



GETTING TO DEPLOYMENT

BRIDGING THE GAPS IN ENERGY INNOVATION IN CANADA

QUEST



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ACKNOWLEDGEMENTS

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QUEST is a national non-government organization that works to accelerate the adoption of efficient and integrated community-scale energy systems in Canada by informing, inspiring, and connecting decision-makers. QUEST undertakes research, communicates best practices, convenes government, utility, private-sector and community leaders, and works directly with local authorities to implement on-the-ground solutions. QUEST grounds all its activities in the “Smart Energy Community”– a concept that encapsulates the ideal end state of the organization’s work.



About Pollution Probe

Pollution Probe is a national, not-for-profit, charitable organization which is improving the health and well-being of Canadians by advancing policy that achieves positive, tangible environmental change. It is a leader in building successful partnerships with industry and government to develop practical solutions for shared environmental challenges.



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LIST OF ACRONYMS

CEF	Community Energy Financing
CFIA	Canadian Food Inspection Agency
CSA	Canadian Securities Administrators
DER	Distributed energy resource
ECCC	Environment and Climate Change Canada
EcoEI	ecoEnergy Innovation Initiative
EIP	Energy Innovation Program
ESDC	Employment and Social Development Canada
EV	Electric vehicle
FCM	Federation of Canadian Municipalities
GIF	Grid Innovation Fund
IEA	International Energy Agency
IESO	Independent Electricity System Operator
ISED	Innovation, Science and Economic Development Canada
LDC	Local distribution company
LICER	Le Laboratoire d'Innovation Civique pour l'Expérimentation Réglementaire
MIS	Maison de l'Innovation Sociale

NRCan	Natural Resources Canada
OEB	Ontario Energy Board
OERD	Office of Energy Research and Development
OSC	Ontario Securities Commission
PV	Photovoltaic
R&D	Research and development

EXECUTIVE SUMMARY

Innovation in the energy sector is crucial if Canada is to meet its net-zero targets. At the same time, accelerating innovation in low-carbon energy sources has dual benefits: it can both contribute to reducing emissions more quickly and it can lead to long-term economic growth, helping Canada recover from the economic impacts of COVID-19.

However, Canada's energy innovation policies are not adequate to ensure the rapid deployment of low-carbon innovation that is needed. By focusing on research, development and demonstration of emerging technologies, and relying on the use of public funding as the main mode of intervention, policies and programs designed to encourage innovation in Canada's energy sector have neglected the importance of deployment. Unlike research, development and demonstration, which are technology-focused, the deployment of innovation is centred around integrating and managing new technology, changing perspectives and corporate cultures, building new competencies and filling skills gaps, inventing new business models, and envisioning how utilities are going to be run and managed.

The non-technological barriers that innovators are facing are limiting the deployment of innovation. This report identifies four areas of intervention to overcome these non-technological barriers and scale up innovation in Canada:

1. Developing strong collaboration and knowledge-sharing mechanisms
2. Building support for navigating the regulatory and policy landscape
3. Creating space for safe real-world trials in the energy ecosystem
4. Capturing knowledge to actively inform policy and regulatory changes.

To address these non-technological barriers, innovation policies and programs need to develop tools to address these four areas. This requires us to move beyond defining innovation from a narrow technological lens and to embrace social, cultural, and economic aspects of innovation.

Innovation Sandboxes are tools that are becoming recognized internationally to encourage innovation in the energy sector. They use collaboration to create conditions for safe and controlled methods to explore new energy products, services, and business models in a real-world environment. Innovation Sandboxes combine four policy tools that can help us meet the four areas that need attention from Canadian energy innovation policy:

- **Innovation Hubs** provide collaboration and knowledge sharing mechanisms
- **Enquiry Services** support innovators in navigating the regulatory and policy landscape
- **Regulatory Trials** allow for safe space for experimentation
- **Regulatory and Policy Learning** ensures that lessons learned are used to inform future energy policy and regulatory discussions.

This report asserts that given their multiple benefits, Innovation Sandboxes have a role to play in accelerating the deployment of innovation and addressing non-technological barriers in Canada's energy sector while complementing current innovation programs. The report also outlines how Canada is no stranger to Innovation Sandboxes; in fact, several are already being used at the federal, provincial, and local governments levels, in various sectors, such as in securities, agrifood, and transportation.

In the energy sector, the Ontario Energy Board (OEB) implemented the first Sandbox in Canada. While it has shown that sandboxes can provide benefits, it has also highlighted areas for improvement for sandboxes to be a more effective innovation tool. And while not true Innovation Sandboxes, some recent Canadian energy innovation programs have introduced sandbox-like tools in their design to address non-technological barriers and the deployment of new practices and business models.

But more work is needed for Innovation Sandboxes to address the barriers to deploying innovation in a way that benefits all. As our first report *Enter the Sandbox: Developing Innovation Sandboxes for the Energy Sector*¹ shows, to be

¹ Richard Carlson and Aida Nciri (July 2020). Enter the Sandbox: Developing Innovation Sandboxes for the Energy Sector. Retrieved from <https://questcanada.org/wp-content/uploads/2020/07/Innovation-Sandboxes-Report-1-EN.pdf>

successful sandboxes need to be well-designed and tailored to the local context and specific needs of each jurisdiction that develop them. As a result, there is no “one” type of Innovation Sandbox.

This is why the design phase of an Innovation Sandbox is crucial. Developing energy Innovation Sandboxes in Canada means developing a framework tailored to each jurisdiction’s context and needs. This means incorporating ideas and feedback from the diverse stakeholders that evolve in the energy system, from energy users and new entrants, to utilities; from the regulators to the government through innovative and inclusive engagement processes.

This second report is part of a four-year Innovation Sandboxes initiative led by Pollution Probe and QUEST to encourage and enable the development and use of Innovation Sandboxes in jurisdictions across Canada. The goal of this project is to create foundational policy frameworks and principles for Innovation Sandboxes that are tailored to participating Canadian provincial and territorial energy systems. Drawing on the information presented and recommendations made in both research reports, QUEST and Pollution Probe will work collaboratively with provincial, territorial, and federal policymakers, regulators, and other key energy stakeholders to develop tailored foundational frameworks that will promote long-lasting conditions for innovation. These frameworks can then be used to change existing policies and regulations or create more effective policies, regulations, and programs to accelerate the transition to a low-emissions future.

INTRODUCTION

Canada cannot reach net zero without the know-how of the energy sector, and the innovative ideas of all Canadians.

Speech from the Throne, 2020²

Canada is no stranger to energy innovation. From developing the CANDU nuclear reactor to commercializing new methods for developing the oil sands, energy innovation has played a large part in Canada's prosperity. Innovators across the country are developing new energy services.³

Canadians also need to rapidly reduce emissions to avoid drastic climate change and ensure continuing prosperity for all. As noted by the International Energy Agency (IEA), reaching net-zero emissions will require "a radical transformation in the way we supply, transform and use energy." Innovation will thus be key to meeting our targets.⁴

Canadian policymakers are not standing still. The federal government alone invested over \$2.3 billion to support the innovation, commercialization and adoption of clean technology between 2017 and 2019.⁵ According to a recent survey of utilities, regulators, policymakers, and other sector participants, there is broad agreement that innovation in energy regulatory practices is needed due to evolving social and environmental goals, market change, and rapid technological developments.⁶

Accelerating innovation in low-carbon energy sources has dual benefits: not only can it help

reduce emissions but it can lead to long-term economic growth, helping Canada recover from the economic impacts of COVID-19.⁷

To achieve both the emissions reductions and economic benefits, it is important to evaluate the effectiveness of investment in low-carbon innovation, and how innovation programs and policies can be deployed much more widely and quickly across Canada. In Canada, as we shall see, there is a history of innovation policies focusing solely on increasing the quantity of innovation, rather than supporting deployment. As such, the aim of these policies is on research and development (R&D), tax credits and other upstream incentives. Innovation in this area is considered to be the most unpredictable, which makes some say that the success of Canadian innovation policy "ranges from marginal to abysmal."⁸

A comprehensive innovation policy approach is needed if we want to be successful in achieving the transition to a low-emission economy.

Given Canada's pressing need to deploy low-carbon innovation to contribute to emissions reduction commitments and to promote economic growth, it is necessary to examine whether

² Governor General of Canada (September 23, 2020). A Stronger and More Resilient Canada: Speech from the Throne. Retrieved from: <https://www.canada.ca/en/privy-council/campaigns/speech-throne/2020/stronger-resilient-canada.html>

³ In this report, we use the term "innovator" to refer to any person or organization (utilities, service and technology providers, etc.) that wants to introduce new methods, ideas, or products. Innovators can therefore be to new entrants or well-established players in the energy markets.

⁴ International Energy Agency (2020). Energy Technology Perspectives 2020. Retrieved from: <https://www.iea.org/reports/energy-technology-perspectives-2020>

⁵ Government of Canada (n.d.). Clean Growth Hub. Retrieved from: <https://www.ic.gc.ca/eic/site/099.nsf/eng/home>

⁶ Patricia Larkin (August 2020). What Works? Identifying and scaling up successful innovations in Canadian energy regulatory decision making: Survey results. Positive Energy, University of Ottawa. Retrieved from https://www.uottawa.ca/positive-energy/sites/www.uottawa.ca/positive-energy/files/what_works_identifying_and_scaling_up_successful_innovations.pdf

⁷ In a survey of more than 200 economists and central banks from around the world, investment in low-carbon innovation was seen as a rare instance where there were both long-term economic returns and also emissions reductions. See Cameron Hepburn, Brian O'Callaghan, Nicholas Stern, Joseph Stiglitz, Dimitri Zenghelis (May 2020). "Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change?," Oxford Review of Economic Policy, Volume 36, Issue Supplement 1, pp. S359–S381. Retrieved from: <https://doi.org/10.1093/oxrep/graa015>

⁸ Richard Hawkins (November 2016). "The Trouble with Innovation: Why Cleaning Up the Environment Is Going to Be a Lot More Challenging than We Think," Canadian Public Policy, Volume 42, Issue S1, pp. S46–S53. Retrieved from: <https://doi.org/10.3138/cpp.2015-020>

the federal, provincial and territorial innovation programs currently available are supporting all three stages of innovation (R&D, demonstration, and deployment). Indeed, a comprehensive innovation policy approach is needed if we want to be successful in achieving the transition to a low-emission economy.

As Pollution Probe and QUEST pointed out in an earlier report, *Enter the Sandbox: Developing Innovation Sandboxes for the Energy Sector*,⁹ Innovation Sandboxes are new, cutting-edge policy tools, originally developed for the FinTech sector, that have been used to foster rapid innovation and deployment in the energy sector by addressing institutional and systemic barriers — which are too often overlooked by conventional innovation policies. Innovation Sandboxes are policy tools that use collaboration among the diverse players of the energy system to create conditions for safe and controlled methods to explore new energy products, services, and business models in a real-world environment.

This report is based on the analysis of 10 current energy innovation programs put in place at the federal, provincial and territorial levels, and of interviews with 13 agencies and utilities running innovation programs. The selection and review of innovation programs did not aim to be exhaustive; rather, the intention was to identify present approaches to energy innovation, emerging trends, and new methods.

