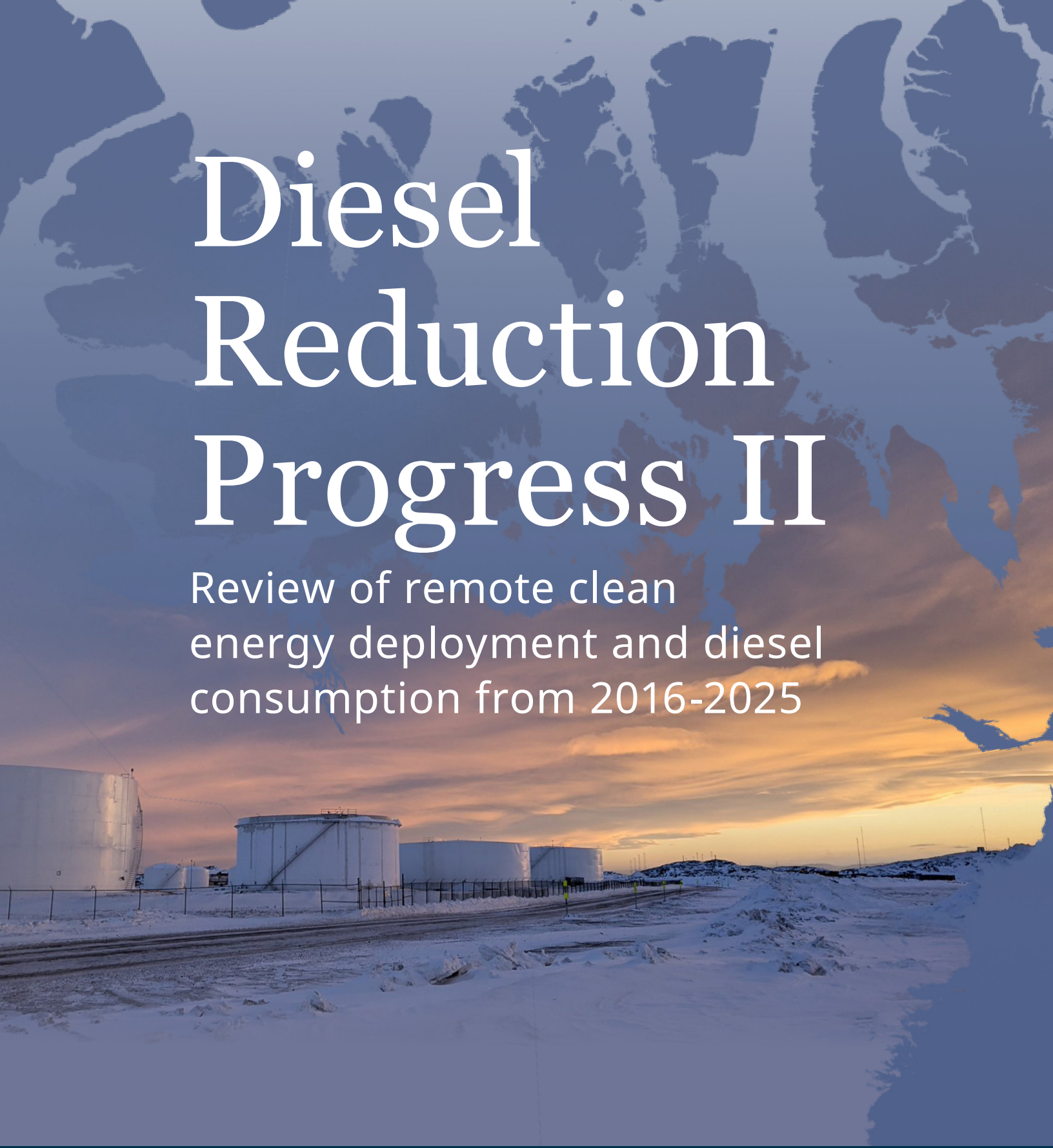
Diesel Reduction Progress II

Review of remote clean energy deployment and diesel consumption from 2016-2025



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PEMBINA Institute

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The Pembina Institute recognizes that the work we steward and those we serve span the lands of many Indigenous Peoples. We respectfully acknowledge that our organization is headquartered in the traditional territories of Treaty 7, comprising the Blackfoot Confederacy (Siksika, Piikani and Kainai Nations); the Stoney Nakoda Nations (Goodstoney, Chiniki and Bearspaw First Nations); and the Tsuut'ina Nation. These lands are also home to the Otipemisiwak Métis Government (Districts 5 and 6).

These acknowledgements are part of the start of a journey of several generations. We share them in the spirit of truth, justice and reconciliation, and to contribute to a more equitable and inclusive future for all.

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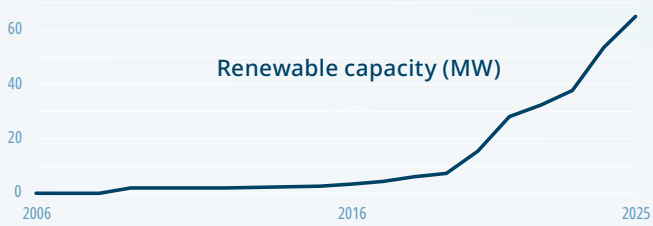
Executive summary

The clean energy transition in remote communities in Canada has accelerated remarkably between 2016 and 2025. The transition has been led by local Indigenous leaders, many of whom have been advocating for and working towards displacing diesel with clean energy for decades. These efforts have begun to pay off as federal, provincial, and territorial funding and policy reforms have opened the door to community-led projects.

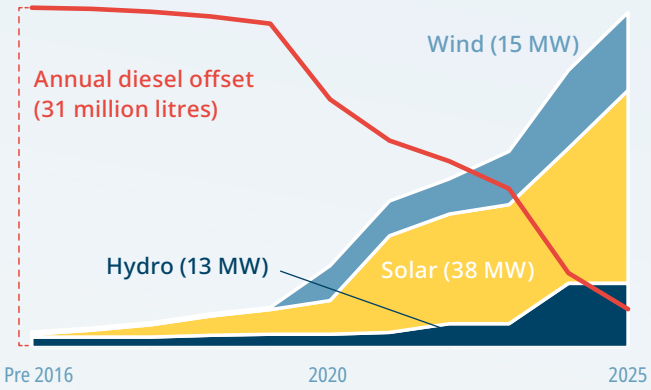


Remote community renewable energy growth

- Clean electricity projects in remote communities grew **20 times faster** between 2016 and 2025 than the previous decade, with most of this progress (about **92%**) occurring between 2020 and 2025.
- **72%** of the community-scale renewable energy projects operating in remote communities are **wholly or majority Indigenous owned**.

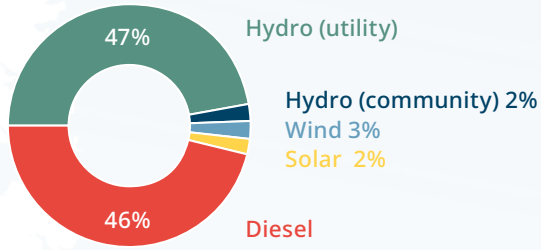
Ownership of remote community clean energy capacity

- These projects have displaced over **142 million litres** of diesel since 2016, which is more than the annual diesel consumption for electricity generation of all three territories combined.



