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# Status of Microgrids in Canada

Alexandre Prieur  
2022 Symposium on Microgrids

**CanmetENERGY**

*Leadership in ecoInnovation*



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# Canadian Context

Canadians generally get their electricity from a clean grid.

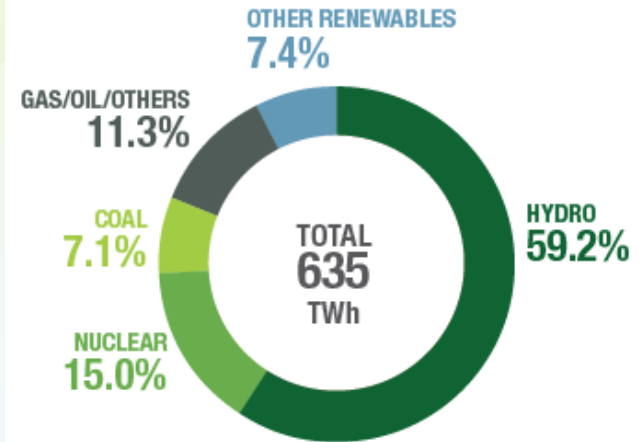
- Integrated entity: provincial, territorial and cross-border
- or through a remote microgrid.

Microgrid main drivers

1. Renewable generation integration to main grid (i.e. Net Zero community and DER integration)
2. 2050 Net Zero targets (i.e. electrification)
3. Reduce diesel dependence for isolated community

GENERATION IN CANADA – 635 TWh

GENERATION BY SOURCE, 2019



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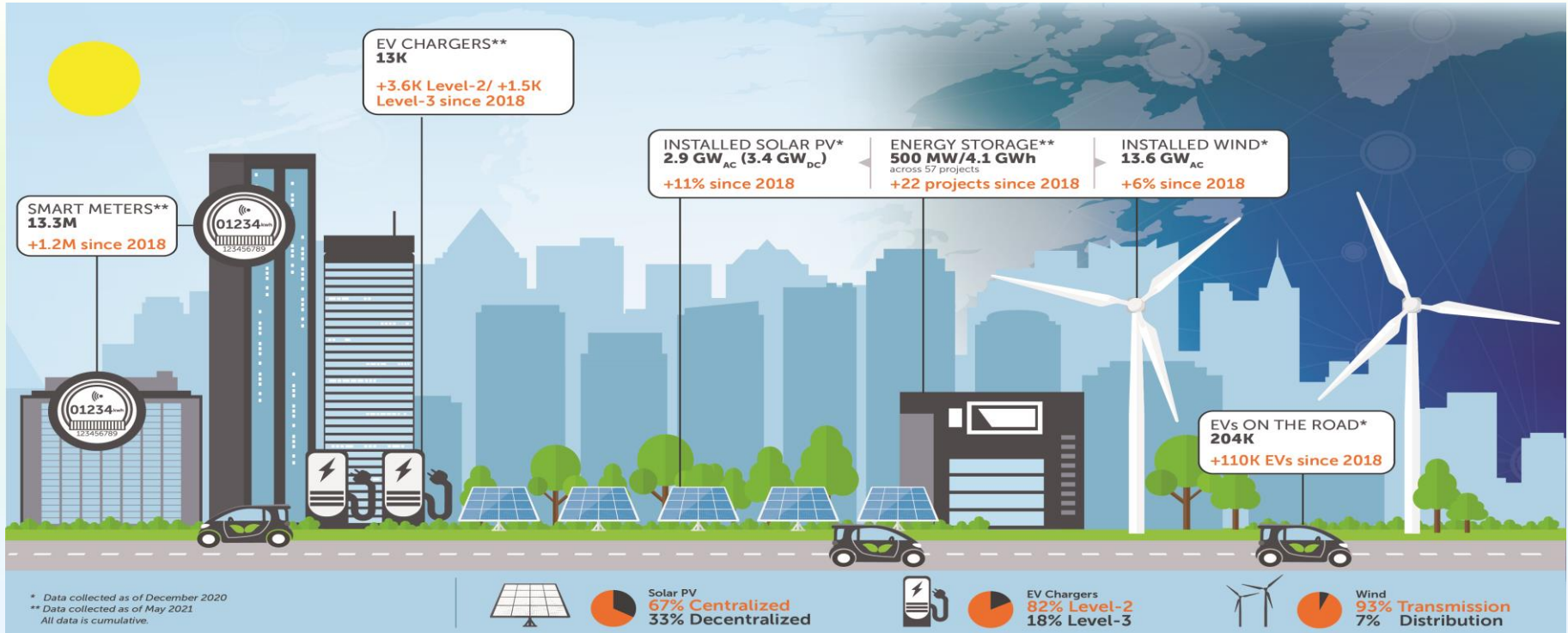


