

productivity, seems largely stalled.[54] In the case of Alberta, renewables development faces outright hostility. Some provinces have shown strong enthusiasm for a variety of SMR technologies, but the economic and technological viability of these systems is subject to serious debate.[55]

Large expansions of electricity generation capacity, particularly from large-centralized facilities like large hydro projects or nuclear facilities, have the potential to stretch the fiscal capacity of utilities and provincial governments themselves, The financial consequences of long-term projections in demand growth not materializing has been demonstrated by the recent experiences of BC and Newfoundland and Labrador Site C and Muskrat Falls hydro projects respectively, and earlier nuclear construction and refurbishment programs in Ontario and New Brunswick.[56] In the case of Ontario the capital costs of a net zero strategy largely based on large centralized, particularly nuclear, generation has been estimated in the range of at least $400 billion.[57]

Some provincial utilities, such as Hydro-Quebec,[58] Ontario Power Generation and its nuclear partner Bruce Power,[59] have embraced what they perceive as opportunities for returns to expansion and their historical roles in megaproject construction through electrification and decarbonization. Other utilities, like Manitoba Hydro, have been more cautious in their responses. They have highlighted the political, economic and technological uncertainties around the actual pathways around electrification and decarbonization, particularly given the timeframes involved and the paces of economic change and technological development in areas like renewables, energy storage and grid management.[60]

Proposals have been made from a variety of sources over the past decade to make better use of the very large hydro-electric storage capacity available in some provinces, notably BC, Manitoba, Quebec and Newfoundland, to support the increased integration of intermittent renewable energy sources (e.g. wind and solar) in other provinces. [61] However, no major initiatives have come of these suggestions to date.

Considerable potential for meeting decarbonized energy needs has been identified through increases in energy efficiency and productivity.[62] Major potential is also seen in the development of distributed energy resources (DERs) linking distributed renewable

energy generation (e.g. rooftop solar) with energy storage capacity at the household or facility level, through advanced grid management technologies.[63] Unfortunately federal and provincial policy frameworks in these areas remain weakly developed, if at all. Moreover, established utilities may be hostile to the development of the full potential of these options out of fear of their capacity to significantly erode grid demand and strand new, large centralized generating assets as a result.[64]

Institutions and federal provincial dynamics

The initial stages of efforts to reduce the carbon footprint of Canada's electricity systems were characterized by relatively strong provincial policy leadership, notably around the coal phase-outs in Ontario, Alberta and Nova Scotia. The federal government ultimately played an important backstopping role in locking in, through its own coal-phase out regulations, the gains made through provincial action.

However, the federal provincial consensus around climate change and decarbonization that characterized the 2015-2018 period has almost completely collapsed in the aftermath of the arrival of new, populist provincial governments, particularly in Ontario, Quebec and Alberta. Relative to the federal-provincial consensus that existed around the 2016 PCF, among the provinces only BC can be described as a significant climate policy leader.[65]

The situation has made movement beyond the phase-out of coal-fired electricity increasingly difficult. The federal government has continued to pursue its commitments under the UNFCCC, but it has no direct control over provincial decision-making around their electricity systems, something which provinces guard jealously, given that most see their electricity systems as sources of strategic economic advantage. Ottawa has sought to influence the provinces through a combination of regulatory measures, notably the proposed Clean Electricity Regulations, and very substantial financial incentives and support.

The CERs prompted hostile responses from the provinces whose electricity systems are largely, or significantly, reliant on fossil fuel fired-generation, and who, following the coal phase-outs, were unprepared for a move in the direction of net zero by 2035. The

regulations now seem stalled. The fiscal incentives and other supports offered by the federal government, particularly around CCUS and SMRs have been well received at the provincial level. However, these technologies are subject to very serious questions about their effectiveness in reducing GHG emissions.

Canada's institutional structures for intergovernmental coordination around electricity are weakly developed. Those structures that do exist largely focus on technical rather than policy matters, or like the Canadian Energy Regulator, have seen themselves as having limited mandates relative to the challenges of decarbonizing energy and electricity systems. Existing interties are focused on access to US markets, rather than cooperation or integration with other provinces. Provincial energy regulators, for their part, have only just begun to have references to the environment and climate change incorporated into their mandates.[66]

Advancing Energy Sustainability

Technological options initially identified by the federal government under its 'clean' electricity framework included improvements in energy efficiency, demand side management, dynamic pricing, solar, wind, hydropower, distributed energy systems. grid interties, energy storage, and geothermal. With the exception of new large hydro-electric projects, these are relatively low-impact options, and are generally seen to fit well within the energy sustainability framework outlined earlier, with limited negative trade-off risks. New large hydro projects, on the other hand, would face significant challenges in a sustainability context in terms of ecological, social and cultural integrity, especially around their potential impacts on Indigenous communities.[67]