This study examines the role and benefits of Innovation Sandboxes within the current energy innovation policy landscape in Canada. Before looking at the role that Innovation Sandboxes could play, we first review the different stages of innovation and the trends in current energy innovation programming in Canada. We then identify four areas of intervention that are needed to address non-technological barriers to scale up innovation. Finally, we examine how Innovation Sandboxes have emerged as an effective policy tool to deploy innovation in Canada — both in the energy and other sectors — as more and more programs are using elements of Innovation Sandboxes in their design.

⁹ Richard Carlson and Aida Nciri (July 2020). *Enter the Sandbox: Developing Innovation Sandboxes for the Energy Sector*. Retrieved from <https://questcanada.org/wp-content/uploads/2020/07/Innovation-Sandboxes-Report-1-EN.pdf>

CURRENT ENERGY INNOVATION PROGRAMS

STAGES OF INNOVATION

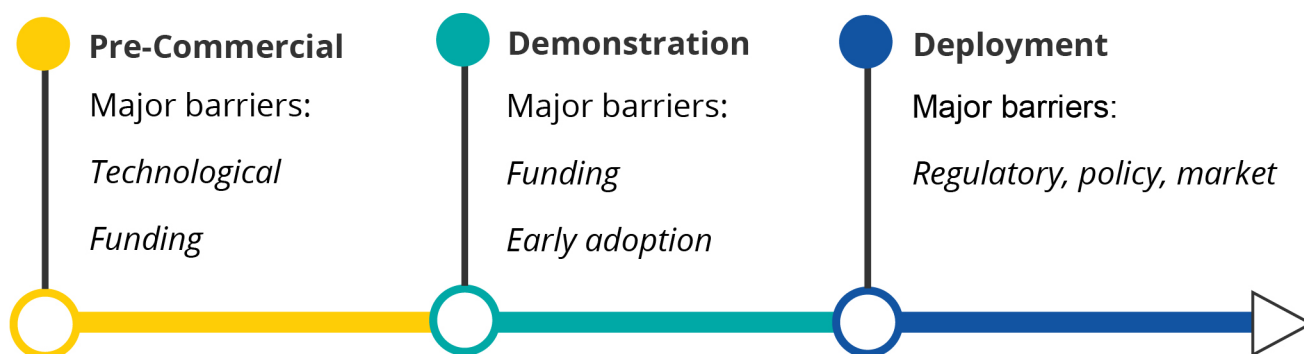
Before examining energy innovation programs in Canada it is necessary to understand how innovation progresses. The diffusion of innovation is not a linear or spontaneous process. From its creation to its adoption, innovation needs to be nurtured and supported through intentional public interventions and policies that address “market failures” and account for the different characteristics associated with each stage of innovation.¹⁰

Innovation is a cycle, typically consisting of three stages:

1. A **pre-commercial** stage characterized by research and development activities to discover, design or develop new solutions
2. A **demonstration** stage of showcase projects, that are limited in scale, to prove technological or technical feasibility
3. A **deployment** stage, leading to scale-up and widespread adoption.

At each stage, innovators face different types of barriers to adoption and thus governments need to adapt their policy tools and interventions to address each specific barrier (see Figure 1 below).

Figure 1- Innovation Progression



The primary barriers at the pre-commercial stage are technological (that is, ensuring technologies work) and financial (lack of funding to conduct R&D). Innovations at this stage may be seen as too risky or lengthy for private investment given that progression to commercial viability can take decades.¹¹ Additionally, other values from pre-commercial R&D, such as knowledge circulation from research findings, cannot be captured, which further limits private investment.¹² Public funding to support R&D is typically the primary policy tool governments use to overcome these pre-commercial barriers.

Demonstration projects also face the barrier of access to funding. However, technological barriers become less important here than identifying early adopters to prove the feasibility of an innovation outside the lab and in the real world. Similarly to pre-commercial R&D, public funding is often used to overcome challenges associated with developing innovative demonstration projects.

¹⁰ Jakob Edler and Jan Fagerberg (January 2017). “Innovation policy: what, why, and how,” in Oxford Review of Economic Policy, Volume 33, Issue 1, pp. 2–23. Retrieved from: <https://doi.org/10.1093/oxrep/grx001>

¹¹ Varun Sivaram, Colin Cunliff, David Hart, Julio Friedmann and David Sandalow (2020). Energizing America — A Roadmap to Launch a National Energy Innovation Mission. Columbia University SIPA Center on Global Energy Policy. Retrieved from: https://www.energypolicy.columbia.edu/sites/default/files/file-uploads/EnergizingAmerica_FINAL_DIGITAL.pdf

¹² Smart Prosperity Institute (April 2017). Accelerating Clean Innovation in Canada. Retrieved from: <https://institute.smartprosperity.ca/sites/default/files/acceleratingcleaninnovationincanada.pdf>

At the deployment stage an innovation becomes commercially viable and thus investment transitions from primarily public to private. Regulatory, policy, and market barriers become the dominant challenges to widespread deployment, requiring policy and market changes. Innovations in the energy sector are especially affected by these barriers given the highly regulated nature of the sector, compounded by the slow rate of change in existing regulatory structures and regulatory agencies.¹³ Under these conditions, innovators face a disincentive, and regulated utilities can even be prohibited from testing innovations due to regulatory constraints or the absence of regulations. As a result, private funding for the adoption of innovations becomes increasingly available only under more favourable policy regimes and regulatory certainty, as the investment risk falls.¹⁴

To overcome the Valley of Death, policymakers need to consider interventions apart from funding that transform the institutional landscape, including policies and regulations that better enable markets to invest in, adopt, and commercialize innovations.

In this context, the move from demonstration to deployment is referred to as a “Valley of Death” because of the unsolved challenge of scaling up innovation. This is characterized by lack of financing for commercialization and subsequent widespread adoption.¹⁵ In order to overcome the Valley of Death, policymakers need to consider

¹³ Guy Holburn (2012). “Assessing and managing regulatory risk in renewable energy: Contrasts between Canada and the United States,” in Energy Policy, Issue 45. Retrieved from: <https://www.ivey.uwo.ca/cmsmedia/3780244/holburn-energy-policy-2012.pdf>; William Eggers and Mike Turley (2018). The future of regulation — Principles for regulating emerging technologies. Deloitte Center for Government Insights. Retrieved from: https://www2.deloitte.com/content/dam/insights/us/articles/4538_Future-of-regulation/DI_Future-of-regulation.pdf

¹⁴ Analytica Advisors (2017). 2017 Canadian Clean Technology Industry Report. Retrieved from: <http://analytica-advisors.com/sites/default/files/2017%20Canadian%20Clean%20Technology%20Industry%20Report%20Synopsis%20FINAL.pdf>

¹⁵ George Ford, Thomas Koutsy and Lawrence Spiwak (September 1, 2007). A Valley of Death in the Innovation Sequence: An Economic Investigation]. SSRN Electronic Journal. Retrieved from: <https://dx.doi.org/10.2139/ssrn.1093006>

interventions apart from funding that transform the institutional landscape, including policies and regulations that better enable markets to invest in, adopt, and commercialize innovations.

CLEANTECH AND ENERGY INNOVATION PROGRAMMING IN CANADA

Canada has many avenues for supporting R&D through public sector contributions. In 2017, public investment amounted to more than one quarter of the total cleantech industry investment in R&D.¹⁶ In 2016-17, \$2.4 billion of financial support was provided for business innovation directly or through universities/colleges, academic researchers, and nonprofits, with most programming supporting clean technology.¹⁷

The increased importance given to this area can be seen by the federal government committing to doubling clean energy R&D and demonstration from 2014 to 2020 (from \$387 million to \$775 million) through participation in Mission Innovation, an international commitment to increase cleantech R&D.¹⁸ Similarly, nine out of 10 provinces have dedicated programs for energy efficiency innovation as well as research institutes and projects focused on energy efficiency innovation.¹⁹

However, many energy innovations struggle with getting beyond the Valley of Death of deployment because most energy innovation programs in Canada do not consider the challenges of scaling up innovation. Projects need to be integrated into the market, become financially viable and not rely on public funding.²⁰ For example, past federal smart grid innovation programs have focused

¹⁶ Analytica Advisors (2017). 2017 Canadian Clean Technology Industry Report. Retrieved from: <http://analytica-advisors.com/sites/default/files/2017%20Canadian%20Clean%20Technology%20Industry%20Report%20Synopsis%20FINAL.pdf>

¹⁷ Treasury Board of Canada Secretariat (2017). Inventory of federal business innovation and clean technology programs. Retrieved from: <https://www.canada.ca/en/treasury-board-secretariat/corporate/reports/inventory-federal-business-innovation-clean-technology-programs.html>

¹⁸ Mission Innovation (n.d.). Canada — Plans and priorities [webpage]. Retrieved from: <http://mission-innovation.net/our-members/canada/plans-and-priorities/>

¹⁹ Efficiency Canada (November 2019). Canadian Provincial Energy Efficiency Scorecard. Retrieved from: <https://www.scorecard.efficiencycanada.org/wp-content/uploads/2019/11/Scorecard.pdf>

²⁰ Analytica Advisors (2017). 2017 Canadian Clean Technology Industry Report. Retrieved from: <http://analytica-advisors.com/sites/default/files/2017%20Canadian%20Clean%20Technology%20Industry%20Report%20Synopsis%20FINAL.pdf>

heavily on technological advancements and technical viability, and not on replicability, deployment, or financial viability.²¹

REVIEW OF SELECT ENERGY INNOVATION PROGRAMS IN CANADA

To understand how energy innovation is supported in Canada, we undertook a review of 10 federal, provincial, and territorial programs (see Table 1). This review was not meant to be exhaustive or to look at all energy innovation programs. Rather, we selected programs to represent a diverse group of regions, administrators, energy sources, and technology readiness levels.

Table 1- Select federal, provincial, and territorial energy innovation programs reviewed as part of this study

Program	Description	Innovation Stage(s) Supported
Atlantic Smart Energy Communities (NB and NS) ²²	<p>Administrators: New Brunswick Power and Nova Scotia Power</p> <p>Provides a testing ground and “sand-box” to deploy new technologies and explore new rate designs, operational and market models, and evolve national building and energy codes.</p> <p>Projects are undertaken by New Brunswick Power and Nova Scotia Power in their respective jurisdictions as part of this initiative and collaborate through biweekly meetings.</p> <p>Timeline: April 2019 - March 2023</p>	Demonstration and Deployment: This initiative aims to both demonstrate and deploy projects aimed to evolve utility operations and business models, and provide learning that will be used in future deployment at scale.
Clean Growth Innovation Fund (BC) ²³	<p>Administrator: FortisBC</p> <p>Funding of pre-commercial natural gas projects to reduce emissions in the natural gas sector, funded through a ratepayer levy.</p> <p>Timeline: 2020-2024</p>	Pre-Commercial: This program explicitly supports projects in the pre-commercialization space.
Community Efficiency Financing (Federal) ²⁴	<p>Administrator: Federation of Canadian Municipalities</p> <p>Funding to municipalities to design and implement tailored local financing programs that support deployment of residential energy efficiency and</p>	Deployment: Low interest loans and loan guarantees provided by local financing programs developed through this program will only be applicable to commercially viable approaches to residential energy efficiency and/or solar PV

²¹ Information from an internal review conducted by the Office of Energy Research and Development, the Government of Canada’s co-ordinator of energy R&D activities.