Remote community renewable energy capacity deployment by year and technology, plus associated diesel reduction (callout values are for 2025)

- Altogether, remote communities have added more than **65 megawatts (MW)** of clean electricity capacity over the past decade, and now produce over **126 gigawatt–hours (GWh)** of clean energy annually, with 35% from wind, 33% from hydro, and 30% from solar.
- Remote renewable electricity generating projects have reduced annual diesel consumption by more than **31 million litres**, and now account for **7%** of total electricity supply in remote communities.



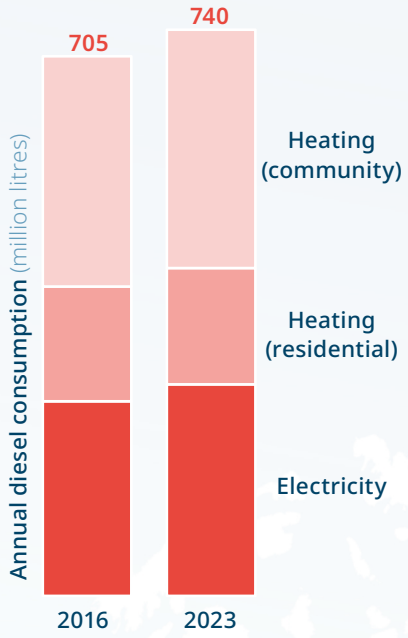
Remote community electricity generation by source

- Grid connection projects have also substantially reduced diesel use for electricity, with recent grid connections in Quebec and Ontario reducing diesel consumption by nearly **22 million litres** annually.
- Significant progress has been made in reducing heating oil consumption; a total of **48 MW** of bioheat projects have displaced roughly **11 million litres** of heating oil per year.

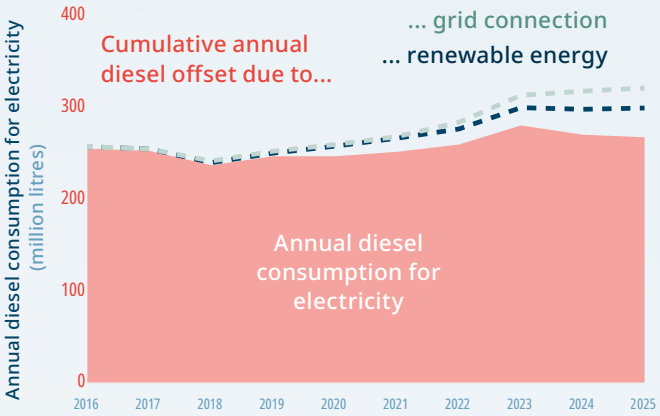
There is still much more work to be done to reduce diesel consumption in remote communities.

Despite the savings resulting from clean energy deployment, fossil fuel use for electricity and heating is still increasing, driven by increased demand and growing communities, especially in the territories.

- Annual diesel and heating oil consumption for electricity and heating has increased by **36 million litres** since 2016 (from 705 million litres per year to over 740 million litres per year).
- **46%** of electricity generation in remote communities comes from fossil fuels (diesel, natural gas, and heavy fuel oil), and **83%** of heating is provided by fossil fuels (heating oil, propane).



Growth of fossil fuel consumption for heating and electricity



Impact of diesel-reducing projects on remote community diesel consumption for electricity

As remote communities grow, the need for clean, reliable, and affordable energy will only increase. Maintaining momentum on clean energy development amid rising demand is essential.

- If the current queue of projects planned for remote communities is completed, an additional **90 million litres** of diesel per year could be displaced.

Many of the federal programs that have enabled recent progress have yet to be renewed or recapitalized, despite the clear demand for further diesel reduction and modern, reliable energy infrastructure. Continued progress in reducing diesel use and deploying clean energy will require coordinated federal, territorial, and provincial policies and sustained funding for diesel reduction, capacity building, and knowledge sharing.

As the federal government looks to strengthen Canada through reinforcing Arctic sovereignty and investing in Northern infrastructure, policies and funding that empower local and Indigenous leaders to advance community-led energy are the surest ways to resilient, energy-secure, thriving remote communities.

Introduction

While most Canadians enjoy a low-carbon, reliable, and affordable energy supply, remote communities, which are predominantly Indigenous, are still highly dependent on expensive imported fossil fuels for both heat and electricity.

Even with significant diesel subsidies in place, remote communities continue to pay 6–10 times more for energy than the rest of Canada.[1] Powering entire communities with diesel generators also has other negative health, environmental, and economic impacts, such as noise and air pollution, an ever-present risk of catastrophic spills or leaks, and constrained power availability, limiting community growth and opportunity.[2]

This report presents Canada's most up-to-date and comprehensive review of diesel consumption and renewable energy deployment in remote communities. It tells a vital story about the transformative potential of targeted policy alongside local and Indigenous leadership.

Complementing our recent policy analysis in *Restoring the Flow*, we showcase in this report how a decade of action has led to tangible progress on shared climate, reconciliation, and infrastructure priorities.[3] But the work is far from complete.

As the climate changes and northern communities' populations grow, more action is needed to maintain momentum and ensure that remote energy systems can meet rising demand. This will require ongoing efforts to reduce diesel and diversify the energy supply with abundant, local renewable energy.

Diversifying energy supply contributes substantially to a number of government and community priorities, such as Arctic sovereignty, energy security, community well-being, and infrastructure improvements. Integrating renewable energy also spurs the sorely needed modernization of remote electricity grids, strengthening grid resiliency, creating new opportunities for community growth, and enabling commercial and industrial ventures.

Energy infrastructure in remote communities is under enormous and intensifying pressure. Climate change is affecting supply chains, at times dramatically driving up the cost of diesel fuel; hard winters coupled with growing demand are stressing local and regional grids; and many existing diesel generators are at or nearing the end of their life.[4]

Together, these challenges put remote energy systems at the centre of a perfect storm: intensifying weather, deteriorating infrastructure, rising costs, and surging demand. Responding requires policies that advance local generation, capacity building, energy efficiency, and microgrid modernization.

Federal, provincial, and territorial programs have begun to deliver these solutions — building local capacity, funding clean energy projects, and allowing community leaders to develop major diesel-reducing projects and facilitate local energy planning.

These programs and community leadership have yielded the most significant energy transition for remote communities since the introduction of diesel generators in the mid-twentieth century. The key challenge now is to keep this progress going.

Remote communities in Canada

A remote community is a non-commercial settlement with year-round residents that has an isolated microgrid with community-wide generation.

This means that it is not connected to the North American electrical grid and does not exist solely to service a private residence, business, or a resource project such as a mine.

There are 210 remote communities in Canada (Figure 1), almost two-thirds of which are formally associated with an Indigenous government, either First Nations (91) or Inuit (50).