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# Smart Grid in Canada 2020-21



<https://www.nrcan.gc.ca/sites/nrcan/files/canmetenergy/pdf/Smart-Grid-in-Canada-2020-2021.pdf>

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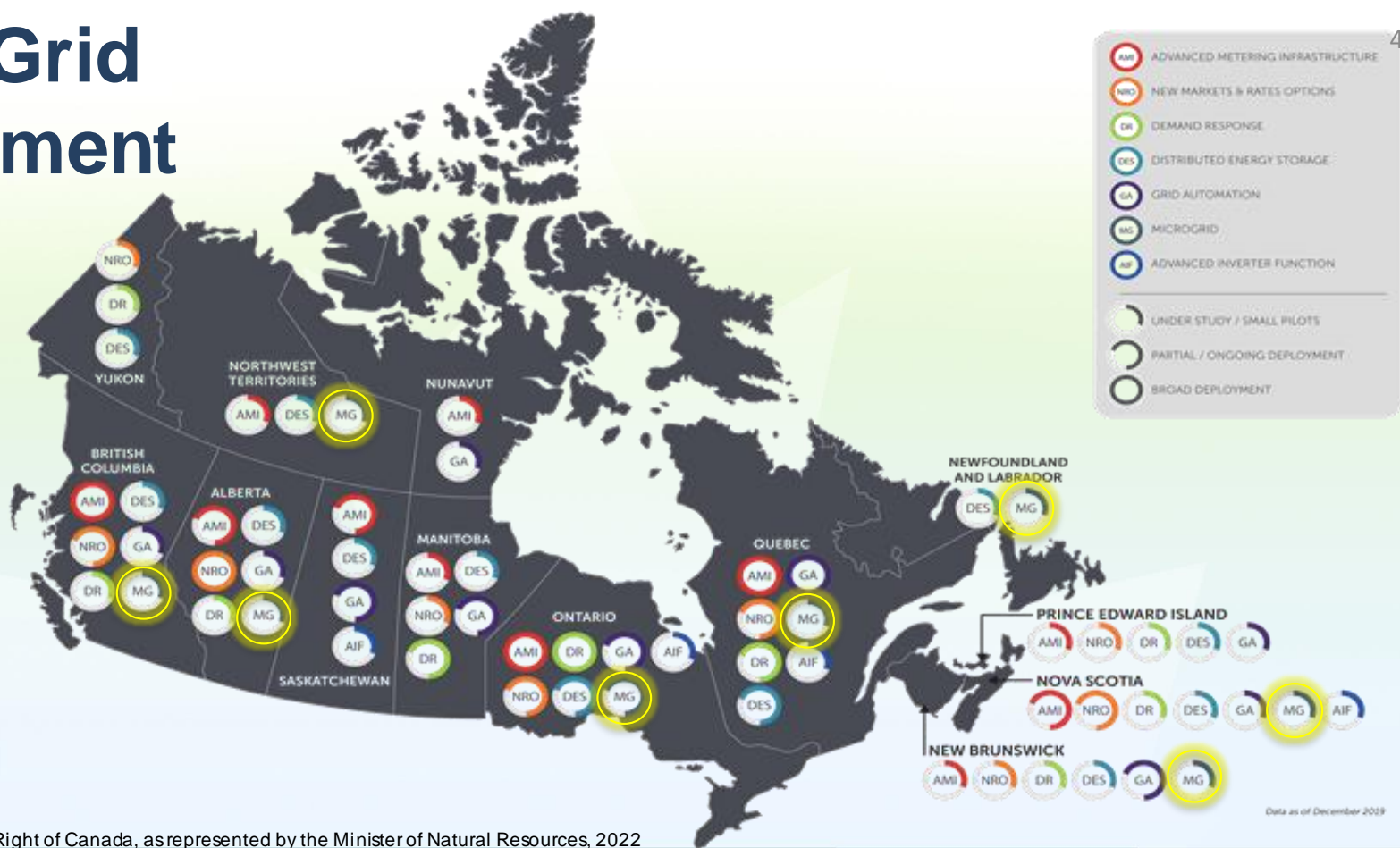