²² New Brunswick Power (n.d.). Smart Grid Atlantic [webpage]. Retrieved from: <https://www.nbpower.com/en/smart-grid/smart-grid-atlantic/>; Nova Scotia Power (n.d.). Smart Grid Nova Scotia [webpage]. Retrieved from: <https://www.nspower.ca/community/innovation/smart-grid-nova-scotia>

²³ FortisBC (n.d.). Clean Growth Innovation Fund [webpage]. Retrieved from: <https://www.fortisbc.com/about-us/clean-growth-innovation-fund>

²⁴ Federation of Canadian Municipalities (n.d.). Community Efficiency Financing [webpage]. Retrieved from: <https://fcm.ca/en/programs/green-municipal-fund/community-efficiency-financing>

	<p>small-scale solar PV, funded through the federal Green Municipal Fund.</p> <p>Timeline: Started in June 2020 (ongoing)</p>	
Deep Home Energy Retrofit Program (NT) ²⁵	<p>Administrator: Arctic Energy Alliance</p> <p>Service delivery of whole-building energy efficiency upgrades with pre- and post-retrofit evaluations and territory-funded rebates based on measures and energy savings.</p> <p>Timeline: 2019-2023</p>	<p>Deployment: This program uses an innovative whole-building delivery model following an independent assessment for deploying residential energy efficiency upgrades.</p>
ecoENERGY for Biofuels Initiative ²⁶ (Federal)	<p>Administrator: Natural Resources Canada</p> <p>Funding for a per-litre incentive for biofuel producers to increase production by offsetting feedstock and fuel price fluctuation risk, similar to a feed-in-tariff.</p> <p>Timeline: 2008-2017</p>	<p>Demonstration: This program was a financial incentive for producers to support the then Federal Renewable Fuels Regulation with no explicit aims of supporting deployment of additional biofuel production beyond the program.</p>
Emissions Reduction Alberta (AB) ²⁷	<p>Administrator: Emissions Reduction Alberta</p> <p>Funding for technological solutions for greenhouse gas emissions reductions, primarily focused on pilot or commercialization projects leveraging private investment.</p> <p>Timeline: Started in 2009 (ongoing)</p>	<p>Pre-Commercial and Demonstration: This program funds projects at various levels of technological readiness, but does not focus on deployment beyond small scale commercial trials.</p>
Energy Innovation Program (Federal) ²⁸	<p>Administrator: Natural Resources Canada</p> <p>Funding for demonstration(s) in a wide range of pre-commercial technologies or infrastructure, or modifications to processes or systems.</p> <p>Timeline: 2014-2018</p>	<p>Pre-Commercial and Demonstration: This program specifically funded research, development and demonstration of clean energy technologies.</p>

²⁵ Arctic Energy Alliance (n.d.). Rebates on Energy-Efficient Products [webpage]. Retrieved from: <http://aea.nt.ca/programs/energy-efficiency-incentive-program>

²⁶ Natural Resources Canada (2016). Previous Program Design: ecoENERGY for Biofuels - Archive [webpage]. Retrieved from: <https://www.nrcan.gc.ca/energy-efficiency/energy-efficiency-transportation/alternative-fuels/biofuels/ecoenergy-biofuels-program/previous-program-design/3617#overview>

²⁷ Emissions Reduction Alberta (2020). Funding [webpage]. Retrieved from: <https://eralberta.ca/apply-for-funding/>

²⁸ Natural Resources Canada (October 28, 2020). Energy Innovation Program [webpage]. Retrieved from: <https://www.nrcan.gc.ca/science-data/funding-partnerships/funding-opportunities/funding-grants-incentives/energy-innovation-program/18876>

Grid Innovation Fund (ON) ²⁹	<p>Administrator: Independent Electricity System Operator</p> <p>Funding for electricity conservation and demand management projects.</p> <p>Timeline: Started in 2005 (ongoing)</p>	<p>Demonstration and Deployment: This program provides funding for technological or financial demonstration projects, which includes new practices and services in addition to technologies. However, projects supporting deployment are generally considered “one-offs” with no formal mechanism for advancing commercialization.</p>
Smart Grid Fund (ON) ³⁰	<p>Administrator: Ontario Ministry of Energy, Northern Development & Mines</p> <p>Funding to test, develop and launch pre-commercial electricity grid modernization projects.</p> <p>Timeline: 2012-2018</p>	<p>Pre-Commercial and Demonstration: This program provided funding for demonstrating pre-commercial electricity projects.</p>
Smart Grid Innovation Network (NB) ³¹	<p>Administrators: New Brunswick Power, University of New Brunswick, Siemens Canada</p> <p>Acts as a single point of contact for product development and testing, technical support, and organization of conferences and training, related to electrical smart grid initiatives.</p> <p>Timeline: Started in 2016 (ongoing)</p>	<p>Pre-Commercial: This program aimed to support pre-commercial concepts and projects through three labs, focused on R&D and technological testing needed before piloting demonstration.</p>

Our review shows that energy innovation programs across Canada generally have the following characteristics:

- + Technology focused:** The majority of programming defines innovation through a technological lens. This is likely a consequence of programming that targets pre-commercial and demonstration stages of innovation, where technological challenges are more present. This is confirmed by the broader approach of innovation adopted by deployment-focused programs: the Arctic Energy Alliance’s Deep Home Energy Retrofit Program focuses on improving service delivery; FCM’s Community Energy Financing focuses on establishing programming to finance deployment; and the Atlantic Smart Energy Communities initiative is exploring new rate designs and operational/market models.
- + Electricity focused:** Most programming relates specifically to the electricity sector, with the focal point of many being grid orchestration and modernization through smart grid technologies, integration of DERs, interoperability, and transactive models. The notable exceptions are FortisBC’s Clean Growth Innovation Fund and EcoEnergy Biofuels, which targeted the natural gas and transportation fuel sectors respectively.

²⁹ Independent Electricity System Operator (2020). Grid Innovation Fund [webpage]. Retrieved from: <http://www.ieso.ca/en/Get-Involved/Funding-Programs/Grid-Innovation-Fund/Overview>

³⁰ Ontario Ministry of Energy, Northern Development and Mines (March 25, 2019). Building the smart grid [webpage]. Retrieved from: <https://www.ontario.ca/page/building-smart-grid>

³¹ Smart Grid Innovation Network (n.d.). Smart Grid Innovation Network [webpage]. Retrieved from: <https://www.sgin.ca/>

³² Smart Grid Nova Scotia was primarily funded through federal funding programs under the Atlantic Smart Energy Communities initiative, but included a portion of rate based funding for Nova Scotia Power under a Capital Planning and Capital Expenditure Justification Criteria.

+ Public funding support: All the programs reviewed were designed around public funding assistance. Most include provincial or federal tax-based funding; however, some also use rate-based funding, such as with IESO's Grid Innovation Fund, FortisBC's Clean Growth Innovation Fund, and projects in Nova Scotia under the Atlantic Smart Energy Communities initiative.³²

The significant emphasis of public funding to support innovation can be seen in the creation of the Clean Growth Hub in 2017, which acts as a one-window portal for innovators to navigate available federal funding programs for clean technologies across 16 government departments and agencies.³³

LESSONS LEARNED FROM THE PROGRAM REVIEW

While many energy Innovation programs available in Canada support pre-commercial technological R&D and demonstration projects, they suffer from two missing components related to the bigger challenge of moving from the demonstration stage to the deployment stage and do not create the conditions for private-sector investment in innovation.

First, energy innovation programming lacks focus on deployment. Only three programs we reviewed included the deployment stage: FCM's Community Efficiency Financing, the Arctic Energy Alliance's Deep Home Energy Retrofit Program, and NB Power and NS Power's Atlantic Smart Energy Communities program. However, the scope of both Community Efficiency Financing and the Deep Home Retrofit Program were both narrowly focused on a standard suite of residential building energy measures, as opposed to broader energy systems.

It is interesting to note that all three deployment programs were developed more recently — they were all launched in 2019 and are ongoing. By contrast, closed programs generally focused on

pre-commercial innovation and demonstration, including the Smart Grid Fund in Ontario and Natural Resources Canada's ecoENERGY for Biofuels and Energy Innovation Program. In the case of IESO's Grid Innovation Fund, support for deployment projects is a more recent shift and not the primary objective of the program. Overall this may indicate a shift in programming towards addressing the gap in support for deployment.

Second, and as a result, no programs involved regulators, nor did they address regulatory and policy structures.³⁴ In the rare exception regulators were approached, but only for approving funding to a program or a project, such as in Nova Scotia under the Atlantic Smart Energy Communities initiative or in BC with the Clean Growth Innovation Fund.

We heard from innovators that this lack of consideration for regulatory matters leads to the following challenges in scaling up innovations:

- 1. Regulatory no man's land:** In some instances, regulations did not catch up with emerging technologies or solutions, leading to a "regulatory no man's land" that creates uncertainty for innovators working with new technologies.
- 2. Regulatory lag:** In other instances, regulations have been on the books for so long that they are no longer stringent enough compared

³⁴ Although not included here, there are some regulatory initiatives in Canada that look at improving regulated utilities. See, for example, the Ontario Energy Board's consultation on the Regulated Price Plan (RPP) Roadmap. This consultation is more concerned with improving utility's operations to meet system needs, and does not consider how changing pricing could help introduce new and innovative delivery models or services. See, Ontario Energy Board (n.d.). RPP Roadmap. Retrieved from: <https://www.oeb.ca/industry/policy-initiatives-and-consultations/rpp-roadmap>. Other examples include the OEB's Responding to DERs consultation and Utility Renumeration consultations. Both deal with innovation, but their primary subject is the activities of regulated utilities rather than on examining how innovation can be integrated into the system. See, Ontario Energy Board (2019). Responding to Distributed Energy Resources. Retrieved from: <https://www.oeb.ca/industry/policy-initiatives-and-consultations/responding-distributed-energy-resources-der>. Another example is the Alberta Utility Commission's (AUC) Distribution System Enquiry. The AUC has mapped out key issues related to the future of Alberta's electric and natural gas distribution system during this public inquiry. The outcomes of this inquiry focus on what the AUC needs to know in order to be in a position to respond to a shifting market, technology, public policy, consumer behaviour and environmental factors as reasons for the transition. See, Alberta Utility Commission (2018). Distribution System Inquiry: Overview. Retrieved from: <https://www.auc.ab.ca/Pages/distribution-system-inquiry.aspx>

³² Smart Grid Nova Scotia was primarily funded through federal funding programs under the Atlantic Smart Energy Communities initiative, but included a portion of rate based funding for Nova Scotia Power under a Capital Planning and Capital Expenditure Justification Criteria.

³³ Government of Canada (n.d.). Clean Growth Hub [webpage]. Retrieved from: <https://www.ic.gc.ca/eic/site/099.nsf/eng/home#p4>

with recent technology performance. In some cases, this limits market deployment of cleaner solutions as older and lower performance solutions still meet the regulatory minimums. For federal regulations, this is often due to overlapping with provincial/territorial regulations, as they reflect the lowest common denominator.

3. Lack of regulatory alignment and a “patchwork of markets”: The level of collaboration between federal and provincial/territorial policymakers on regulation and policies is uneven and ranges from weak to strong, depending on jurisdictions and sectors. There is a need for collaboration to streamline and harmonize regulations between provincial and territorial levels with federal regulations to reduce the “patchwork of markets” that can lead to higher costs as suppliers have to adjust for each market. Similarly, international cooperation is key to adopting coherent standards and access to international markets.

4. The complexity of navigating the systems: The energy system can be challenging to navigate. It takes significant resources to understand the system as well as to influence it. For example, participating in consultations is onerous, costing both time and money. Small innovative businesses who may be emerging players in energy systems don’t always have the knowledge, resources or capacity to find their path in the system and to contribute to the processes of regulatory and policy development.