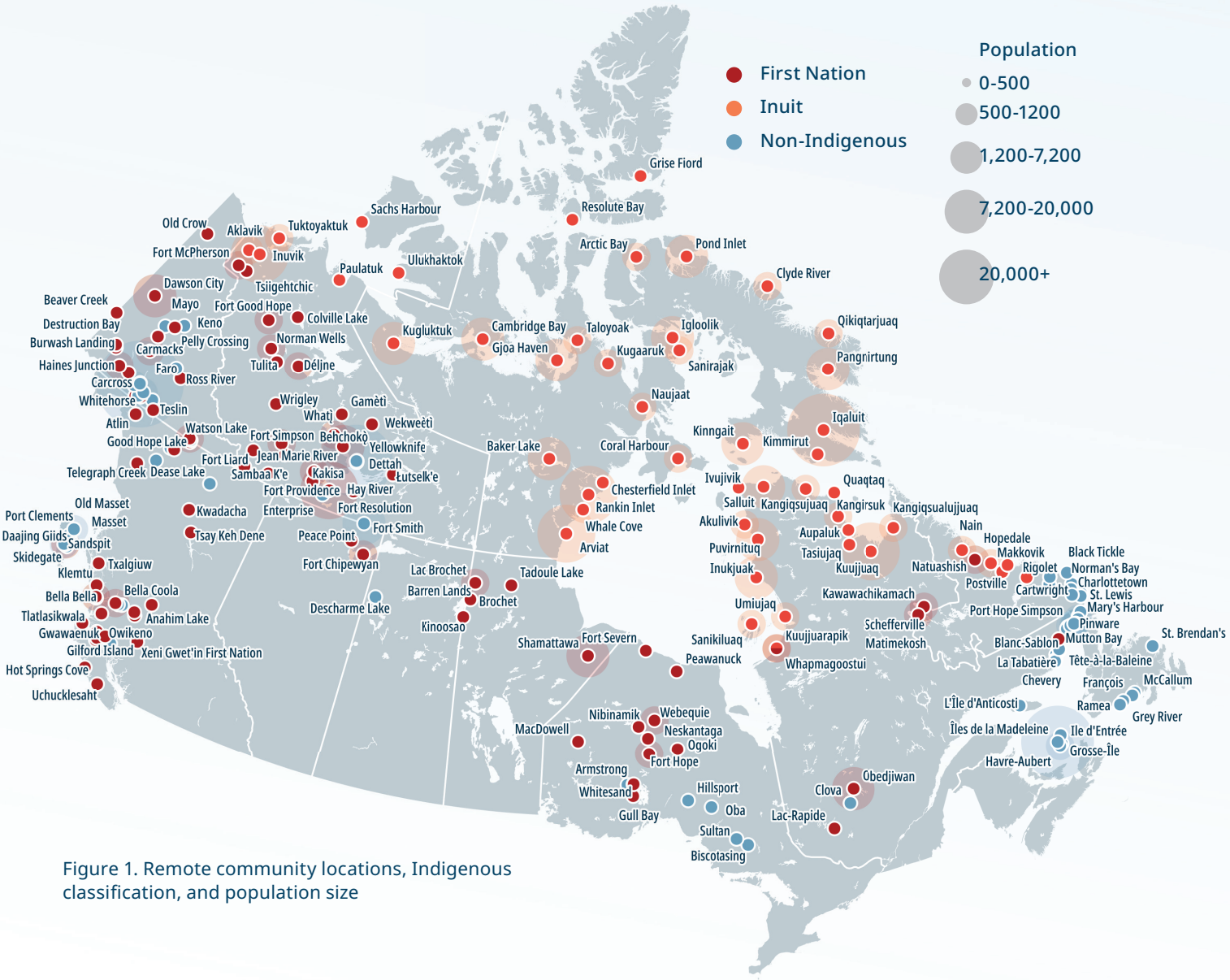


Figure 1. Remote community locations, Indigenous classification, and population size

Primary energy sources and supply access

Around three-quarters of remote communities in Canada (147) use diesel as their primary energy source for electricity generation (Figure 2).

Two communities in the Northwest Territories — Inuvik and Norman Wells — use locally produced natural gas in addition to diesel, and the Magdalen Islands in Quebec use heavy fuel oil instead of diesel in their generators. Since the energy density of these fuels is very similar to that of diesel, this report refers to them all as diesel.

The remaining 63 remote communities are hydro-powered, with diesel generators as backup.

Many of these communities are connected to remote regional grids, notably the Yukon main grid, the Snare and Taltson grids in the Northwest Territories, and the Lac Robertson grid in eastern Quebec and southern Labrador. In the past two decades, 30 formerly remote communities have been connected to the North American electrical grid.

Fuel supply access significantly impacts energy security and affordability as diesel, propane, and heating oil must be transported across vast distances within narrow seasonal windows due to sea ice, storms, or ice roads. Several communities are only accessible by plane year-round. Climate change and geopolitical impacts on the fuel supply chain are dramatically driving up fuel costs in some remote communities.[5]