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# Smart Grid Deployment



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Data as of December 2019



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# Public Sector Investments

**\$2,115M**  
TOTAL PROJECT VALUE

**\$726M**  
PUBLICLY INVESTED

**538**  
PROJECTS



1. Infographic does not include academic funded networks
2. The Ministry of Ontario Energy, Northern Development and Mines Smart Grid Fund microgrid projects are not included.

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# Federal Funding Programs

Department	Program	Period	Funds
<b>NRCan</b> (Natural Resources Canada)	Energy Innovation Program ←	ONGOING	\$52.9M / year
	Program of Energy Research and Development ←	ONGOING	\$35M / year
	Clean Growth Program	2017 - 2021	\$155M
	<b>Green Infrastructure</b>		
	• Smart Grids ←	2018 - 2022	\$100M
	• Electric Vehicle Infrastructure Demonstrations	2018 - 2022	\$30M
	• Electric Vehicle and Alternative Fuel Infrastructure Deployment Initiative	2018 - 2022	\$80M
	• Emerging Renewable Power Program	2018 - 2023	\$200M
	• Energy Efficient Buildings RD&D	2018 - 2026	\$182M
• Clean Energy for Rural and Remote Communities ←	2018 - 2024	\$220M	
• <b>CIRNAC-NorthernREACHE &amp; CERRC ---- Off-Diesel Funding</b> ←	2022 - 2027	\$300M	
• Smart Renewables and Electrification Pathways Program (SREPs) ←	2021 - 2025	\$964M	
<b>NSERC</b> (Natural Sciences and Engineering Research Council Canada)	NSERC Energy Storage Technology Network	2015 - 2020	\$5.2M

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# Smart Grid Program (2018-2023)

**\$100M in funding over 5 years**

- Budget 2017, Green Infrastructure Program
- Demonstrations (\$35M) & Deployments (\$65M)**