At the federal level, steps towards regulatory reform were initiated in 2019 through the Treasury Board of Canada Secretariat’s Targeted Regulatory Review, which will inform the development of a Regulatory Roadmap to guide future regulatory modernization initiatives in the clean technology sector.³⁵ However, this initiative is focused solely on federal-level regulations and not provincial or territorial regulations, under which energy is primarily regulated across Canada.

³⁵ Treasury Board of Canada Secretariat (TBS) (June 2019). “Regulatory modernization — Request for stakeholder comments,” in Canada Gazette, Part I, Volume 153, Number 26: Government Notices. Retrieved from: <http://www.gazette.gc.ca/rp-pr/p1/2019/2019-06-29/html/notice-avis-eng.html#nc5>

HOW TO MOVE BEYOND TECHNOLOGY-FOCUSED INNOVATION POLICIES

The previous section showed that most energy innovation programming to date in Canada have prioritized the technological barriers faced by R&D and demonstration primarily in the electricity sector, but have not effectively addressed the non-technological barriers faced by innovators — namely, regulatory gaps and misalignment, the complexity of navigating the energy system, and neglecting to involve regulators and policymakers. By focusing on technology R&D and pre-commercialization, and relying on the use of public funding as the main mode of intervention, energy innovation policy in Canada has neglected the deployment phase of innovation. While technology is necessary, considering only technological development supported through public funding is not sufficient to promote and scale-up innovative solutions in the energy sector.

“By focusing on technology R&D and pre-commercialization, and relying on the use of public funding as the main mode of intervention, energy innovation policy in Canada has neglected the deployment phase.”

To address the non-technological barriers and to accelerate deployment, we have identified four areas that innovation deployment policies need to address:

1. Develop strong collaboration and knowledge-sharing mechanisms
2. Support for navigating the regulatory and policy landscape

3. Create safe real-world trials for experimenting safely in the energy ecosystem
4. Capture knowledge to actively inform policy and regulatory changes.

DEVELOPING STRONG COLLABORATION AND KNOWLEDGE SHARING MECHANISMS

Except in rare instances, most energy innovation policies and programs lack sound, comprehensive and well-thought-out collaborative and knowledge-sharing mechanisms. Typically, the results of a project centre on technical learning and advancements and are only shared in industry conferences and publications, leaving innovators and their innovations isolated from the economic, policy and social dimensions of the system. This was recognized in a recent assessment of federal smart grid programs that stressed the need to focus on “fostering networks and connections for innovation”.³⁶ In another example, an evaluation of the Energy Innovation Program (formerly ecoEnergy Innovation Initiative, ecoEII) found that information dissemination is one area where greater efforts are needed to promote and share findings with relevant stakeholders. The evaluation also notes that there was little to no funding allocated to share knowledge.³⁷

Typically, the results of a project centre on technical learning and advancements and are only shared in industry conferences and publications, leaving innovators and their innovations isolated from the economic, policy and social dimensions of the system.

That is not to say that collaboration has not been recognized, as some of the initiatives we looked at do include some forms of collaboration, such as:

- + Subject matter experts and innovators sharing their expertise and experience at conferences, which can lead to stimulating and in-depth conversations with new knowledge being shared. For example, the Smart Grid Innovation Network conference in New Brunswick convenes different stakeholders.
- + Connections are made between internal subject-matter experts and innovators to help innovators learn and navigate the system. For example, the federal Clean Growth Hub connects innovators with other departments, the ecoEII brings together researchers from government labs with innovators, and the Ontario Energy Board’s Innovation Sandbox connects internal regulatory experts with innovators.
- + Mechanisms to develop partnerships to conduct projects. For example, the IESO’s Grid Innovation Fund in Ontario encourages innovators to pair up with “suitable partners”, including a local distribution company (LDC), to “test the concept in a real-world environment” The application scoring is highly dependent on the “evidence of strong and appropriate partnerships”.³⁸
- + NRCan’s ecoEII and EIP connect applications with experts in the federal labs to provide two-way learning (see next section).
- + The Atlantic Smart Energy Communities initiative is starting an interesting collaboration between the energy utilities of two provinces, NB Power and NS Power. This collaboration has enabled both utilities to secure federal funding for their initiative. They are also in the preliminary stage of setting up knowledge exchange mechanisms through regular meetings. A tangible result has been learning from each other to improve their tender bid process. The initiative is also the outcome of a collaboration between a utility (NB Power), academia (New Brunswick University) and the private sector (Siemens and IBM).

The constraints of existing market structures can explain the lack of collaborative and knowledge-sharing mechanisms in energy innovation policy:

³⁶ Cited from an internal review conducted by the Office of Energy Research and Development, the Government of Canada’s co-ordinator of energy R&D activities.

³⁷ Audit and Evaluation Branch Natural Resources Canada (July 8, 2019). Evaluation of Energy Innovation Program,. Retrieved from: <https://www.nrcan.gc.ca/nrcan/plans-performance-reports/strategic-evaluation-division/reports-plans-year/evaluation-reports-2014/evaluation-energy-innovation-program/22401>

³⁸ Independent Electricity System Operator (2020). Grid Innovation Fund Application Guideline, pp 3 and 7. Retrieved from: <http://www.ieso.ca/-/media/Files/IESO/Document-Library/funding/Grid-Innovation-Fund/Grid-Innovation-Fund-Application-Guideline-2020.pdf?la=en>

in a competitive market setting no one likes to share information and so they “keep their cards close to their chest”, as one interviewee said.³⁹ Furthermore, publicly funded innovation programs rarely put a strong emphasis on knowledge dissemination.

One anecdote shared by an interviewee highlights the neglect of knowledge dissemination. The interviewee noted that, despite there being no less than four federally funded studies on smart thermostats in Canada that have similar design and results, there was still a desire to conduct and fund more demonstration projects. They saw this as indicating a lack of willingness to share results due to intellectual property and market considerations, making it difficult for those not participating in the project itself to learn from the results.

SUPPORTING INNOVATORS TO NAVIGATE THE REGULATORY AND POLICY LANDSCAPE

Energy innovation programs in Canada overlook the difficulty that innovators, especially new entrants and small companies, face in navigating the complexity of the current energy and innovation policy landscape. As acknowledged by the Treasury Board of Canada Secretariat, “the Government of Canada’s innovation programs are dispersed which makes it difficult for businesses to find the support that they need”.⁴⁰ We also heard that the regulations, rules and processes, as well as the diversity of actors, agencies and programs that constitute energy systems, are often overwhelming for new entrants and small businesses that do not have the resources or capacity to pay consultants to help them navigate this system.

In an inventory of federal business innovation and clean technology programs conducted by the Treasury Board of Canada, it was found that most programs provided only financial support through grants or other financial contributions, with only 17 out of 82 programs including some

kind of advisory services for innovators.⁴¹ Current innovation programs are overlooking the need for innovators and new entrants to get support to navigate the current energy sector and help answer their questions and concerns.

“The regulations, rules and processes, as well as the diversity of actors, agencies and programs that constitute energy systems, are often overwhelming for new entrants and small businesses.”

One program that provides navigation support is the federal Clean Growth Hub (CGH). The CGH is a federal initiative that was created in 2017 to help innovators find potential federal funding programs and services available to them. While the Hub can inform the design of federal programs based on what they heard from participants, the CGH does not have the mandate to inform federal and provincial energy policy and regulation.

CREATING SAFE SPACE FOR REAL-WORD TRIALS

Due to their heavy focus on technological demonstration projects, current energy innovation programs lack a space to experiment with non-technological innovations such as business models, consumers’ behaviours, governance and operational processes, and collaboration practices.

Demonstration projects often result in a one-time project developed in an isolated environment that is typically not replicated because of its lack of integration with other parts of the system. For instance, one evaluation of smart grid policies notes the risk of “death by demo”, as many organizations swirl in an endless loop of having more and more demonstration projects without making substantial changes to their business, operating, or consumer models.⁴²

³⁹ Interview with a project manager, September 2020

⁴⁰ Treasury Board of Canada Secretariat (2017). Inventory of federal business innovation and clean technology programs. Retrieved from: <https://www.canada.ca/en/treasury-board-secretariat/corporate/reports/inventory-federal-business-innovation-clean-technology-programs.html>

⁴¹ Treasury Board of Canada Secretariat (2017). Inventory of federal business innovation and clean technology programs. Retrieved from: <https://www.canada.ca/en/treasury-board-secretariat/corporate/reports/inventory-federal-business-innovation-clean-technology-programs.html>

⁴² Cited from an internal review conducted by the Office of Energy Research and Development, the Government of Canada’s co-ordinator of energy R&D activities.

We heard about the need for innovation to move beyond conventional demonstration and to allow for safe trialing and testing within a real-world environment. Examples of the types of innovations that could be tested in this way include trialing new business, operational, governance, or consumer models, and testing new rate structures and practices. An approach that uses real-world trials has the potential to introduce new opportunities that complement demonstration projects by considering how the innovation integrates into the energy system (current standards, policies regulations, and business models) and interacts with other players (consumers, investment partners, and others).



We heard about the need for innovation to move beyond conventional demonstration and to allow for safe trialing and testing within a real-world environment.



The Atlantic Smart Energy Community is an example of a real-world trial. New Brunswick and Nova Scotia established an interesting real-world trial through the Atlantic Smart Energy Communities initiative to compare and gather insights from different grid management structures and parameters. The trial set coordinated DER control across a number of sites and technologies to better understand the kinds of controls needed to realize as many value streams as possible from DERs (for both the hosting customer and the grid). Two experiments aim to explore new energy value creation opportunities in a residential setting (Municipality of Shediac, NB) and in commercial settings (in the municipalities of Amherst and Halifax, NS) thought the installation and central utility control of an array of distributed energy resources (including solar panels, battery storage, smart thermostats, EVs, etc.). Another pilot focuses on nanogrid control devices where each home would act as its own buyer and seller of electricity with the nano controller enabling transactions. The aim is to identify the best setting to integrate DERs on the

grid, as well as to compare whether automated smart devices are more efficient than customer-controlled devices.

In comparison to real-world trials, demonstration projects generally do not engage with energy regulators and policymakers and neglect their potential role in enabling the innovation to scale up. We heard that there is an increasing awareness of the essential role that regulators can play in innovation projects and some interviewees pointed out that energy regulators in fact need to be engaged in testing new rate structures in relation to smart grid innovation projects, such as using time of use rates.

For example, an interviewee discussing a smart grid project explained that public funding usually covers the majority of a pilot project's costs. In this case, the regulator was not involved, and as a result, it didn't pay attention to the outcome of the demonstration project. Yet it is only when project participant were looking at scaling up and securing sustainable funding sources that they realized that the regulator needed to be involved either to change the rules on deferral accounts⁴³ or on the rate-payers tariff structure (in the case of regulated utilities).⁴⁴

This example shows that with new business models and new types of energy services emerging for smart grid technologies and distributed energy resources projects, regulators will need to be involved in innovation programs as new rate-making processes and conventions are being explored.

⁴³ To apply deferral accounts a utility needs to show the benefits of an investment to be able to recover it (to show it was prudent), which can require some changes in the rule or clearer criteria from the regulator in the case of smart grids and other emerging technologies changing the structure of the grid and consumers' experience.