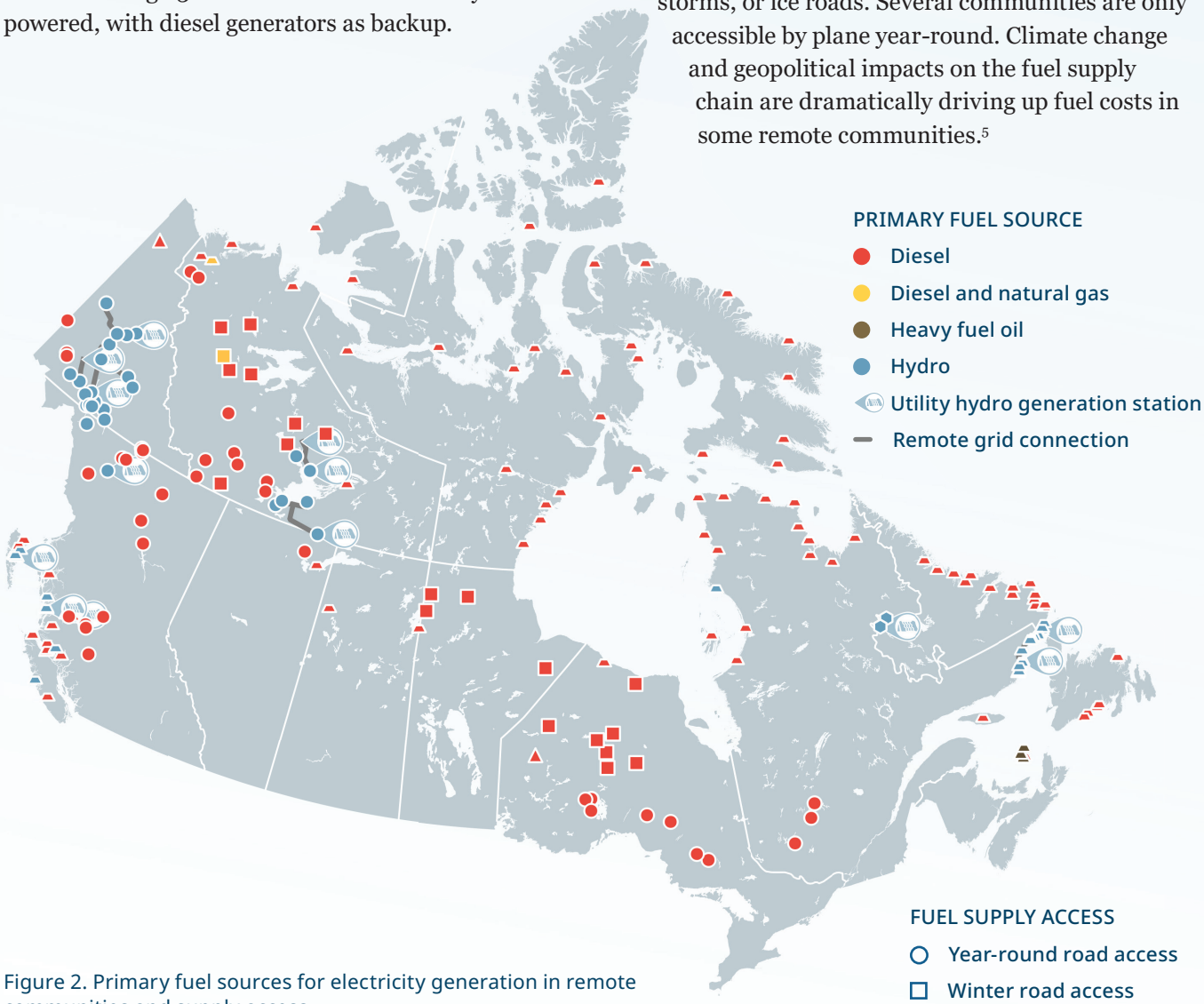


Figure 2. Primary fuel sources for electricity generation in remote communities and supply access

Also shown are major multi-community remote grids, and remote utility hydro generation stations (including independent power producers operating such stations that are not community owned).

Electricity generation and renewables

Utility hydro systems provided 47% of the total electricity for remote communities in 2023 and diesel provided another 46% (Figure 3).[6] The remaining 7% was supplied by other renewable energy systems, which are overwhelmingly Indigenous owned, led and championed, and over 90% of which were commissioned since 2020.

In the past decade, renewable energy systems have been widely deployed across remote communities to reduce diesel use and provide secure, affordable power and other community benefits on remote microgrids.

Between 2016 and 2026, 65 MW of renewable capacity have been installed, supplied by 33 community-scale solar projects, seven hydro projects, and four wind projects (Figure 4), as well as hundreds of net metering projects.

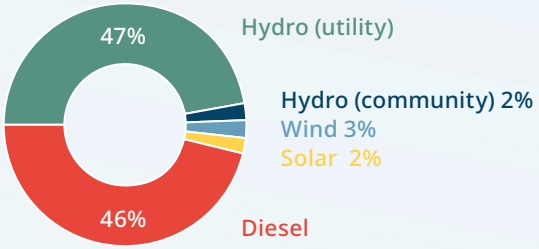


Figure 3. Remote community electricity generation by source

Nine projects use grid-scale batteries to maximize diesel reduction and improve grid stability. Collectively, these projects produce over 126 GWh of clean energy annually, with 35% from wind, 33% from hydro, and 30% from solar.

Combined, they have reduced annual diesel consumption by over 29 million litres and displaced over 142 million litres of diesel since 2016.

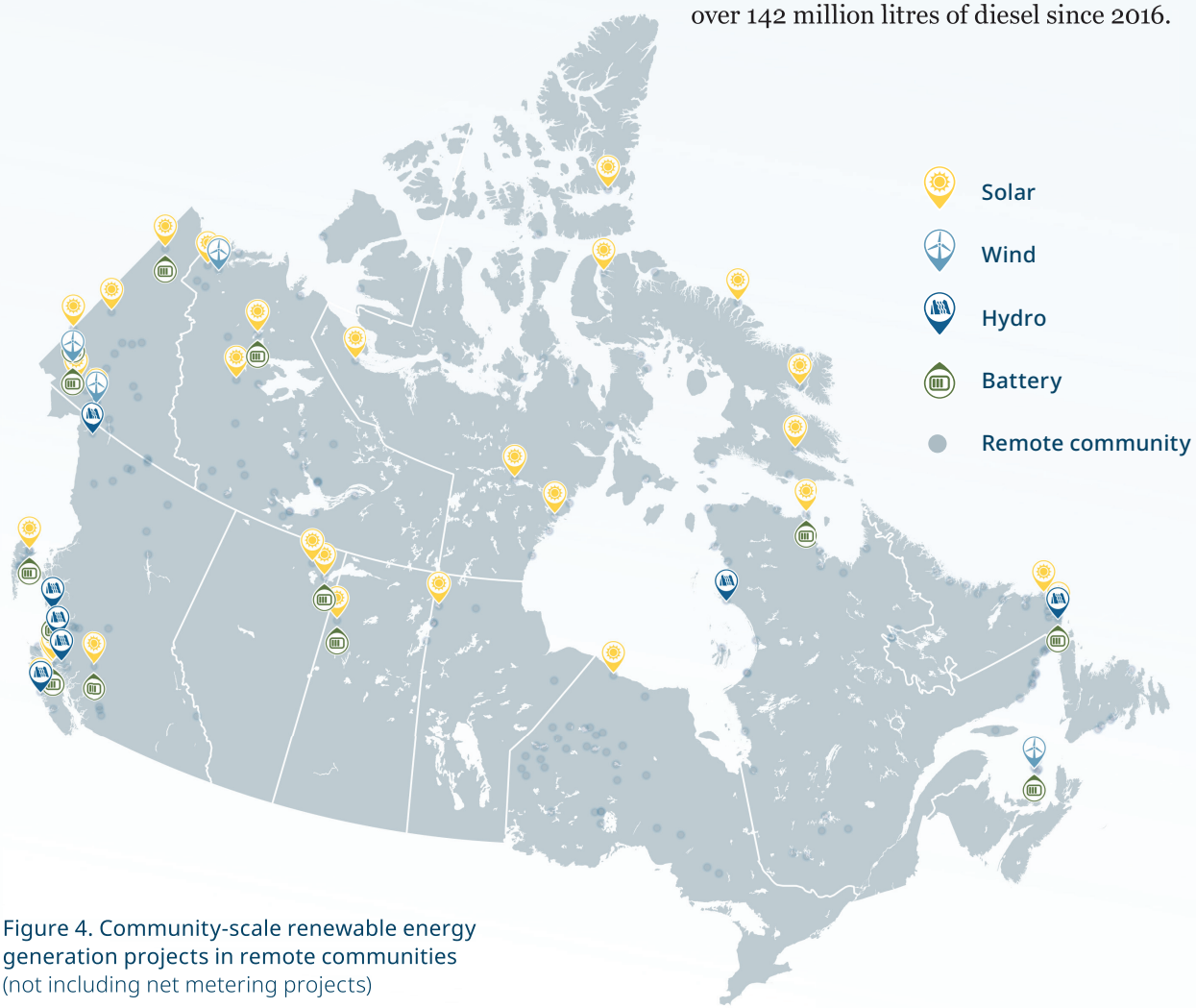


Figure 4. Community-scale renewable energy generation projects in remote communities
(not including net metering projects)

The renewable energy transition

This buildout of clean energy projects in remote communities is unprecedented in scope and scale. Clean electricity projects in remote communities grew 20 times faster between 2016 and 2025 than the previous decade, with most of this progress (about 92%) occurring between 2020 and 2025 (Figure 5 and Figure 6).