**Targeted System Outcomes:**

GHG emission reductions

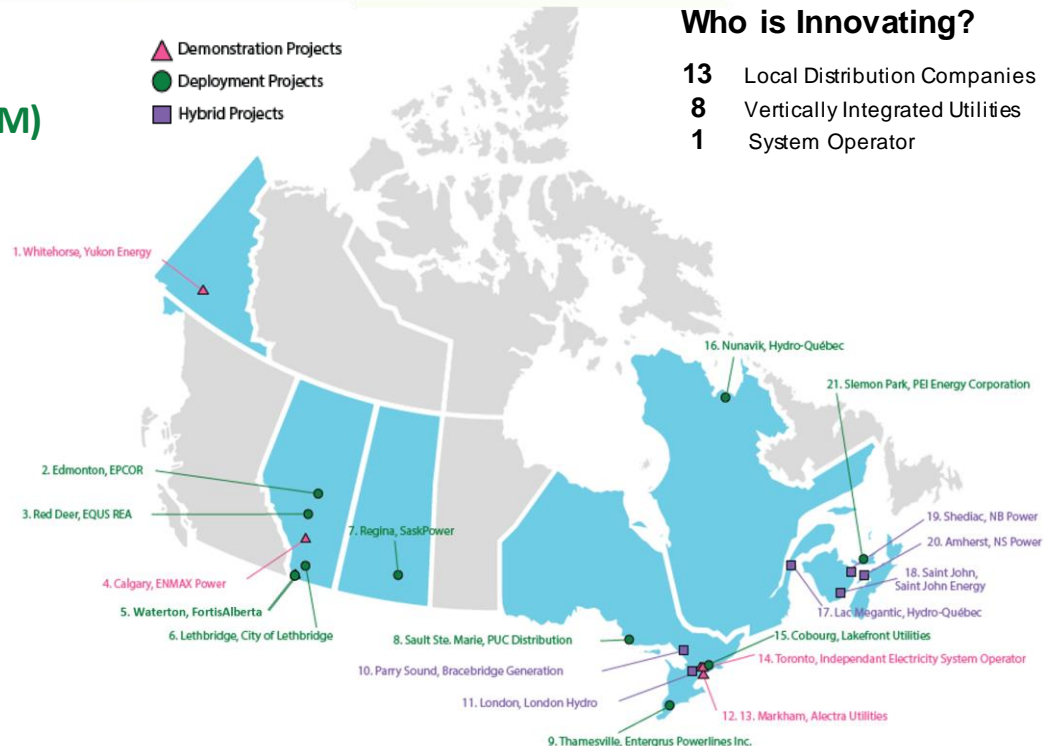
Deliver economic and social benefits

Optimizing use of the existing electricity system assets

Increased system reliability, resiliency, and flexibility

Increased penetration of renewable generation

Improved cybersecurity



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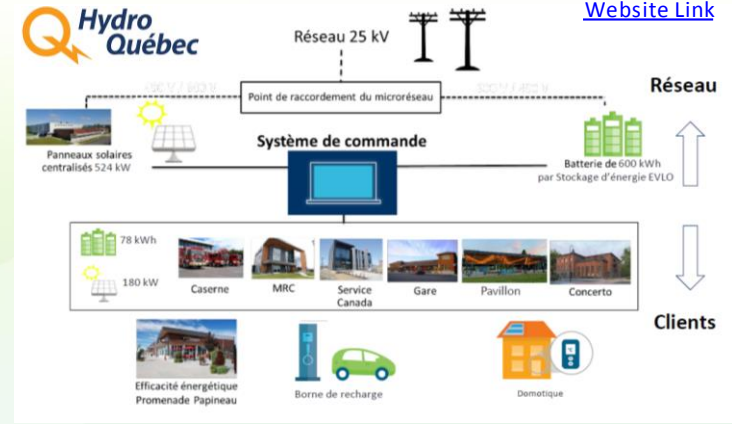
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# Case Study: Lac-Mégantic Microgrid

**Recipient:** Hydro-Québec  
**Location:** City of Lac-Mégantic, QC  
**Total Project Value:** \$12.8M  
**NRCan Funding:** \$5.2M  
**Project Duration:** 4 years, 2018-2022

## Summary and benefits:

- Partnership with the City of Lac-Mégantic to support the energy transition in Quebec, leveraging the reconstruction of the city following the train accident
- Test **control strategies** of an intelligent seamlessly islandable microgrid containing various DER technologies (batteries, solar PV, EV charging stations), home automation equipment, demand response, energy efficiency, and optimization software
- Demonstrate and deploy integrated solutions to scale **the adoption of decentralized renewable energy generation to remote communities across Quebec to reduce diesel fuel consumption**
- Improve reliability and resiliency of the grid
- Improve the **quality, affordability, and safety** of delivered power to customers



[Website Link](#)



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# Case Study: Project SPEEDIER

**Recipient:** Bracebridge Generation  
**Location:** Parry Sound, ON  
**Total Project Value:** \$8.3M  
**NRCan Funding:** \$3.8M  
**Project Duration:** 4 years, 2018-2022

## Summary and benefits:

- Create a Smart, Proactive, Enabled, Energy Distribution; Intelligent, Efficiently, Responsive (SPEEDIER) grid that builds towards a net zero smart community
- Addresses the issue of reducing load on a capacity-constrained transmission station identified in the long-term energy plan
- Increase solar PV, storage, EV penetration in the Town
- Develop greater automation and integration within the utility environment
- Explore new business models and market structures
- Build a seamlessly islanded microgrid that incorporates renewable energy and storage supporting the municipality's net-zero goals
- Serve as a model for expansion to other nearby communities