⁴⁴ In the case of New Brunswick, the regulator approved the change in ratepayer tariff to fund the Atlantic Smart Energy Community project through the "innovation justification criteria". It was the first time that this happens, and there is a need to make it more intentional.

CAPTURING KNOWLEDGE TO ACTIVELY INFORM POLICY AND REGULATORY CHANGES

Current energy innovation programs have limited to no mechanisms to capture the findings and knowledge from projects and programs to inform policy and regulatory changes, yet this is essential to remove structural barriers to innovation and facilitate their scale-up.

Policy and regulatory changes informed by innovation initiatives are rare. For example, in the case of IESO's Grid Innovation Fund, one project resulted in an amendment of provincial regulation on commercial refrigeration setpoint temperature, which was increased by a few degrees. But this feedback loop to the regulator was an occasional one and never part of a systematized process.

Of the 10 programs reviewed through this study, we only found one innovation program that tried to capture project findings to inform policy and regulatory changes. The Energy Innovation Program (formerly ecoEII) says that knowledge gained from completed projects has informed some regulatory and standards changes, although there is no formal tracking.⁴⁵ An evaluation of the program found that the ecoEII has informed the development of 25 codes and standards (see Sidebar A for examples). The program evaluation stresses that "NRCan plays an important role not just in its direct support of research and technology advancement, but also in terms of its enabling role — engaging with a variety of stakeholders, increasing the capacity of key stakeholders to conduct research, providing technical input into codes and standards development, and generating knowledge to support policy and decision-making."⁴⁶

SIDEBAR A

EXAMPLES OF HOW INNOVATION PROJECTS CAN INFORM CODE AND STANDARDS CHANGE

The Canadian Standards Association Group ecoEII project delivered a series of safety standards and protocols related to the supply, charging and storage of electricity for electric vehicles. This work helped to inform the 2015 and 2018 versions of the Canadian Electric Code, which is expected to result in safer use of electric vehicle equipment. Project documentation also indicated better alignment of the Canadian Electric Code with the U.S. National Electrical Code.

The results of the trials at the Low Carbon Fuel Demonstration Pilot Plant (Lafarge project proponent) were used as the basis for applications to the Ontario Ministry of the Environment and Climate Change for the permanent use of low carbon fuels at the Bath plant and could be used by other Cement Industry companies. Ontario Regulation Alternative Low-Carbon Fuels (ALCF) Reg. 79/15 was influenced by research, modelling, and testing of low carbon fuels at Lafarge's Bath Cement Plant.⁴⁷

⁴⁵ Interview with NRCan, October 16, 2020.

⁴⁶ Natural Resources Canada, Audit and Evaluation Branch (July 8, 2019). Evaluation of the Energy Innovation Program. Retrieved from <https://www.nrcan.gc.ca/nrcan/plans-performance-reports/strategic-evaluation-division/reports-plans-year/evaluation-reports-2014/evaluation-energy-innovation-program/22401>

⁴⁷ Natural Resources Canada, Audit and Evaluation Branch (July 8, 2019). Evaluation of the Energy Innovation Program. Retrieved from <https://www.nrcan.gc.ca/nrcan/plans-performance-reports/strategic-evaluation-division/reports-plans-year/evaluation-reports-2014/evaluation-energy-innovation-program/22401>

RETHINKING INNOVATION PROGRAMS AND UNLEASHING THE CONCEPT OF INNOVATION

To truly enable and accelerate innovation in the energy sector, we need to consider the importance of the deployment stage of innovation and thus need to account for, and address overlooked non-technological barriers to innovation.

As we have pointed out in the previous sections, we need to rethink how we design and develop innovation programs by incorporating the four areas of interventions we highlighted. This requires us to move beyond defining innovation from a narrow technological lens and to embrace social, cultural, and economic aspects of innovation.

We heard the need to expand the definition of innovation echoed through our interviews. Respondents emphasized the need to consider the social and ecosystemic dimensions of innovation within which technologies evolve to accelerate the deployment of innovation. As noted earlier, the deployment phase is not about technologies, but about integrating and managing new technology, changing perspectives and corporate cultures, building new competencies and filling skills gaps, inventing new business models, and envisioning how utilities are going to be run and managed.⁴⁸

Adopting broader definitions of innovation can help to overcome a key bias that has prevailed in the design of most energy innovation policies in Canada: the tendency to reduce innovation programs to public funding that supports R&D, demonstration and commercialization projects.

As we heard the need to rethink innovation programs in the energy sector, adopting broader definitions of innovation can help to overcome a key bias that has prevailed in the design of most energy innovation policies in Canada: the

tendency to reduce innovation programs to public funding that supports R&D, demonstration and commercialization projects (see Sidebar B on the next page).

⁴⁸ Aggregation of comments from three participants interviewed in September 2020.

SOCIAL AND SYSTEMIC INNOVATION: TWO CONCEPTS THAT HELP TO RETHINK INNOVATION

The ideas of social innovation⁴⁹ or systemic innovation⁵⁰ can help us consider a broader definition of innovation. Although there are some differences between the concepts, both cast light on the larger ecosystem that surrounds technologies, from the various actors involved to the practices and language, and from existing institutional, policy, and market landscapes to existing infrastructure.

While the concepts of social innovation and systemic innovation have many definitions, they share four attributes:

1. They account for alternative or new business models, participatory governance approaches to energy questions, innovative policy interventions, and new framings to look at energy challenges (such as 'prosumerism' and energy poverty).⁵¹
2. They stress the importance of collaboration and that people and organizations can co-create and learn together.
3. They acknowledge and embrace the messy process of innovation and stress the importance of understanding the manifold interactions within the system, learning from experimentation (or learning by doing).
4. They look at scaling up effective solutions to entrenched challenges in a specific system or sector by adapting the system to accommodate newly created knowledge.

This more inclusive approach to innovation, while still emerging, is not entirely new in Canada. The social enterprise sector has embraced the notion of social innovation as a core principle.⁵² At the local level, a few initiatives build on the concept of social innovation. In Montréal for example, la Maison de l'Innovation Sociale defines social innovation as "an approach that tackles complex issues in an integrated way and takes full advantage of communities' full potential, makes better use of their assets and resources, while at the same time strengthening their capacity to take action to promote their emancipation".⁵³ At the federal level, Employment and Social Development Canada (ESDC)'s programs and policies have developed the Social Innovation and Social Finance initiative, to help more people, especially those most vulnerable, contribute to and share in the prosperity of their community and society.

⁴⁹ Julia M. Withmayer et al. (December 2020). "Beyond instrumentalism: Broadening the understanding of social innovation in socio-technical energy systems," in *Energy Research & Social Science*, Volume 70. Retrieved from: <https://doi.org/10.1016/j.erss.2020.101689>

⁵⁰ Brendan Haley (November 2, 2016). "Getting the Institutions Right: Designing the Public Sector to Promote Clean Innovation," in *Canadian Public Policy*, Volume 42, Issue S1, pp. S54-S66. Retrieved from: <https://doi.org/10.3138/cpp.2016-051>

⁵¹ Julia M. Withmayer et al. (December 2020). "Beyond instrumentalism: Broadening the understanding of social innovation in socio-technical energy systems," in *Energy Research & Social Science*, Volume 70. Retrieved from: <https://doi.org/10.1016/j.erss.2020.101689>

⁵² See, for example, how Social Innovation Canada, created in 2019, maps social innovation initiatives across the country at <https://sicanada.org/regions/>

⁵³ Maison de l'innovation sociale (MIS) (n.d.). Our Mission. Retrieved from: <https://www.mis.quebec/en/get-to-know-us/mission/>

UNLEASHING INNOVATION: THE ADVANTAGES OF USING INNOVATION SANDBOXES

THE ROLE OF INNOVATION SANDBOXES

As discussed in the previous section [How to move beyond technology-focused innovation policies](#), there are four main non-technological barriers to deploying innovation in Canada. Many of these barriers are not unique to the energy sector nor to Canada,⁵⁴ and there are lessons to learn by looking at what has been done in other sectors and in other jurisdictions.

Innovation Sandboxes are becoming recognized internationally to encourage innovation. Innovation Sandboxes are policy tools that rely on collaboration to create conditions to deploy new energy products, services, and business models in a real-world environment, in a safe and controlled way. They are about promoting innovation in a broad sense.



Innovation Sandboxes are policy tools that rely on collaboration to create conditions to deploy new energy products, services, and business models in a real-world environment, in a safe and controlled way.



The UK Financial Conduct Authority started the first sandbox in 2016 for financial technology (FinTech). Since the UK's sandbox launch, over 50 countries have developed or announced they

will develop a FinTech sandbox.⁵⁵ We examined the role that Innovation Sandboxes can play in deploying innovation in our earlier report, *Enter the Sandbox: Developing Innovation Sandboxes for the Energy Sector*.⁵⁶

Innovation Sandboxes consist of four policy tools (see Figure 2 on the next page) — Innovation Hubs, Enquiry Services, Regulatory Trials, and Regulatory and Policy Learning — that align well with the four interventions identified in the previous section [How to move beyond technology-focused innovation policies](#).

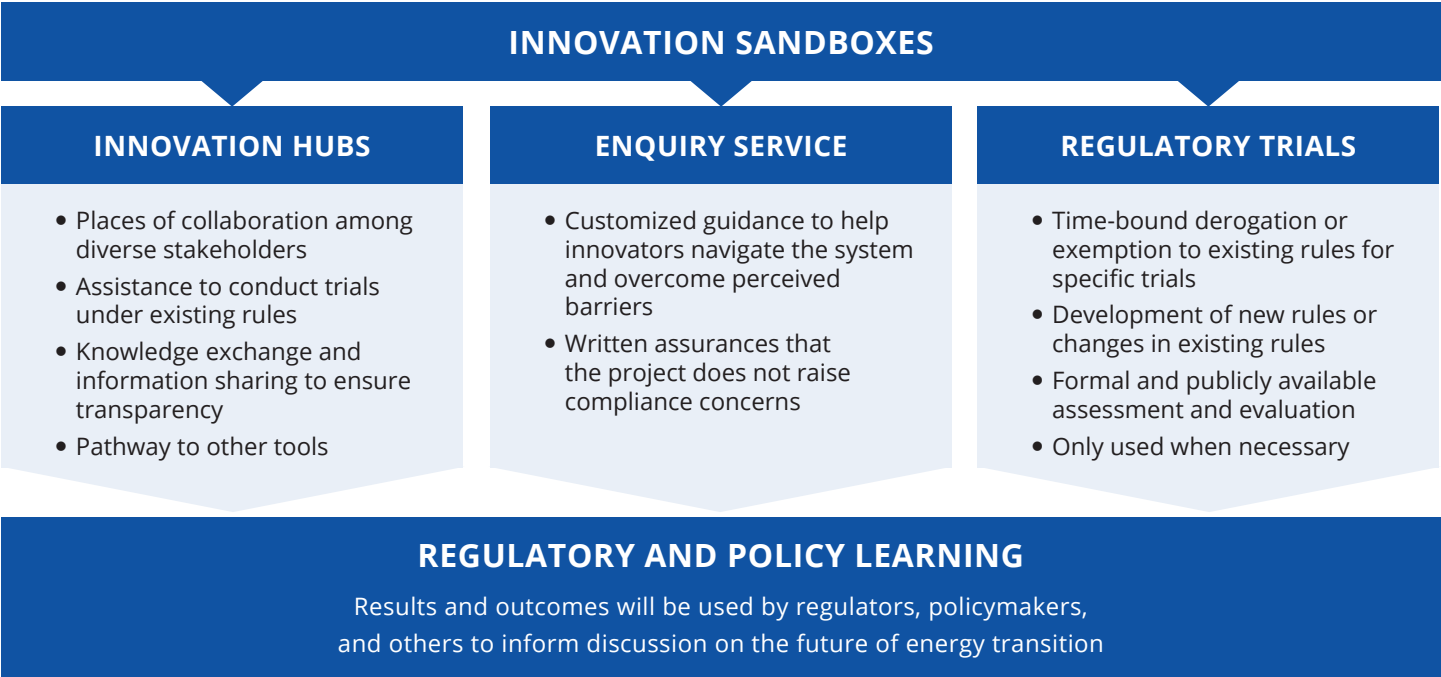
- **Innovation Hubs** can provide collaboration and knowledge sharing mechanisms
- **Enquiry Services** can support innovators in navigating the regulatory and policy landscape
- **Regulatory Trials** allow for safe space for real-world experimentation
- **Regulatory and Policy Learning** ensures that lessons learned are used to inform future energy policy and regulatory discussions.