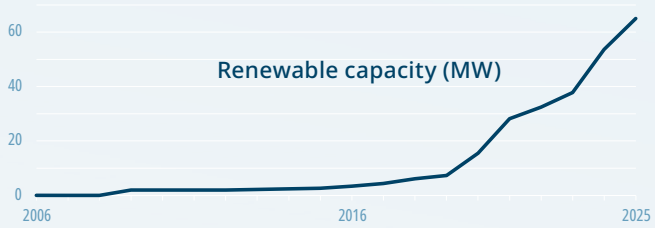


Figure 5. Remote community renewable energy growth

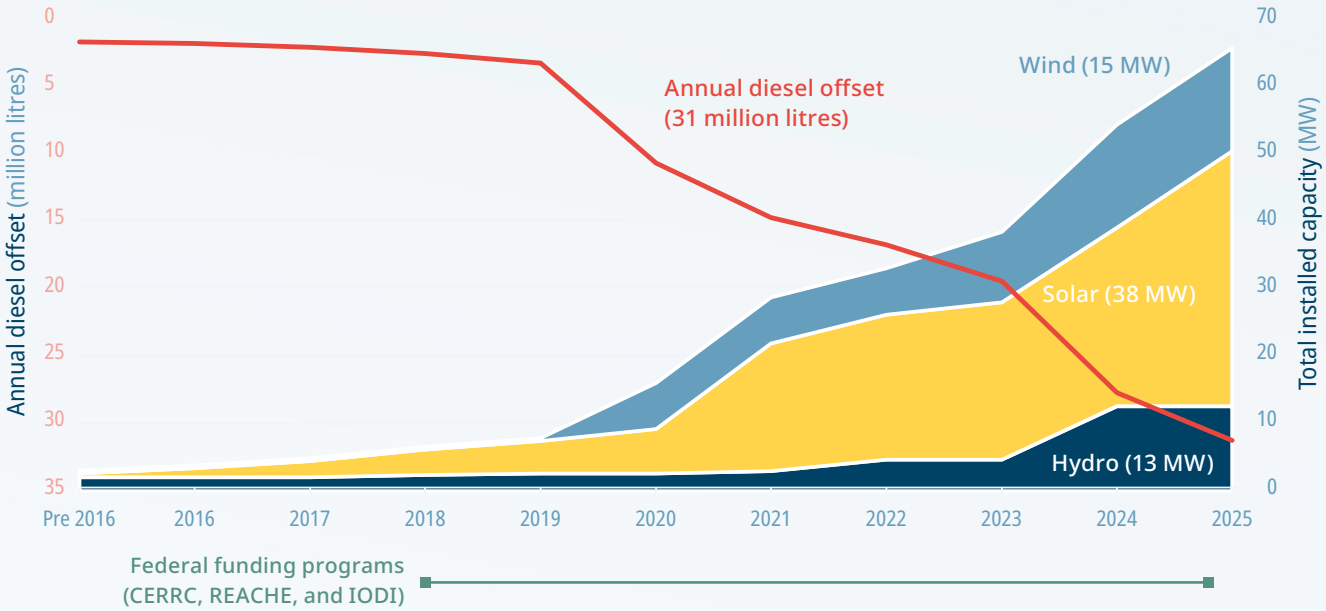


Figure 6. Remote community renewable energy capacity deployment by year and technology, plus associated diesel reduction (callout values are for 2025)

Three-quarters (49 MW) of the new renewable capacity has come from community or IPP projects, 76% of which are wholly or majority Indigenous owned. Another 30% (13 MW) came from net metering projects, and utility-led projects contributed 6% (4 MW) (Figure 7).

Figure 7. Ownership of remote community clean energy capacity

The rapid expansion of diesel-reducing projects between 2016 and 2026 has been buoyed by strong federal programs to support Indigenous-led clean energy under the Wah-ila-toos initiative, including the Northern Responsible Energy Approach for Community Heat and Energy (REACHE) program and the Clean Energy for Rural and Remote Communities (CERRC) program, offered by CIRNAC and NRCan respectively. Both programs started in 2018 and have provided critical funding to hundreds of projects.

These programs have been complemented by capacity-building programs such as the Indigenous Off-Diesel Initiative (IODI), which started in 2019 with the explicit purpose to train community energy champions to advance diesel reduction, connect them with funding for project development, and support community energy planning.[7]

Grid connection

Projects to connect remote communities to the North American electrical grid are a significant driver in reducing diesel consumption for electricity.

Over the past two decades, 27 formerly off-grid communities have been connected to provincial electricity systems: five in B.C., 17 in Ontario, and five in Quebec (Figure 8). The communities in Ontario were connected as part of the Wataynikaneyap Power transmission line, an Indigenous-led project that is majority owned by a coalition of 24 Ontario First Nations.

Since 2016, these grid connections have displaced nearly 22 million litres of diesel annually (Figure 9).

Transmission projects to service remote communities are often ambitious and costly, but they allow utilities to relegate diesel generators to backup status and provide primary power to these communities from Canada's electricity grid.

Figure 8. Formerly remote communities connected to the North American electrical grid 2006-2026
Includes the transmission route for the Indigenous majority-owned Wataynikaneyap Power project in Ontario

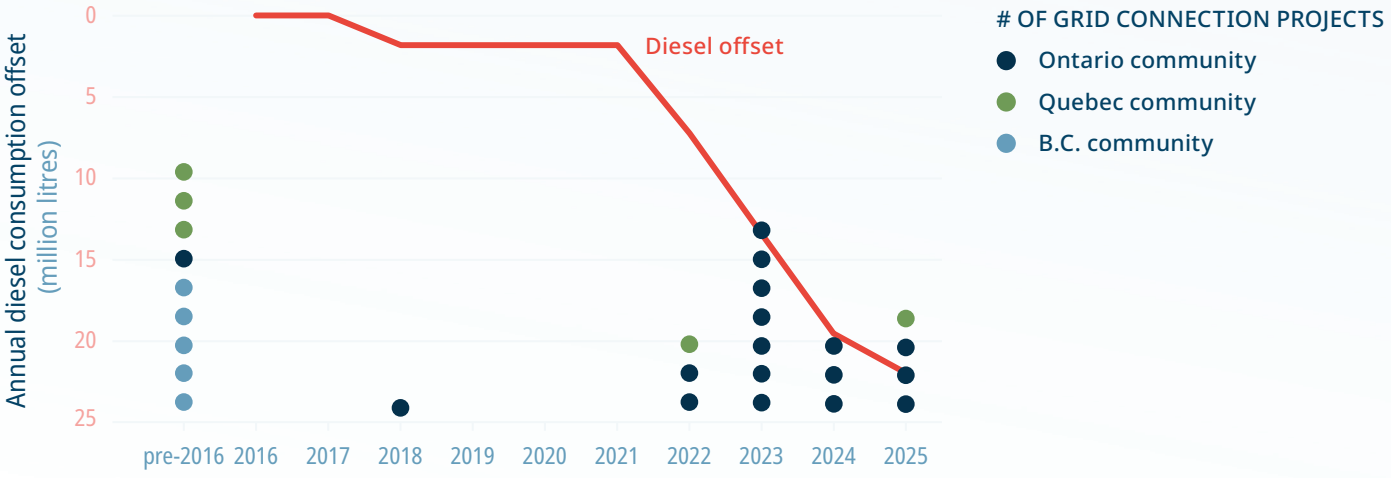


Figure 9. Timeline of grid connection projects and associated diesel offset

Heating in remote communities

Electricity consumption only makes up a little over one-third of total energy use in remote communities. The lion's share of fossil fuel consumption comes from heating residential and community buildings (Figure 10).