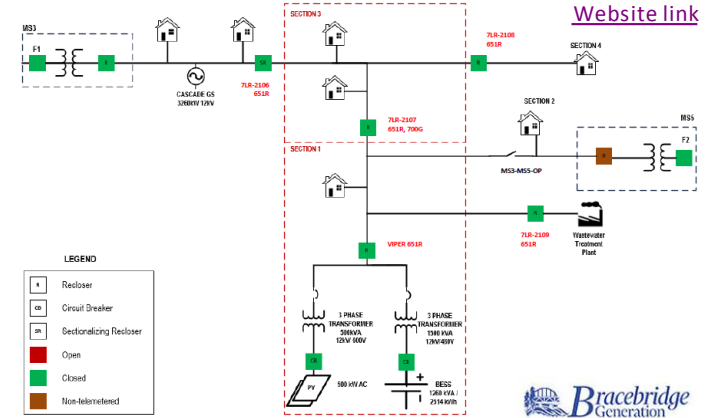
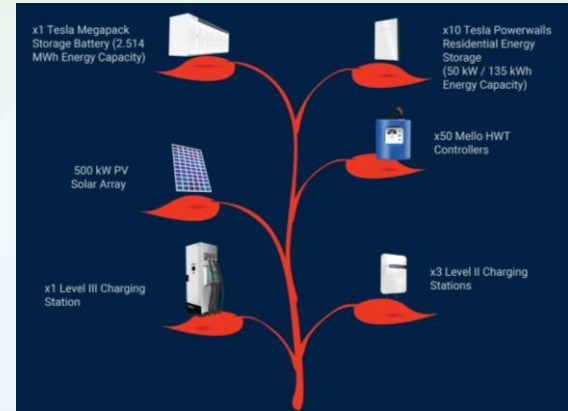


Figure 8: Project SPEEDIER Grid Connected Single Line Diagram



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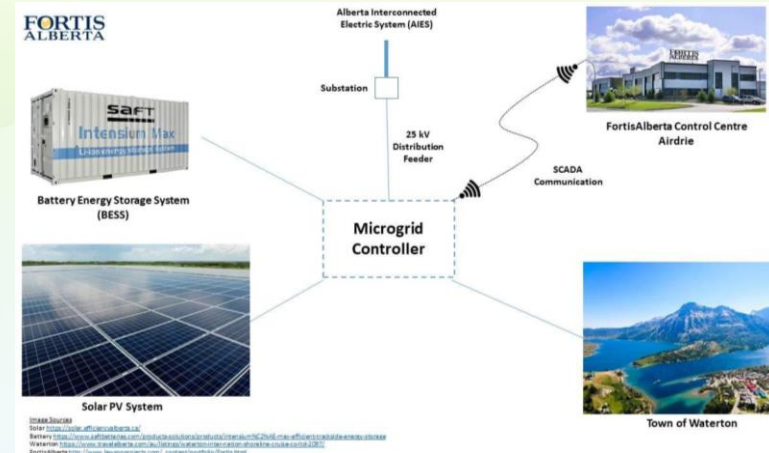


# Case Study: Waterton Energy Storage Project

**Recipient:** Fortis Alberta  
**Location:** Waterton, AB  
**Total Project Value:** \$4.9M  
**NRCan Funding:** \$0.5M  
**Project Duration:** 5 years, 2018-2023

## Summary and benefits:

- Waterton experiences more electricity outages by frequency and duration vs many other locations in AB as a result of being on a single 70 km distribution line
- Showcase stacked technical, economic and social benefits of utilizing a 2.36 MWh battery energy storage system (BESS), 400 kW solar PV, and advanced distribution control systems to address reliability issues faced by rural customers
- Islanding capability will provide much needed resiliency and emergency services
- Establish an AB-based cost benchmark to address distribution system deficiencies using non-wire alternatives
- Create a demonstration site and knowledge sharing opportunity for communities, utilities, government and other stakeholders regarding the use of emerging DER technologies



# Case Study: Slemon Park Microgrid

**Recipient:** PEI Energy Corporation  
**Location:** Summerside, PEI  
**Total Project Value:** \$24.4M  
**NRCan Funding:** \$4.4M  
**Project Duration:** 5 years, 2018-2023

[Website link](#)

## Summary and benefits:

- 10-MW solar facility with 1.5 MWh DC-coupled grid-connected energy storage, as well as a small deployment of residential energy storage systems
- Seamless islandable microgrid to provide resiliency and ancillary services for the central grid
- Benefit of improved marketability for PEI (green energy, increased reliability, peak load reduction, and energy efficiency)