⁵⁴ See, for example, Daniel Schwanen (December 2017). Innovation Policy in Canada: A Holistic Approach. CD Howe Commentary No. 497. Retrieved from: https://www.cdhowe.org/sites/default/files/attachments/research_papers/mixed/C.D.%20Howe%20Commentary%20-%20Innovation%20Policy%20in%20Canada%2C%20A%20Holistic%20Approach_0.pdf

⁵⁵ Ross Buckley, Douglas Arner, Robin Veidt, and Dirk Zetzsche (2019). "Building FinTech Ecosystems: Regulatory Sandboxes, Innovation Hubs and Beyond." EBI Working Paper Series 2019, No. 53. Retrieved from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3455872

⁵⁶ Richard Carlson and Aida Nciri (July 2020). Enter the Sandbox: Developing Innovation Sandboxes for the Energy Sector. Retrieved from <https://questcanada.org/wp-content/uploads/2020/07/Innovation-Sandboxes-Report-1-EN.pdf>

Figure 2- The four tools of Innovation Sandboxes



Jurisdictions can choose among these policy tools, selecting those that meet their specific needs. As a result, there is no one way to design and implement Innovation Sandboxes as each is tailored to a jurisdiction’s specific needs and context.

Given the benefits that Innovation Sandboxes can provide in deploying innovation across Canada’s energy sector (see Sidebar C on the next page), we can learn from other sandbox initiatives, or those that contain sandbox-like elements, to encourage the innovation we need.

BENEFITS OF INNOVATION SANDBOXES

As we discussed in our earlier report, *Enter the Sandbox: Developing Innovation Sandboxes for the Energy Sector*,⁵⁷ an Innovation Sandbox has five benefits:

1. Can help remove non-technological barriers to innovation
2. Values learning-by-doing to remove perceived barriers and create pragmatic and practical change
3. Protects consumers
4. Can flexibly work with different forms of energy
5. Promotes collaboration to identify problems and frame solutions.

Additionally, we learned that there are multiple ways to run an Innovation Sandbox. Innovation Sandboxes are diverse in who is creating and implementing them. They can be developed by governments and regulators — in some cases both — to pursue specific policy outcomes. In one instance, the Sandbox was initiated by utilities.

Innovation Sandboxes are also diverse in the energy sources they consider: while the focus has tended to be on the electricity system, some include, or will be expanded to, natural gas. A few have also included transportation and electrical vehicles.

Finally, Innovation Sandboxes are diverse in the policy tools that are associated with them, such as funding, data sharing, and academic research. Finally, they are diverse in the scope of regulatory trials.

⁵⁷ Richard Carlson and Aida Nciri (July 2020). *Enter the Sandbox: Developing Innovation Sandboxes for the Energy Sector*. Retrieved from <https://questcanada.org/wp-content/uploads/2020/07/Innovation-Sandboxes-Report-1-EN.pdf>

INNOVATION SANDBOXES IN CANADA OUTSIDE THE ENERGY SECTOR

Innovation Sandboxes are a relatively new policy tool globally, but they are becoming more widely recognized as a useful tool for encouraging the deployment of innovation in various sectors. Canada is no exception. Federal, provincial, territorial, and municipal levels are increasingly interested in the development of Innovation Sandboxes, and some jurisdictions have already established Innovation Sandboxes in different sectors. For example, the federal government has identified Innovation Sandboxes and Regulatory Trials as part of its initiative to broadly promote emerging technologies and to modernize regulatory frameworks in a number of sectors.⁵⁸

Federal, provincial, and municipal levels are increasingly interested in the development of Innovation Sandboxes, and some jurisdictions have already established Innovation Sandboxes in different sectors.

Like in most jurisdictions, the first Innovation Sandboxes in Canada were introduced in the FinTech sector, as the result of positive international experience, especially in the UK, to cope with the emergence of new technologies, such as robo-advisors, cryptocurrencies and blockchain. The implementation of a sandbox in the Canadian FinTech sector was seen as a way to encourage innovation so that the sector was not left behind, as well as a way to create new services that could benefit consumers.⁵⁹

⁵⁸ Innovation, Science and Economic Development Canada (2018). Report from Canada's Economic Strategy Tables: Clean Technology. Retrieved from: <https://www.ic.gc.ca/eic/site/098.nsf/eng/00023.html>

⁵⁹ Interview with CSA, October 5, 2020.

The Ontario Securities Commission (OSC), the Ontario regulator for the securities and financial industry, introduced the first Canadian Innovation Sandbox in the Fintech sector in 2016 with the LaunchPad initiative.⁶⁰ Following on from the OSC sandbox, in 2017 the Canadian Securities Administrators (CSA) created a national Regulatory Trial system for the FinTech sector. Given that it has no legislative authority over provincial financial regulators, the CSA's role is to coordinate Regulatory Trials across Canada's provinces and territories to harmonize regulations and ensure insights from trial results can be used nationally.

Between 2016 and August 2020, 11 companies participated in the CSA's regulatory trials, all of which were focused on crypto-asset business.⁶¹

Interestingly, while the CSA's Regulatory Trials were initially considered to be the key feature of the sandbox, it was found that discussing projects and exchanging information with CSA staff about FinTech regulation was as, if not more, meaningful and useful for companies. The CSA's sandbox also used findings from trials to inform longer-term policies and regulatory processes.

In addition to the securities industry, Innovation Sandboxes with a focus on Regulatory Trials are being considered or under development at the federal level in the transportation, health, and agri-food sectors (See Table 2). The federal government is supporting the development of those sandboxes with \$219.1 million budgeted on regulation modernization for these three sectors over five years, starting in 2019-20, and \$3.1 million per year on an ongoing basis.⁶²

These sandbox initiatives came out of 2018 federal Targeted Regulatory Reviews that examined the barriers to economic growth and innovation and looked at modernizing

⁶⁰ Ontario Securities Commission (2020). Our approach. Retrieved from: <https://www.osc.gov.on.ca/en/our-approach.htm#recent-examples>

⁶¹ CSA (n.d.). CSA Regulatory Sandbox. Retrieved from https://www.securities-administrators.ca/industry_resources.aspx?id=1626. One of the reasons for the relatively low uptake is that the applicant has to be subject to regulation and the proposed activity needs an exemption. Many incumbent participants may not need exemptions due to them having a different regulatory structure, Interview with CSA, October 5, 2020.

⁶² Department of Finance Canada (2019). Investing in the Middle Class. Budget 2019. Retrieved from <https://www.budget.gc.ca/2019/docs/plan/budget-2019-en.pdf>

regulation in these sectors.⁶³ The second round of Targeted Regulatory Reviews is currently underway and is looking at the clean technology sector, digitalization and technology neutral regulations, and international standards. These reviews are also looking to encourage regulatory experimentation of some kind.⁶⁴

In the transportation sector, a sandbox-like activity was developed in Quebec to understand how Uber would affect the regulated taxicab industry. The results of the Regulatory Trial informed the development of a regulatory framework to enable future innovations in the province's taxi industry (See Table 2).⁶⁵

Innovation Sandboxes are being introduced in a variety of sectors in Canada and their usefulness in scaling up innovation.

Municipal governments are also developing Innovation Sandboxes. In Montréal, Le Laboratoire d'Innovation Civique pour l'Expérimentation Réglementaire (LICER, the Civic and Regulatory Innovation Laboratory) provides an example of a municipal Innovation Sandbox (See Table 2 on the next page). Led by Maison de l'Innovation Sociale (MIS), this project will support innovative mobility and food security projects that require

new regulatory models or are facing regulatory obstacles.⁶⁶ LICER is part of a broader initiative led by the City of Montréal that received \$50 million from the federal Smart City Challenge.

Overall, Innovation Sandboxes are being introduced in a variety of sectors in Canada and their usefulness in scaling up innovation is being recognized. In general, though, Innovation Sandboxes in Canada tend to focus heavily on Regulatory Trials, while the other tools are not considered as often. Encouraging collaboration and information sharing through Innovation Hub services has not been as common in Canada, for instance. Yet, Innovation Sandboxes that have been operating the longest — namely, the OSC's and the CSA's — have shown that Enquiry Service tools are important and undervalued.

⁶³ Transport Canada (2019). The Transportation Sector Regulatory Review Roadmap Policy and Program Initiatives and Novel Approaches. Retrieved from https://tc.canada.ca/en/corporate-services/acts-regulations/transportation-sector-regulatory-review-roadmap-policy-program-initiatives-novel-approaches#NA_TDG; Health Canada (2020). Health and Biosciences Sector Regulatory Review Roadmap. Retrieved from <https://www.canada.ca/en/health-canada/corporate/about-health-canada/legislation-guidelines/acts-regulations/targeted-regulatory-reviews/health-biosciences-sector-regulatory-review-roadmap.html>; Canadian Food Inspection Agency (2019). Targeted Regulatory Review: Agri-food and Aquaculture Roadmap. Retrieved from <https://www.inspection.gc.ca/about-cfia/acts-and-regulations/forward-regulatory-plan/agri-food-and-aquaculture-roadmap/eng/1558026225581/1558026225797>

⁶⁴ Treasury Board of Canada Secretariat (TBS) (n.d.). Targeted Regulatory Reviews. Retrieved from: https://cdn.ymaws.com/cafc.ca/resource/resmgr/docs/tbs_webinar_deck_en.pdf

⁶⁵ Annabelle Olivier (October 12, 2018). "Quebec extends Uber pilot project for another year," Global News. Retrieved from: <https://globalnews.ca/news/4542262/quebec-extends-uber-pilot-project-for-another-year/>

⁶⁶ Maison de l'Innovation Sociale (MIS) (2020). Launch of LICER: A laboratory designed to overhaul municipal regulations. Retrieved from <https://www.mis.quebec/en/actualites/launch-licer-laboratory-overhaul-municipal-regulations/>

Table 2 – Overview of Innovation Sandboxes outside of the energy sector in Canada