Heating is largely provided by heating oil, which is very similar to diesel but is burned in furnaces located in each building, while diesel used to generate electricity is burned in a centralized generation station.

Several communities in the Northwest Territories and Nunavut have district heating systems, which can be significantly more efficient than individual building heating systems.

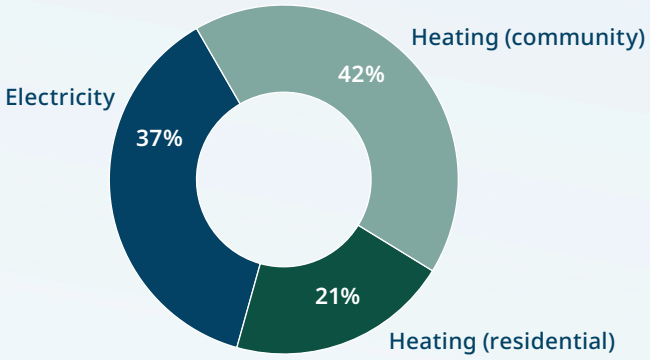


Figure 10. Overall fossil fuel consumption split for heating and electricity

Firewood and propane are also commonly used for heating. Certain communities, especially those powered by hydro systems, use electric space heating, including heat pumps that are much more efficient than baseboards or other electric heating technologies.

Biomass boilers, usually fed by woodchips, are playing a growing role in providing heating for communities, especially in the Northwest Territories. There are now over 48 MW of biomass projects deployed in remote communities, offsetting an estimated 11 million litres of heating oil per year.

Energy efficiency programs that support building retrofits to improve insulation also play a significant role in reducing diesel, but their impact is hard to measure due to limited data. According to the Arctic Energy Alliance, energy efficiency programs in the Northwest Territories alone have reduced heating oil consumption by over 3 million litres annually.[8]

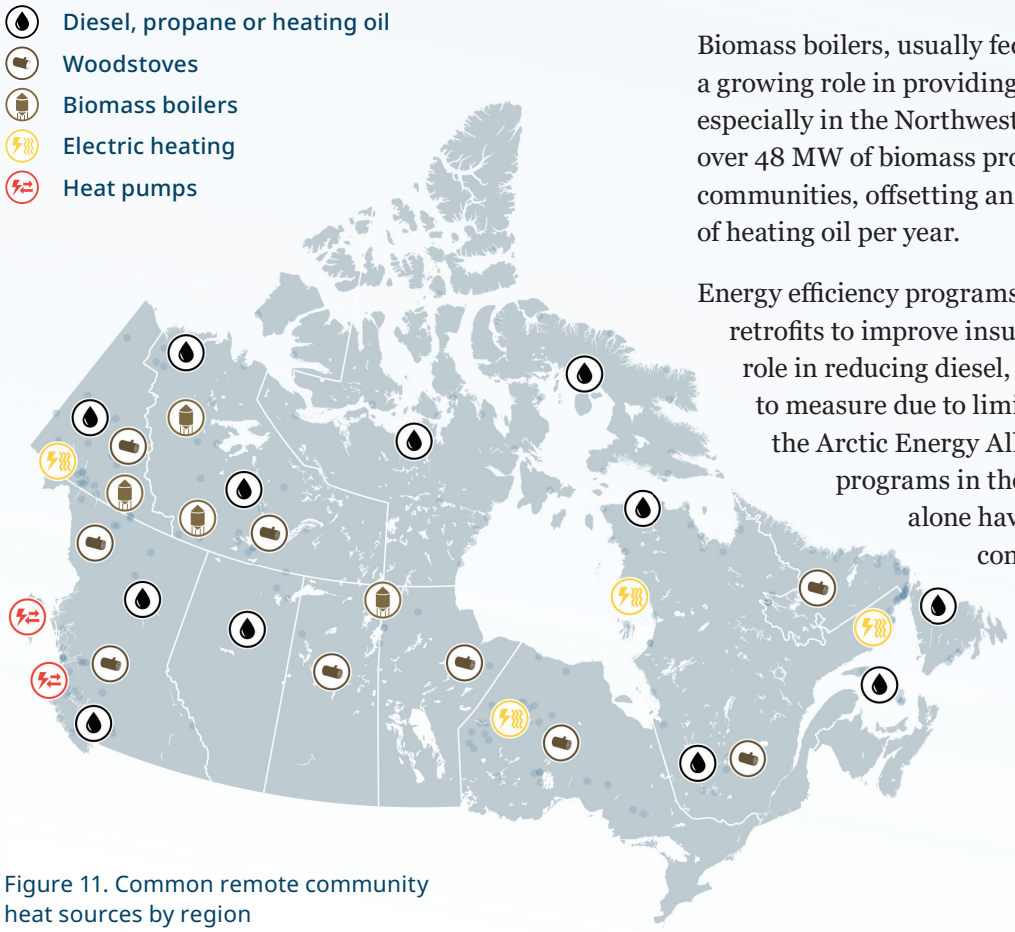


Figure 11. Common remote community heat sources by region

Trends in diesel consumption

Using the best available data, we modelled fossil fuel use for heat and electricity to estimate total annual diesel consumption in remote communities in 2016 and 2023.[9]

In 2023, diesel used for heat and electricity exceeded 740 million litres, up from 705 million litres in 2016 (Figure 12).[10]

Even with renewable energy projects displacing over 31 million litres of diesel and grid connections offsetting around another 22 million litres annually, fossil fuel consumption (diesel, propane, natural gas, heating oil, and heavy fuel oil) in remote communities is still increasing.

There are some regional factors for increased diesel consumption, such as the years-long outage at the Talston Hydro station due to necessary maintenance.[11] Largely, however, this rising consumption is due to an increase in remote community energy use.

This reflects broader national trends of increasing energy use, but is further driven by population growth, especially in the territories where remote population sizes have steadily grown since 2011 (Figure 13).