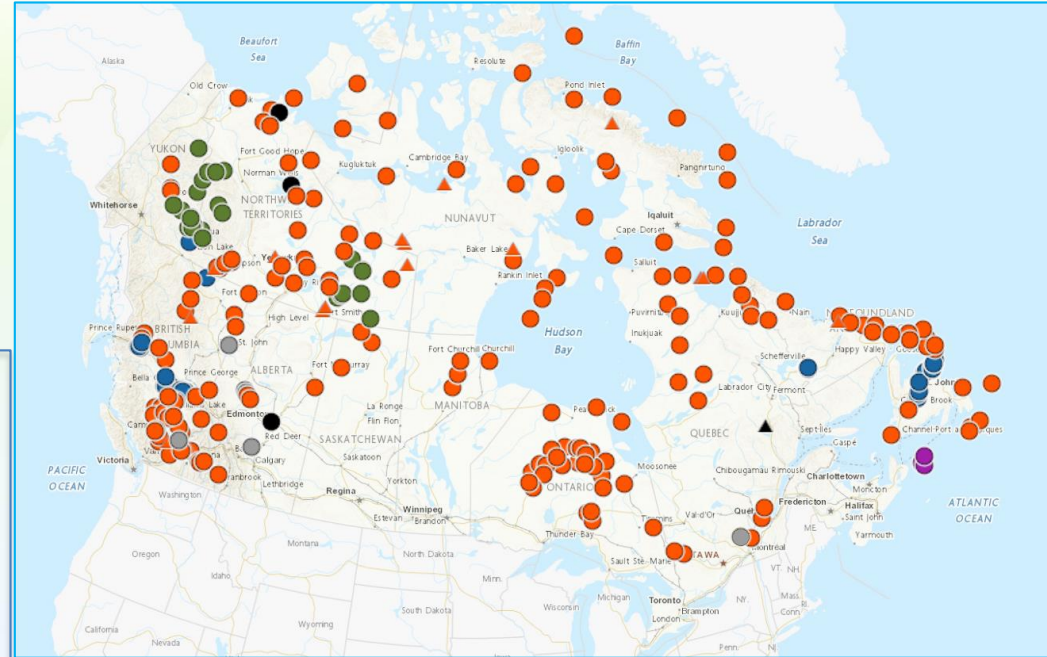


# Remote Communities

In Canada, many Northern and remote communities lack a connection to the North American electricity grid. Around 300 of them depend on diesel-based generation for power.

## Main power source

- Diesel
- Heavy fuel oil
- Hydro
- Natural gas
- Regional grid
- Unknown
- ▲ Diesel – commercial
- ▲ Natural gas – commercial



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# Zero Diesel Future: Transitioning Indigenous and Remote Communities to Clean Energy



## Context

<b>Remote Communities</b>	270
<b>Type of Community</b>	
Indigenous	167
Non-Indigenous	86
Commercial	17
<b>Electricity Generated by</b>	
Diesel/Fuel Oil	201
Regional Grid	25
Natural Gas	3
Hydro	35
None	6
<b>Accessibility</b>	
All Year Road	102
Fly-in	102
Other	66
<b>Total Population</b>	<b>188,828</b>

## Mandate Commitment

TRANSITION INDIGENOUS COMMUNITIES FROM DIESEL TO RENEWABLE ENERGY BY

**2030**

## Delivering Early Results



### Communities with Projects

- Indigenous Communities
- Non-Indigenous Communities

*70% of projects are Indigenous owned/led.*

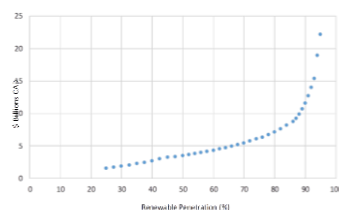
Results:  
**31M** litres of diesel reduced

**680M** LITRES OF DIESEL ARE USED ANNUALLY IN CANADA

## Changing Landscape

- **More renewables:** significant growth in last 5 years
- **Technology evolving:** more efficient, cheaper
- **Community-ownership:** strong demand, aligns with reconciliation agenda
- **PT Policies:** key to meeting climate goals

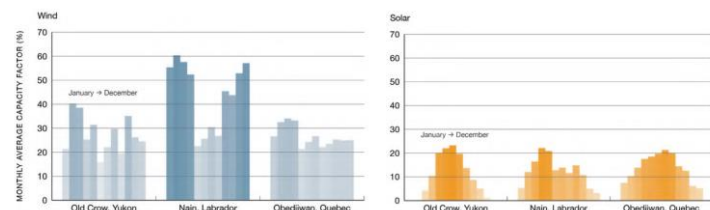
## Pathway to 2030 Renewables



**Cost Curve: Meeting 2030 Target (Wind/Solar + Battery)**

- 30% reduction = \$1.5B-2B
- 60% reduction = ~\$4.3B
- 90% reduction = ~\$11.5B
- 95% reduction = ~\$22B