Sector	Authority	Name of Sandbox	Overview
Agri-food	Canadian Food Inspection Agency (CFIA)	Supply chain management	CFIA's Regulatory Trial aims to assess the feasibility of the application of blockchain technologies for supply chain management to improve information and data sharing and regulatory oversight in the agri-food sector. The project involves the adoption of a data-exchange platform using blockchain. The project will test various aspects of regulatory application of the technology to evaluate numerous implications, but will also leverage supply chains and technologies that are already advancing. ⁶⁷
Health	Health Canada	Advanced Therapeutic Products	The <i>Food and Drugs Act</i> and its regulations do not currently address advanced therapeutic products (ATPs). Health Canada's Regulatory Trial will involve creating a tailored authorization pathway and concierge service for ATPs, and they will be authorized either by a licence with terms and conditions (such as quality and safety requirements); or order of permission. New and innovative products will be targeted, including tissues developed through 3D printing, artificial intelligence, and gene therapies targeted to specific individuals. ⁶⁸ The "concierge service" will provide a single point of contact for direct, well-informed interactions with relevant government officials and enable access to key information for companies with products looking to be considered for the ATP pathway. ⁶⁹
Mobility and food security	Maison de l'Innovation Sociale (MIS)	Le Laboratoire d'Innovation Civique pour l'Expérimentation Réglementaire (LICER, Civic and Regulatory Innovation Laboratory)	Launched in July 2020, LICER is a four-year project that is part of a broader \$50 million initiative led by the City of Montreal, with funding from the federal Smart City Challenge. ⁷⁰ Led by Maison de l'Innovation Sociale (MIS), LICER will support innovative mobility and food security projects by using a collaborative and inclusive approach that involves a diversity of stakeholders, including academics, citizens, private, public, municipal, and national. ⁷¹

⁶⁷ Canadian Food Inspection Agency (2019). Targeted Regulatory Review: Agri-food and Aquaculture Roadmap. Retrieved from <https://www.inspection.gc.ca/about-cfia/acts-and-regulations/forward-regulatory-plan/agri-food-and-aquaculture-roadmap/eng/1558026225581/1558026225797>

⁶⁸ Department of Finance Canada (2019). Investing in the Middle Class. Budget 2019. Retrieved from <https://www.budget.gc.ca/2019/docs/plan/budget-2019-en.pdf>

⁶⁹ Health Canada (2019). Agile regulations for advanced therapeutic products and clinical trials. Retrieved from: https://www.sac-oac.ca/sites/default/files/resources/healthcanada_atp_discussionpaper.pdf

⁷⁰ Maison de l'Innovation Sociale (MIS) (2020). Launch of LICER, a laboratory designed to overhaul municipal regulations. Retrieved from <https://www.mis.quebec/en/actualites/launch-licer-laboratory-overhaul-municipal-regulations/>

⁷¹ Ibid.

Transportation	Ministère des Transports du Québec (Quebec Ministry of Transportation)	Uber pilot project	<p>In 2016, Quebec signed an agreement with Uber on a pilot project which allowed the company to operate in three cities: Montreal, Quebec City and Gatineau. This Regulatory Trial was implemented to allow the government to collect information on ride-sharing services and their impact on Quebec's taxi industry.⁷² The pilot imposed certain restrictions on Uber while exempting the company from traditional taxi industry regulations, such as permits and other requirements.⁷³ The pilot project was extended, with modifications, until 2019. In 2019, legislation was passed that created a legal framework to regulate both traditional taxi companies and ride-sharing services.⁷⁴</p>
Transportation	Transport Canada	Electronic Shipping Documents	<p>The federal <i>Transportation of Dangerous Goods Regulations</i> requires a paper shipping document to accompany the transportation of dangerous goods. The Regulatory Trial, initiated in 2019, will test the use of electronic shipping documents for dangerous goods shipments, which present a number of potential benefits over paper. A variety of platforms and technologies will be evaluated across four transportation modes (air, marine, rail, and road), in both rural and urban environments.⁷⁵ Four companies currently participate in the Regulatory Trial project.⁷⁶</p> <p>Participants are given time-limited permission to use an equivalency certificate within their systems provided that they meet safety and information-sharing criteria. Other stakeholders, including first responders and law enforcement, are involved in consultations and other project activities. The final project report (expected in 2022-2024) will include recommendations for modernizing the <i>Transportation of Dangerous Goods Regulations</i> with paperless alternatives.</p>

⁷² Annabelle Olivier (October 12, 2018). "Quebec extends Uber pilot project for another year," Global News. Retrieved from: <https://globalnews.ca/news/4542262/quebec-extends-uber-pilot-project-for-another-year/>

⁷³ Sidhartha Banerjee (November 1, 2018). "Taxi drivers seek up to \$1B from Quebec for allowing Uber to operate," National Post. Retrieved from: <https://nationalpost.com/pmnn/news-pmn/canada-news-pmn/taxi-drivers-lawsuit-can-proceed-against-quebec-over-ubers-arrival/wcm/bb07666f-73eb-4183-9e0b-58a80532a3cd>

⁷⁴ M. Lapierre (2019). Uber is officially allowed in Quebec as province passes taxi reform law. CTV News Montreal. Retrieved from: <https://montreal.ctvnews.ca/uber-is-officially-allowed-in-quebec-as-province-passes-taxi-reform-law-1.4632378>

⁷⁵ Transport Canada (2020). Regulatory sandbox on electronic shipping documents. Retrieved from: <https://tc.canada.ca/en/dangerous-goods/regulatory-sandbox-electronic-shipping-documents>

⁷⁶ Transport Canada (2020). Participating companies. <https://tc.canada.ca/en/dangerous-goods/regulatory-sandbox-electronic-shipping-documents/participating-companies>

Securities	Canadian Securities Administrators (CSA)	CSA Regulatory Sandbox	<p>The CSA Regulatory Sandbox was launched in 2017 to support fintech businesses seeking to offer innovative products, services and applications. The Regulatory Sandbox allows firms to obtain time-limited registration relief or exemptive relief from securities laws requirements, under a faster and more flexible process than through a standard application, in order to test their innovations on the market.⁷⁷ All firms with innovative business models, from start-ups to well established companies, can apply. The type of trial and support is determined on a case-by-case basis. Proposals for a regulatory trial are filed with the firm's local securities regulator and then brought to the CSA's national committee, who makes collective decisions. Through CSA's 'passport regime' the sandbox can be run across Canada. As of August 2020, 11 companies have participated in the CSA's regulatory trial, all of which have focused on crypto-asset business.⁷⁸</p>
Securities	Ontario Securities Commission (OSC)	OSC LaunchPad initiative	<p>OSC created the IS in 2016 with its LaunchPad initiative, which aims to create more flexibility for innovative fintech business models, products, services or applications to get to markets.⁷⁹ The LaunchPad initiative includes the Enquiry Service function where the OCS team discusses innovative products and provides informal guidance. It also allows regulatory trials.⁸⁰ The OSC coordinates sandbox reviews with the CSA Regulatory Sandbox of novel businesses that want to operate across Canada.⁸¹</p>

⁷⁷ Canadian Securities Administrators (n.d.). CSA Regulatory Sandbox. Retrieved from: https://www.securities-administrators.ca/industry_resources.aspx?id=1588

⁷⁸ Ibid.

⁷⁹ Ontario Securities Commission (2020). Our approach. <https://www.osc.gov.on.ca/en/our-approach.htm#recent-examples>

⁸⁰ Ontario Securities Commission (2020). Request support. <https://www.osc.gov.on.ca/en/request-support.htm>

⁸¹ Ontario Securities Commission (2020). Navigating Securities Regulation. Retrieved from: <https://www.osc.gov.on.ca/en/navigating-regulation.htm#how-we-help-investors>

ELEMENTS OF INNOVATION SANDBOXES IN THE ENERGY SECTOR IN CANADA

While elements of sandbox-like tools can be seen in Canadian energy innovation programs, Ontario is the home of the only energy Innovation Sandbox in Canada. The Ontario Energy Board (OEB) — the energy regulator in Ontario — introduced an Innovation Sandbox in 2019 following feedback from the sector concerning regulatory barriers, and the desire to act quickly to encourage innovation.⁸²

The OEB Sandbox provides for Regulatory Trials where derogations from OEB codes, rules, licensing requirements, and some statutory provisions can be made. Progress has been slow, and in the 18 months (January 2019 to June 2020), 33 proponents approached the OEB. The only public outcome has been an information note from the OEB on how a regulated utility can use behind-the-meter storage systems. Four applications were made related to regulatory requirements for which the OEB did not have the authority to provide relief, and exemptions from other regulators or legislated would have been required; a fifth application was made related to activities for which no exemption was required.⁸³

The preliminary results of the OEB's initiative and its slow progress suggest that the Innovation Sandbox design can be improved to enhance coordination with other regulatory bodies and to incorporate additional tools beyond the Regulatory Trial approach. The OEB notes that information and guidance on regulatory issues were what most of the proponents wanted, rather than Regulatory Trials.⁸⁴ There is also no formal mechanism for information sharing and collaboration, apart from ad hoc sector guidance notes.

In addition to the OEB Innovation Sandbox, several energy innovation programs in Canada have incorporated one or more Innovation Sandbox-like tools in their design.

As mentioned above there are four components of Innovation Sandboxes:

- + **Innovation Hubs:** Places of collaboration and knowledge exchange
- + **Enquiry Services:** Customized guidance to help innovators navigate the system
- + **Regulatory Trials:** Time-bound derogation or exemption to existing rules for specific trials
- + **Regulatory and Policy Learnings:** Results used to inform discussion on the future of energy transition

In addition to the OEB Innovation Sandbox, several energy innovation programs in Canada have incorporated one or more Innovation Sandbox-like tools in their design.

While not full Innovation Sandboxes as they are not focused on systemic change, some Canadian energy innovation programs contain elements of these tools (see Table 3). For these programs, we are also including those that allow for experimentation programs, which would be similar to Regulatory Trials except that they don't require any derogations but are still looking at how to do things differently when it comes to consumer behaviour, business models and rate structures.

⁸² Advisory Committee on Innovation (November 2018). Report to the Chair of the OEB. Retrieved from: <https://www.oeb.ca/sites/default/files/Report-of-the-Advisory-Committee-on-Innovation-20181122.pdf>

⁸³ Ontario Energy Board (2019) Innovation Sandbox: Reporting 1. Retrieved from: https://www.oeb.ca/_html/sandbox/reporting-1.php

⁸⁴ Ontario Energy Board (July 2020). Innovation Sandbox: Reporting 2. Retrieved from: https://www.oeb.ca/_html/sandbox/reporting-2.php

Table 3 – Elements from Innovation Sandboxes in Canadian energy innovation programs

Jurisdiction	Program	Description	Regulatory Trials / Experimentation	Innovation Hub	Enquiry Service	Informing policy
Federal	Clean Growth Hub ⁸⁵	The Clean Growth Hub helps innovators understand the types of federal programs and incentives that could apply to their project, and connects them to other departments.			<input checked="" type="checkbox"/>	
Federal	ecoEI/En-ergy Inno-vation Pro-gram ⁸⁶	Connects applicants with experts within the government to share knowledge and expertise.		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Federal	Communi-ty Energy Financing (CEF) ⁸⁷	Provides funding to municipalities to experiment with innovative funding or procurement programs.	<input checked="" type="checkbox"/>			
North-west Territo-ries	Deep Home Energy Ret-rofit Pro-gram ⁸⁸	A whole-building approach to energy efficiency where residents can connect directly with experts at the Arctic Energy Alliance to assess specific needs.			<input checked="" type="checkbox"/>	
Nova Scotia and New Bruns-wick	Atlantic Smart Ener-gy Communi-ties	Provides a testing ground and “sandbox” to deploy new technologies and explore new rate designs, operational and market models, and evolve national building and energy codes.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Ontario	Innovation Sandbox ⁸⁹	Provides for Regulatory Trials and information exchange.	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
Ontario	Grid Innovation Fund ⁹⁰	Funds projects that aim to test new services, practices or program approaches, or at closing a skills gap in the sector.	<input checked="" type="checkbox"/>			