In practice, notwithstanding its initial references to a wider range of technological options, the federal government has placed a growing emphasis on CCUS and SMRs in terms of financial support via tax credits and other measures. Federal impact assessment and other approval processes in relation to these technologies have been eliminated outright or aggressively 'streamlined as well, including the effective exemption of SMRs from the 2019 *Impact Assessment Act*.[68]

From sustainability perspective CCUS and SMR focussed pathway being pursued by the federal government raises serious concerns in terms of likely effectiveness in decarbonizing the electricity system, given the doubts about the economic and technological practicality of these technologies.[69] The focus on CCUS, and especially SMRs, also raises wider questions in a sustainability context.[70] CCUS is seen to carry significant potential to lock-in long-term dependence on fossil fuels.[71] SMRs for their part, raise many of the same concerns as conventional reactors around fuel life-cycle impacts, waste management, unique and uniquely severe catastrophic accident, security, and weapons proliferations risks.[72]

Taken as a whole, the federal government's approach to decarbonizing the electricity sector seems to have to paid little or no attention to the risks of significant negative trade-offs against wider sustainability goals of the decarbonization pathways it has chosen to pursue. Rather, its choices have tended to reflect the technological preferences of powerful incumbent actors, particularly provincial utilities and the nuclear industry, in the sector.

Conclusions

This chapter assessed Canada's approach to decarbonization of its electricity systems in terms of the criteria of: effectiveness in achieving decarbonization; the performance of legal and governance institutions and processes around the decarbonization effort; and the consideration of wider sustainability considerations in the pursuit of decarbonization. The findings against these criteria are summarized in **Figure 3** below.

Figure 3: Assessment of Decarbonization of the Electricity Sector in Canada

Criteria	**Decarbonization effectiveness**	**Institutional structures and intergovernmental cooperation**	**Advancing energy sustainability in decarbonization**
Assessment	Provincially led coal-phase-outs have led to significant reductions in	Increasing federal-provincial conflict over decarbonization of sector beyond coal	Consideration of non-carbon dimensions of sustainability weak to non-existent.

	emissions of GHGs and other air pollutants. Progress beyond coal phase-outs stalled.	with non-hydro provinces. Weak institutional structures for policy coordination around electricity decarbonization.	

By far the most demonstrably effective measures taken by Canadian governments to date to reduce GHG emissions have been the phase-outs of coal-fired electricity generation in Ontario, Alberta, and to a lesser extent Nova Scotia. The effectiveness of decarbonization efforts beyond the coal phase-outs is much more doubtful. The proposed federal Clean Electricity Standard regulations now appear to be on indefinite hold as a result of provincial objections. There is little or no provincial leadership in the direction of phasing out gas-fired generation, now the leading source of GHG emissions from the electricity sector.

The initial 2015-2018 phase of efforts to decarbonize the electricity sector were characterized by high levels of federal provincial consensus and cooperation. However, that consensus has almost completely collapsed in the aftermath of a series of provincial elections resulting in populist conservative governments. The federal government has pursued a strategy of a combination of regulatory measures and fiscal incentives around decarbonization. Financial support for CCUS and SMRs in particular, has been well received at the provincial level, but the federal government's proposed Clean Electricity Regulations have been met with hostile responses from the non-hydro provinces and are now stalled.

Significant progress towards decarbonization based exclusively on financial incentives seems unlikely, but further efforts to employ effective regulatory tools may deepen the level of political conflict between the federal government and the fossil fuel dependent provinces. The legal and constitutional boundaries between provincial authority over electricity through S.92A of the Constitution Act, and the federal criminal law power exercised through the regulation of "toxic" substances under CEPA, are so far untested.[73]

Institutional structures for policy coordination among governments around the decarbonization of the electricity sector remain weakly developed, as are interprovincial interties. The federal effort to move towards a net zero electricity system by 2035, while also pursuing multi-fold increases in electricity production is deeply challenging in itself. This is particularly the case given a heavy reliance on large, centralized generation focused supply side approaches, with the implications of high capital costs and multi-decade planning and construction timelines. It may well be close to impossible even with strong provincial engagement and support, which so far has not been forthcoming. The situation is further complicated by the possibility of a change in government at the federal level in a direction far less committed to addressing climate change and decarbonization.[74]

Considerations of the non-carbon dimensions of sustainability in the approach of the federal government and most provinces to the decarbonization of the electricity sector have been virtually non-existent. In addition to the doubts about the effectiveness of CCUS and nuclear-focused approaches to decarbonization being pursued by the federal government and a number of non-hydro provinces, these pathways raise a range of wider serious sustainability concerns. The aggressive 'streamlining' of assessment and decision-making processes around technologies and sectors that are deemed to be 'clean' further weakens opportunities for consideration of the long-term implications of the choices that are being made.

Taken as a whole, decarbonization of the electricity sector in Canada began with a relative strong start around the phase-out of coal-fired electricity, but has now slowed, with increasing levels of federal-provincial conflict, and the embedding of pathways whose contributions to sustainable energy transitions are open to serious question.

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