## Wind/Solar Penetration Potential: 3 Examples





# Strengthened Climate Plan: A STREAMLINED APPROACH TO TRANSITIONING INDIGENOUS AND REMOTE COMMUNITIES TO CLEAN ENERGY

**CONTEXT:** 292 remote communities and industrial sites across Canada are not connected to North America's power grid. Almost 200 are communities that rely completely on diesel for heat and power. The majority are Indigenous. Combined, those communities consume over 680 million litres of diesel per year.

**OVERVIEW:** \$300M over 6 years (2021-2027) to support the transition of **Indigenous and remote communities** from diesel and fossil fuel to **renewable, efficient energy systems** accessed through a **single-window** funding program with support from across federal departments

- Establish the Indigenous and Remote Communities Clean Energy Hub to deliver **\$300M** plus additional funding:
  - **\$25M** for the Yukon Climate Change Priorities (2021-22)
  - +** ➤ **\$36M** for the Strategic Partnerships Initiative Program (2021-24)
  - **\$40.4M** for planning & feasibility of Northern hydroelectricity/grid interconnection projects (2021-24)

## Building on Progress for a Healthy Environment and a Healthy Economy



### Renewable, efficient energy to meet Canada's 2030 Target

- ✓ NRCan's CERRC/IODI and CIRNAC's Northern REACHE programs are currently supporting projects in 160 communities
- ✓ Expected diesel reduction of 31M litres annually
- ✓ ~100 kilotonnes (kt) of avoided CO<sub>2e</sub> annually

### INDIGENOUS CLIMATE LEADERSHIP

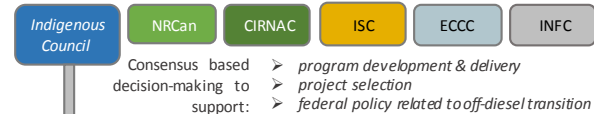
### Canada's Partnership with Indigenous peoples

- ✓ Projects in every jurisdiction with remote Indigenous communities
- ✓ Over 70% of current project are Indigenous-led
- ✓ Over 90% are located in Indigenous communities

## What: HUB FUNCTIONAL AREAS

1. **Reconciliation:** Advancing Indigenous Climate Leadership by Partnering and Meaningfully Engaging with Indigenous peoples
2. **Policy:** Establishing a National Focal Point on Indigenous Clean Energy Policy
3. **Funding:** Providing Single Window Project Funding and Full Cycle Support

## How: Governing Board and Indigenous Council



### INDIGENOUS COUNCIL

The *Indigenous Council* is a crucial mechanism for including First Nations, Inuit, and Métis perspectives in **decision-making processes within the Hub**. Their expert advice will support the Hub in advancing Indigenous Climate Leadership.

## Why: ANTICIPATED RESULTS

Additional progress expected from new funding based on current expected results from NRCan (CERRC and IODI) and CIRNAC (Northern REACHE):

### ENVIRONMENTAL

- 35M Litres of diesel or 115 kt GHGs avoided annually by 2030
- 38.9 MW new renewable energy generation and heating capacity
- > 100 GWh annual power production from new renewable energy systems
- GHG avoided/\$ invested is modest due to high project costs in remote context compared to rest of Canada
- Additional benefits include reduction of spills and of air pollutants

### SOCIAL

- Indigenous leadership and ownership of clean energy projects
- Enabling Indigenous leadership and rights-holders to continue to develop and demonstrate clean energy and climate leadership

### ECONOMIC

- ~8800 new job years by 2027
- ~175 new projects funded
- Revenue generation and savings from energy efficiency

## MILESTONES



\* Emissions reductions depend on numerous factors and inter-related programs/regulations, and anticipated results approved to date may vary over time from initial sector modelling.

# Clean Energy for Rural and Remote Communities (CERRC)

- \$220M over 8 years (2018-2026) for bioheat, renewable energy demonstration and deployment, and capacity-building projects
  - All funding provisionally allocated
  - 37 announced renewable and bioheat projects
- <https://www.nrcan.gc.ca/reducingdiesel/clean-energy-for-rural-and-remote-communities-funded-projects/22524>

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# For more information...



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