⁸⁵ Government of Canada (n.d.). Clean Growth Hub [webpage]. Retrieved from: <https://www.ic.gc.ca/eic/site/099.nsf/eng/home#p4>

⁸⁶ Natural Resources Canada (October 28, 2020). Energy Innovation Program [webpage]. Retrieved from: <https://www.nrcan.gc.ca/science-data/funding-partnerships/funding-opportunities/funding-grants-incentives/energy-innovation-program/18876>

⁸⁷ Federation of Canadian Municipalities (n.d.). Community Efficiency Financing [webpage]. Retrieved from: <https://fcm.ca/en/programs/green-municipal-fund/community-efficiency-financing>

⁸⁸ Arctic Energy Alliance (n.d.). Rebates on Energy-Efficient Products [webpage]. Retrieved from: <http://aea.nt.ca/programs/energy-efficiency-incentive-program>

⁸⁹ Ontario Energy Board (n.d.). OEB Innovation Sandbox. Retrieved from: https://www.oeb.ca/_html/sandbox/index.php

⁹⁰ Independent Electricity System Operator (2020). Grid Innovation Fund [webpage]. Retrieved from: <http://www.ieso.ca/en/Get-Involved/Funding-Programs/Grid-Innovation-Fund/Overview>

Innovation Hubs and Regulatory Trials are the two Sandbox-like elements that are commonly found in recent Canadian energy innovation policy, although Enquiry Services are also sometimes included. Interestingly, Innovation Hubs and Enquiry Services tend to be included in federal programs, while provincial programs favour Regulatory Trials.

The federal focus on Innovation Hubs is likely due to the federal government's lack of constitutional authority in the electricity and natural gas sectors to enable projects in provinces and territories. As a result, this makes them more likely to rely on funding and collaboration to achieve their goals (see Sidebar D on the next page).

Provincial programs tend to focus on Regulatory Trials, which is not surprising as energy regulation is a provincial power. These trials aim to provide a "real-world" environment to test solutions to overcoming the barriers to greater deployment.

One outlier in the provincial and territorial projects we examined is the Northwest Territories' Deep Home Energy Retrofit Program. Rather than looking at innovative technologies, the program uses an innovative funding mechanism that includes an assessment of the whole building to identify where changes are needed to help deploy energy efficiency in northern communities. The innovation is in the program design, rather than the technology used.⁹¹

A second outlier is the Community Energy Financing (CEF) program run by the Federation of Canadian Municipalities (FCM). The CEF program provides funding for municipalities to develop innovative financing mechanisms for residential energy retrofits and small-scale solar photovoltaic (PV). While not offering regulatory experimentation, the CEF does allow for municipalities to experiment and test innovative funding mechanisms to find the system that will work best for different communities.⁹² Unlike many of the other programs, it does not focus on innovative technology or energy system design and exclusively looks at small residential energy retrofits and solar PV.

⁹¹ Interview with Arctic Energy Alliance, September 8, 2020. Information available at Arctic Energy Alliance (2020). Rebates on Energy-Efficient Home

Improvements: Deep Home Energy Retrofit Program. Retrieved from: <http://aea.nt.ca/programs/deep-home-energy-retrofit-program>.

⁹² Federation of Canadian Municipalities (2020). Community Efficiency Financing: Application Guide. Retrieved from: <https://data.fcm.ca/documents/funding/gmf/cef-application-guide-gmf.pdf>

HOW DOES THE FEDERAL GOVERNMENT FIT IN?

The provinces in Canada have constitutional jurisdiction over energy policy and regulation unless it crosses a provincial or international border. As a result, most of the tools available to accelerate energy innovation lie with the provinces.⁹³

This division of powers has both benefits and costs. Being able to design an energy system to meet the particular needs of a province in such a diverse country as Canada is important. At the same time, the patchwork of regulations and markets can make the commercialization of a new energy product difficult as it has to conform to multiple different standards.

This division of powers can be seen in the types of innovation policies implemented federally and provincially. The federal government has one large power — the ability to provide funding — and it can use that to steer innovation. It can also restrict the use of dirtier alternatives through environmental regulations or carbon pricing. At the same time, the convening power of the federal government can help bring together diverse stakeholders to increase collaboration and knowledge transfer.

At the same time, the convening power of the federal government can help bring together diverse stakeholders to increase collaboration and knowledge transfer. This convening power can be very powerful in promoting collaboration and knowledge exchange.

One example of this convening power is the federal government's Economic Strategy Tables, which comprise policymakers and CEOs, to provide recommendations on various sectors. One of these groups is on accelerating the development and deployment of cleantech. In addition to targeting funding to where innovation is needed, some of the recommendations from the cleantech Economic Strategy Tables include creating an Office of Regulatory Innovation which would coordinate with provincial and territorial regulators on best practices and provide a forum for innovation. Another idea is to create an Innovative Regulations Advisory Council, which would include representatives from the public and private sectors, to advise on reducing barriers to cleantech deployment.⁹⁴

One of the roles of these organizations could be similar to that played by the Canadian Securities Administrators (CSA) and their regulatory sandbox. While the CSA doesn't run the sandbox — that is left to the provincial securities regulators — the CSA works with the regulators to ensure that any lessons learned from the Regulatory Trials are shared nationally and that everyone can benefit.

⁹³ It should be noted that the federal government has some limited power under environmental regulations that can affect provincial energy use, be that carbon pricing or emissions caps on coal-fired power. And while the territories do not have constitutional jurisdiction over their energy sector as provinces do, in practice they are provided with the same authority.

⁹⁴ Innovation, Science and Economic Development Canada (October 4, 2018). Report from Canada's Economic Strategy Tables: Clean Technology. Retrieved from: <https://www.ic.gc.ca/eic/site/098.nsf/eng/00023.html>

CONCLUSION

Innovation in Canada's energy sector is being supported, with most resources and attention directed at the first two stages of innovation (R&D and demonstration) and on technological innovation. The common policy tool used by Canadian governments to promote innovation has been through direct public funding. While public funding for R&D into new technology and for pre-commercialization and demonstration stages are crucial, it is not sufficient for a comprehensive innovation policy approach.

Through interviews with utilities and provincial, territorial, and federal energy agencies managing innovation programs, we heard that innovators are facing a series of key non-technological barriers that are slowing down innovation. We heard about the difficulty to make sense of the complex regulatory landscape as well as the gap between current regulations and new technologies, business models and practices. There is broad agreement among stakeholders in Canada about the need for greater engagement in the regulatory process and for more innovative regulatory practices to fill this gap and create a community of energy innovation.



We also heard that energy innovation policy requires more than just dollars as “it is also about connecting the dots”.



We also heard that energy innovation policy requires more than just dollars as “it is also about connecting the dots”. Many interviewees pointed out that some innovations that are granted public funding are not “genuinely innovative” because they had already gone through the demonstration phase in other regions but others were not aware and/or the knowledge was not shared. We heard about the need to experiment, trial, and test new ways of doing things in the real world but in a safe and controlled way, and to learn from

experimentation to inform changes in policy, regulatory processes and governance.

If we want to achieve our climate and economic targets, we need both to speed up the pace and increase the uptake of innovation. However, we need to do so in a way that benefits all energy customers and that mitigates risks and unintended consequences. This requires us to rethink energy innovation policies at all three levels of government and to:

- ✚ Support the third stage of innovation (deployment) and move beyond public funding
- ✚ Address non-technological barriers to innovation and create long-term conditions that enable innovation to scale up.

Innovation Sandboxes can solve both of these problems by providing a broader lens through which to consider innovation and innovation policy in the energy sector, and by rebalancing the focus away from funding technology to also including deploying innovation. As we saw in our international research *Enter the Sandbox: Developing Innovation Sandboxes for the Energy Sector*,⁹⁵ Innovation Sandboxes can help the Canadian energy system move from a narrow focus on technology to adopt a systems-level approach that overcomes the non-technological barriers to innovation. Internationally, while Innovation Sandboxes were first introduced in the FinTech sector, jurisdictions have included them in other sectors (including energy) as a part of their innovation policy toolbox because they are starting to see the value that sandboxes can offer to accelerate and scale-up innovation through systemic changes.

The good news is that Canada is no stranger to Innovation Sandboxes. Innovation Sandboxes are already being used at the federal, provincial, territorial, and local government levels, and in various sectors, including securities, agrifood, and transportation.

In the energy sector, OEB has been the first organization to use Innovation Sandboxes. The OEB's sandbox initiative is recent and the first

⁹⁵ Richard Carlson and Aida Nciri (July 2020). *Enter the Sandbox: Developing Innovation Sandboxes for the Energy Sector*. Retrieved from <https://questcanada.org/wp-content/uploads/2020/07/Innovation-Sandboxes-Report-1-EN.pdf>

results suggest that its design and submission process can be improved to make Innovation Sandboxes an efficient tool. Some recent energy innovation programs have started to incorporate sandbox-like elements in their design to address non-technological barriers and to boost the deployment of new practices and business models.

The good news is that Canada is no stranger to Innovation Sandboxes. Innovation Sandboxes are already being used at the federal, provincial and local government levels, and in various sectors, including securities, agrifood, and transportation.

The four components of Innovation Sandboxes — Innovation Hubs, Enquiry Services, Regulatory Trials, and Informed Policy Changes — have the potential to complement existing innovation programs by addressing the non-technological barriers to deployment. They also have the potential to inform policy and regulatory reform.

But more is needed. As our report *Enter the Sandbox: Developing Innovation Sandboxes for the Energy Sector*⁹⁶ shows, to be successful sandboxes need to be well-designed and there is not only “one” type of Innovation Sandbox as they need to be tailored to the local context and specific needs of the jurisdiction in which they are developed.

This is why the design phase is crucial. Developing effective energy Innovation Sandboxes in Canada means ensuring they reflect each jurisdiction’s context and needs and are designed by incorporating feedback from diverse stakeholders representing the entire energy system, from energy users to new entrants, to utilities; from the regulators to the government. Therefore, developing effective Innovation Sandboxes requires the use of innovative and inclusive engagement processes.

As part of the Innovation Sandbox initiative, QUEST and Pollution Probe will hold a national workshop in the winter of 2021 to collect feedback and input from key energy stakeholders, including representative of institutions, companies and utilities, non-profits, and energy consumers in order to capture a diversity of perspectives on overarching principles for the Innovation Sandboxes, along with identifying barriers specific to the jurisdiction. QUEST and Pollution Probe will then work with several provinces and territories through a series of engagement workshops to develop tailored frameworks. Finally, QUEST and Pollution Probe will share learnings from the research and workshops and a national vision based on jurisdictional realities for the role of Innovation Sandboxes in Canada’s low-emissions future. The project will wrap with a national conference to disseminate project results, maintain the project’s momentum, and explore the next phase for Innovation Sandboxes in Canada.

⁹⁶ Richard Carlson and Aida Nciri (July 2020). *Enter the Sandbox: Developing Innovation Sandboxes for the Energy Sector*. Retrieved from <https://questcanada.org/wp-content/uploads/2020/07/Innovation-Sandboxes-Report-1-EN.pdf>



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