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Electric Utility Innovation Benefits:

Lessons Learned from Government
Programming

Canada

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Electric Utility Innovation Benefits: Lessons Learned From Government Programming

Office of Energy Research and Development – Natural Resources Canada - June 2025

The Office of Energy Research and Development (OERD) plays a key role in the Government of Canada's efforts delivering energy research, development, and demonstration (RD&D) funding, accelerating efforts in energy innovation and clean technology programming. In essence, the mission of OERD is to support energy innovation in Canada through research, policy, and programs.

Energy innovation is a vast and dynamic area including technologies such as renewable energy; smart grids; carbon capture, utilization, and storage; and many others. It also includes the application of these technologies in a range of Canadian contexts and in consideration of the overarching regulatory and policy frameworks that direct and govern the development and adoption of these technologies.

There are many benefits of innovation across technology types and applications. The following paper focuses on utility-led electric grid innovation and its benefits to customer choice, experience, and affordability, and to the broader energy system. The objective of this paper is to highlight the benefits of utility-led electric grid innovation projects that OERD has observed from past projects to communicate the importance of utility-led innovation and the role it plays in delivering value to customers, to the energy system, and to Canada's broader energy innovation ecosystem.

What We See: OERD Observations From its Programs

Utility-led innovation projects have resulted in benefits to customer choice and experience, affordability, and the energy system.

Natural Resources Canada (NRCan) has funded electric grid innovation projects since 2003 and has observed meaningful outcomes that advance technological, social, environmental, and economic benefits for Canadians. NRCan supports adopters (such as utilities) and their electricity system partners in developing and demonstrating innovative solutions to address sector challenges. This, in turn, enhances adopters' ability to drive system change and provide value to the entire electricity ecosystem including customers, taxpayers, and the utility.

The Green Infrastructure [Smart Grid Program \(2018-2023\)](#) provided partial funding to 22 utility and adopter-led demonstration and deployment projects across 8 provinces and territories. The program advanced technical solutions such as grid monitoring and automation, integration of distributed energy resources, microgrids, technologies to optimize and improve demand management (demand response

and energy efficiency), and new markets. Broadly, these projects have resulted in several significant benefits, including:

- Improved utilization of existing electricity system assets
- Increased penetration of distributed energy resources (DER)
- Increased reliability, resiliency and flexibility of the power system
- Maintained or enhanced cyber security
- Enabled reductions in greenhouse gas (GHG) emissions
- Economic benefits, including local job creation; new business models, market actors, and revenue opportunities; and net energy bill savings to customers

The projects funded (see the Annex for a project list) have completed. Final public reporting is becoming available, **which provides evidence that utility-led innovation projects can result in benefits to customer choice and experience, to affordability, and to the electricity system.** The following list includes examples of such projects:

- [A microgrid](#) that reduced congestion issues on a constrained transmission system, thereby deferring costly upgrades by increasing the utilization of existing assets while enhancing power quality and reliability
- [A microgrid with state-of-the-art capabilities](#) that enables GHG emissions reductions and that has the potential to be replicated in remote locations that rely on fossil fuel-based generation. This project will also help with local training and skills development and promote public education and awareness through a public exhibition
- [A transactive energy market](#) that leveraged customer-owned assets to provide valuable grid services during peak demand periods in exchange for credits to local businesses, thereby promoting grid efficiency while providing economic benefits to local merchants and promoting customer participation in energy markets
- [Controllable DERs paired with advanced telemetry and artificial intelligence](#) that optimize distribution-level resource dispatch and reduce monthly peak demand, resulting in substantial cost savings to the utility, as well as system GHG reductions
- [A competitive market-based approach](#) to secure energy, and capacity and reserve services from DERs to meet local, regional and province-wide electricity needs through transmission- and distribution coordination. This demonstration project explores the potential of non-wire solutions to defer, reduce or avoid costs associated with traditional infrastructure. The project supports reliability and affordability to ratepayers, provides communities more options to address their local electricity needs, and provides new revenue opportunities to new market participants, such as commercial businesses.

Examples of Benefits From Utility Innovation

Supporting affordability. Utility innovation can deliver cost-effective solutions for customers through the testing and implementation of novel technologies, services, and business models. For example,

innovative grid optimization solutions and demand-side management can deliver reduced energy consumption and increased comfort for customers compared to conventional approaches. These solutions can also maximize the use of existing assets, reducing the need for new grid investments that would otherwise put upward pressure on rates.