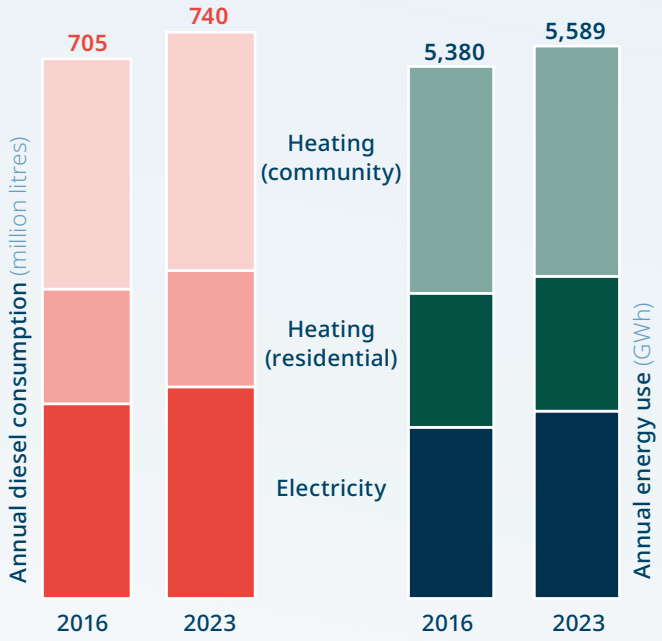


Figure 12. Comparison of fossil fuel consumption and energy use for heating and electricity in 2016 and 2023

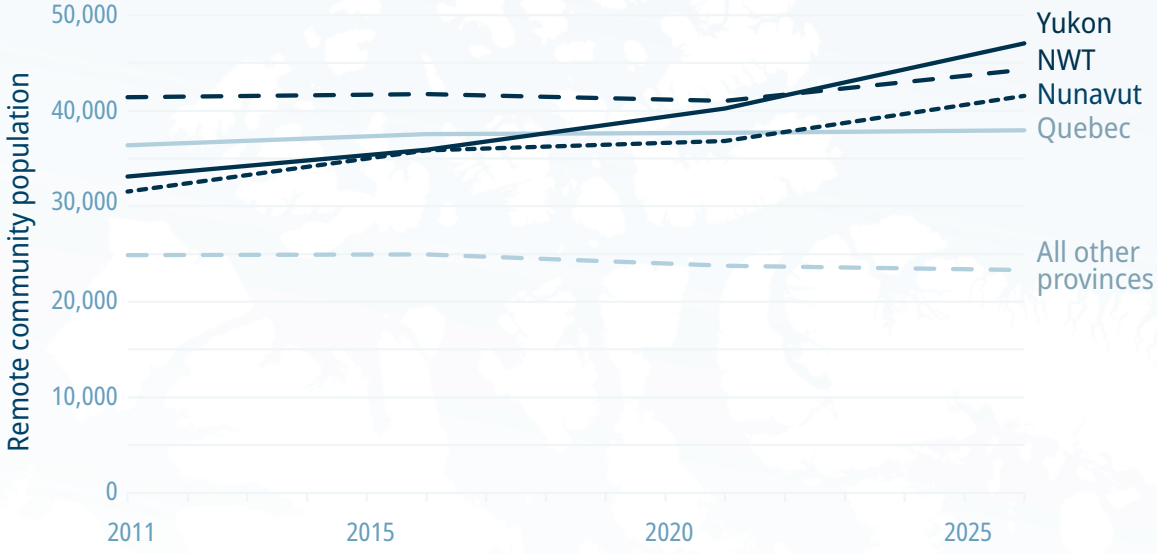


Figure 13. Change in population in remote communities

Diesel consumption in context

Despite increasing diesel consumption, substantial progress has been made in decarbonizing electricity production for remote communities.

Between 2016 and 2023, while annual electricity use grew by 14% (164 GWh), annual diesel use increased by only 6% (22 million litres) (Figure 14).

New grid connections and renewable energy projects have reduced annual diesel consumption for electricity by nearly 21%.

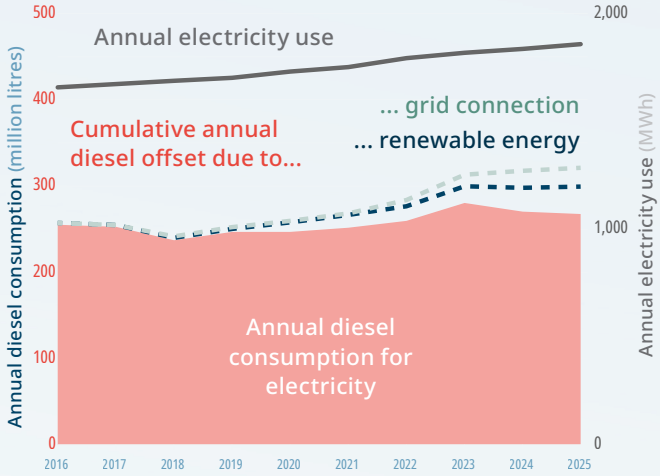


Figure 14. Impact of diesel reducing projects on remote community consumption for electricity

Diesel consumption is modelled after 2023 to account for projects completed in that period.

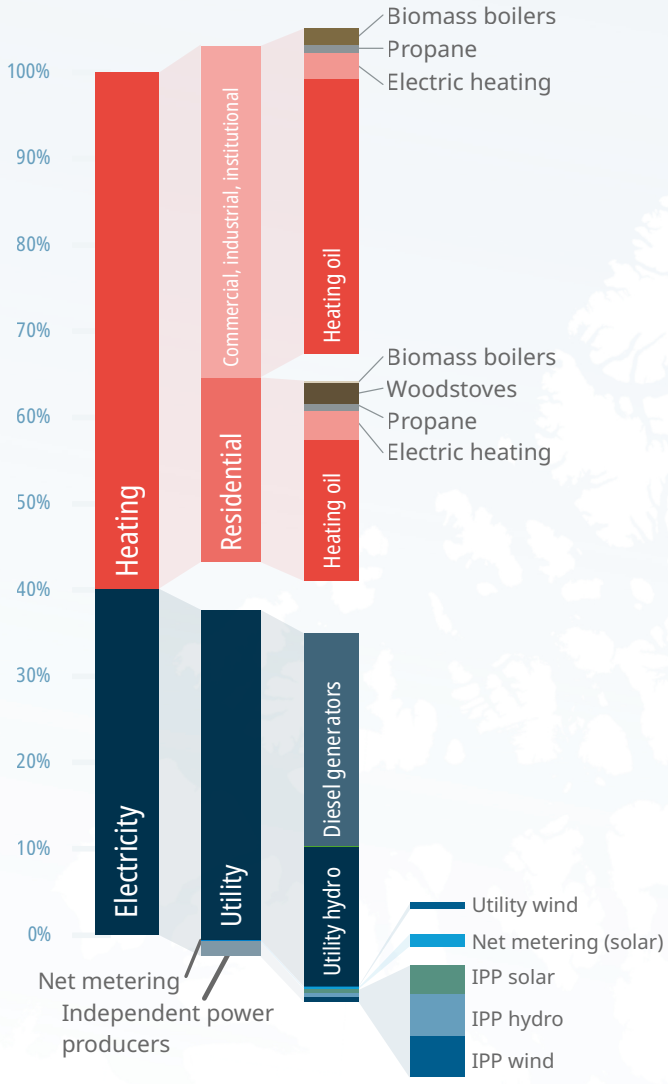


Figure 15. Energy supply sources for heat and electricity in remote communities

Electricity generation only accounts for about 37% of fossil fuel use in remote communities.