Delivering value to customers. Electrification and the energy transition are changing expectations about the traditional relationship between customers and utilities. Customer needs and preferences are evolving with the rising adoption of distributed energy resources; Internet-connected smart grid technologies and devices, and electric transportation and heating. Through innovation in new technical solutions, services, and service delivery models, utilities have the potential to better meet customer needs and improve service for customers. Innovation in service delivery models includes scenarios where customers could be rewarded for active participation in the provision of value-added services to the grid.

Improving the reliability and resiliency of the electric system. Electric service disruptions can be harmful to customers and can have serious economic impacts. Disruptions are becoming more frequent because of extreme weather events. Utility innovation can promote the implementation of innovative technologies and services such as advanced distribution management systems, self-healing grids, and fault probability analysis, allowing utilities to respond more quickly and effectively to changing energy system needs and service disruptions.

Enhancing a broader energy innovation ecosystem. Utilities have the potential to adopt and implement innovative technologies and solutions at the transmission and distribution level to the benefit of their customers. Because of the ability to deploy innovative solutions broadly, utility innovation can stimulate private sector innovation and improves the effectiveness and impact of government support for sector-wide innovation, ultimately resulting in the accelerated development and adoption of novel cost-effective solutions to the benefit of customers.

Promoting innovation through data collection and knowledge dissemination. Data and information are required to evaluate the viability of new business models and use cases for novel solutions. These insights can help utilities and decision-makers in other jurisdictions to consider the value of similar novel solutions deployed in their markets.

What We Heard: Stakeholder Perspectives on Utility Innovation

Stakeholders have communicated to NRCan the value of, and need for, utility innovation in supporting core utility business activities; improving customer choice and experience; and reducing costs.

In the [“What we heard” results](#) from the NRCan Request for Information published in 2023 on electricity regulation and grid modernization regarding **enabling innovation and promoting innovation projects at the utility level**, respondents:

- Identified that current regulatory frameworks pose challenges to utilities with respect to proposing innovative projects to their regulators. They also stated that the current regulatory landscape is challenged by evolving market conditions and ongoing system changes in the energy sector.
- Emphasized the importance of regulatory sandboxes and other mechanisms and processes to enable and promote piloting and experimentation
- Highlighted an ongoing need for research, development, and demonstration projects, especially for systems integration of new technologies and operations.

In the [“What we heard” results](#) from the NRCan Request for Information published in 2022 on grid readiness for zero-emission vehicles regarding **innovation in enabling new technical solutions and applications to meet the emerging needs of an evolving energy system**, respondents:

- Identified the importance of encouraging interoperability, building out the infrastructure that is needed to accommodate transportation electrification, and enabling new capabilities for this infrastructure. This would involve establishing open-innovation approaches to facilitate interoperability and increase knowledge dissemination.
- Emphasized the importance of promoting the development and adoption of grid readiness technology at the distribution level, from the innovation phase to scaling and deployment.

OERD Observations of Regulatory Mechanisms to Support Innovation

OERD acknowledges the efforts of several jurisdictions in developing regulatory mechanisms that enable utility innovation that benefits customers. Regulatory support for innovation can provide the necessary predictability required for utilities to incorporate innovation into long-term planning and promote organizational culture change in a way that temporary government programs cannot.

- [FortisBC Energy Clean Growth Innovation Fund](#): The British Columbia Utilities Commission approved FortisBC Energy Inc.’s \$24.5 million ratepayer-funded Clean Growth Innovation Fund, which allows the natural gas utility to invest regulated capital in renewable gas innovation projects with a focus on decarbonization. FortisBC Energy’s proposed Clean Growth Innovation Fund will finance GHG reduction projects, including projects to blend hydrogen and renewable natural gas.
- [Nova Scotia Utility and Review Board \(NSUARB\) Innovation Justification Criteria](#): These criteria allow innovation projects to be justified on the basis that there is a reasonable expectation that they will provide customer value on 1) reducing upward pressure on revenue requirement, 2) reliability and grid stability, 3) environmental and other compliance, and 4) customer experience improvements. Projects can also be justified on the basis that they are reasonably expected to allow for testing before deploying at scale, provide valuable data and learnings, or aid in the development of business cases.

- [Ontario Energy Board \(OEB\) Innovation Sandbox](#): The first of its kind in Canada, the Innovation Sandbox supports pilot projects testing new activities, services, and business models. The OEB has also published an Innovation Handbook and has launched an Innovation Sandbox Challenge, all in the interest of promoting utility innovation to promote affordability and to create customer value.
- [Office of Gas and Electricity Markets \(UK\) Network Innovation Allowance](#): The Allowance provides funding to electricity network companies to fund innovative projects that have the potential to deliver financial benefits to customers. This allows utilities to create innovation funds and to claim them as operations and maintenance expenditures.

Annex: List of projects funded by NRCan's Green Infrastructure Smart Grid Program

The table below contains a list of projects funded by the NRCan's Green Infrastructure Smart Grid Program from 2018 to 2023.

Table 1. List of projects funded by NRCan's Smart Grid Program (2018-2023)

Number	Recipient	Project Title	Project Type	System category
1	Yukon Energy	<u>Residential Demand Response Program (RDRP)</u>	Demonstration	DERMS
2	EPCOR	<u>EPCOR Smart Grid System (ESGS)</u>	Deployment	DERMS, Microgrid, Distributed energy storage
3	EQUUS REA	<u>Canada's 1st Member-Owned Rural Smart Grid Project</u>	Deployment	DERMS
4	ENMAX Power	<u>Integrating Distributed Generation into Secondary Networks in Large Urban Centres</u>	Demonstration	Grid monitoring and automation
5	FortisAlberta Inc.	<u>FortisAlberta Waterton Energy Storage Project</u>	Demonstration	Microgrid-connected

Number	Recipient	Project Title	Project Type	System category
6	City of Lethbridge	<u>Conservation Voltage Reduction (CVR) Deployment in Lethbridge Electricity Utility (LEU) Distribution Network</u>	Demonstration	Grid monitoring and automation
7	SaskPower	<u>SaskPower Distribution Modernization Program</u>	Deployment	Grid monitoring and automation
8	PUC Distribution Inc.	<u>Sault Smart Grid</u>	Deployment	Grid monitoring and automation
9	Entegrus Powerlines Inc.	<u>Conservation Voltage Reduction</u>	Deployment	Grid monitoring and automation
10	Bracebridge Generation Ltd.	<u>Smart, Proactive, Enabled, Energy Distribution; Intelligent, Efficiently, Responsive (SPEEDIER) Project</u>	Hybrid	DERMS
11	London Hydro	<u>West 5 Smart Grid Project</u>	Hybrid	DERMS
12	Alectra Utilities Corporation	<u>Power.House Hybrid: Minimizing GHGs and Maximizing Grid Benefits</u>	Demonstration	DERMS
13	Alectra Utilities Corporation	<u>The Transactive Grid – Enabling an End-To-End Market Services Framework Using Blockchain</u>	Demonstration	DERMS
14	Independent Electricity System Operator (IESO)	<u>Interoperability and Non-Wires Alternative Demonstration</u>	Demonstration	New markets and rate options (NRO)
15	Lakefront Utilities	<u>Digital Utility Platform</u>	Deployment	Grid monitoring and automation

Number	Recipient	Project Title	Project Type	System category
16	Hydro-Québec	<u>Smart Grid Deployment of Off-Grid Networks</u>	Deployment	Microgrid off-grid, grid monitoring, automation and storage off-grid
17	Hydro-Québec	<u>Lac-Megantic Microgrid</u>	Hybrid	Microgrid-connected
18	Hydro-Québec	<u>Diesel, solar, and battery microgrid: Hydro-Quebec Remote Communities in Nunavik (Quaqtaq)</u>	XXX	
19	Saint John Energy	<u>Integrated Dispatchable Resource Network for Local Electric Distribution Utility</u>	Hybrid	DERMS
20	New Brunswick Power	<u>Dynamic Voltage Control for the Integration of Renewables</u>	Hybrid	DERMS
21	Nova Scotia Power	<u>Collaborative Grid Innovation for Atlantic Smart Energy Communities</u>	Hybrid	DERMS
22	PEI Energy	<u>Slomon Park Microgrid Project</u>	Deployment	Microgrid, DERMS

Legend: DERMS – Distributed Energy Resource Management System