Heating accounts for the other 63% (Figure 15), and is heavily reliant on fossil fuels, with 80% of remote community heat supplied from heating oil and propane.

Decarbonizing heating in remote communities is difficult, since switching to electric heat requires abundant clean electricity supply on each microgrid.

As more communities move to renewables-powered microgrids, high-efficiency electric technologies, such as heat pumps, will be able to meet a growing share of heating demand.

In the meantime, focusing on reducing overall heat demand through energy efficiency improvements and district heating systems offers the most benefit to communities and the environment.

Planning for growth

Populations in the North (Yukon, Northwest Territories, Nunavut, and northern Quebec) are expected to continue to grow.

Using data from Statistics Canada, our forecasts (Figure 16) show the total remote community population will exceed 210,000 by 2045 under a medium-growth scenario and 230,000 under a high-growth scenario, up from 161,000 in 2006. As the federal government ramps up its focus on Arctic security and resource development, higher growth scenarios are probable.

As northern and remote communities grow, investing in modernizing their energy systems to integrate clean and abundant energy is essential. Projects completed thus far have generated significant momentum in decreasing diesel use, and planned projects could build on this momentum (Figure 17).

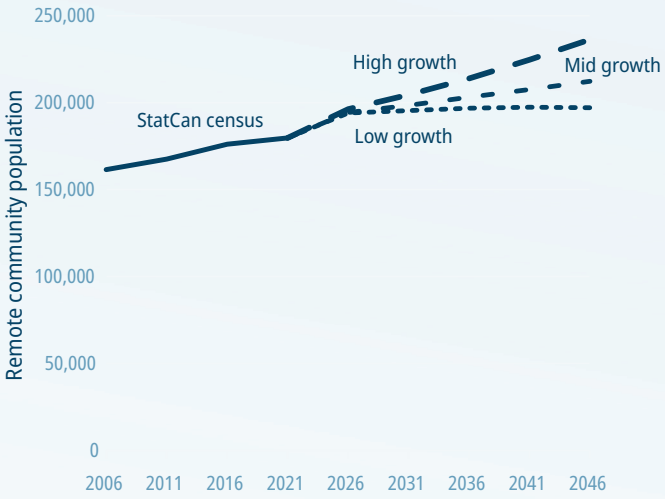


Figure 16. Projected population growth for remote communities

Planned projects include many community-scale renewable projects, as well as major projects such as the Kivalliq Hydro-Fibre Link, the Iqaluit hydro plant, and the Yukon–B.C. grid intertie, the latter two of which were refered to the federal Major Projects Office.

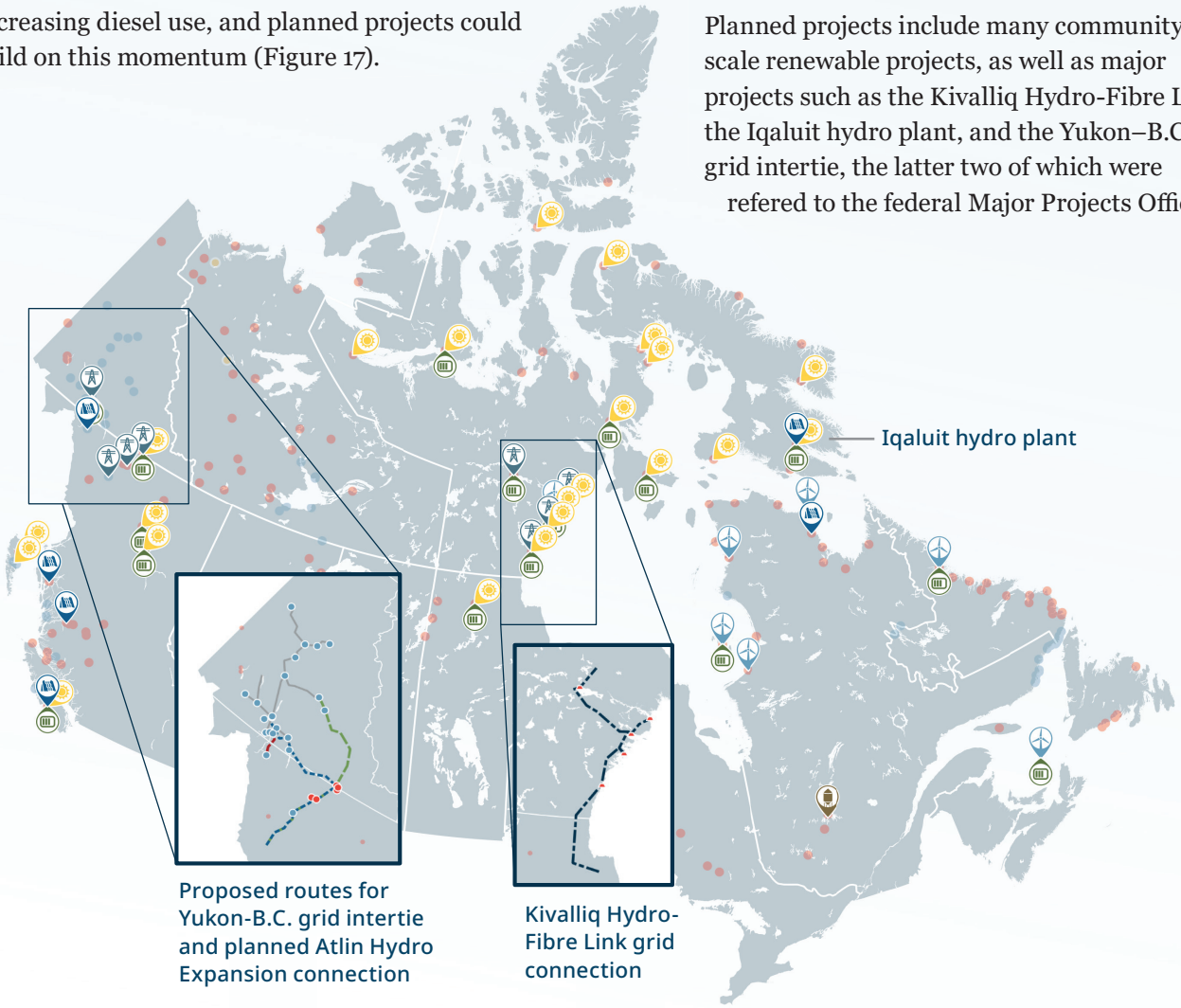


Figure 17. Planned* diesel reducing/renewable energy projects for remote communities
* Planned projects have or are undergoing significant development work and have a significant chance of being fully executed.

If all currently planned generation and grid projects come to fruition, reducing annual diesel use for electricity generation by 90 million litres, overall diesel demand would still be above 180 million litres per year (Figure 18).

The viability of many of these projects depends on continued federal support through grants, guaranteed financing, remote microgrid investments and upgrades, and priority permitting.

Their realization promises significant reductions in diesel use, along with a host of other co-benefits, including greater energy security, enhanced economic development, and healthier communities.

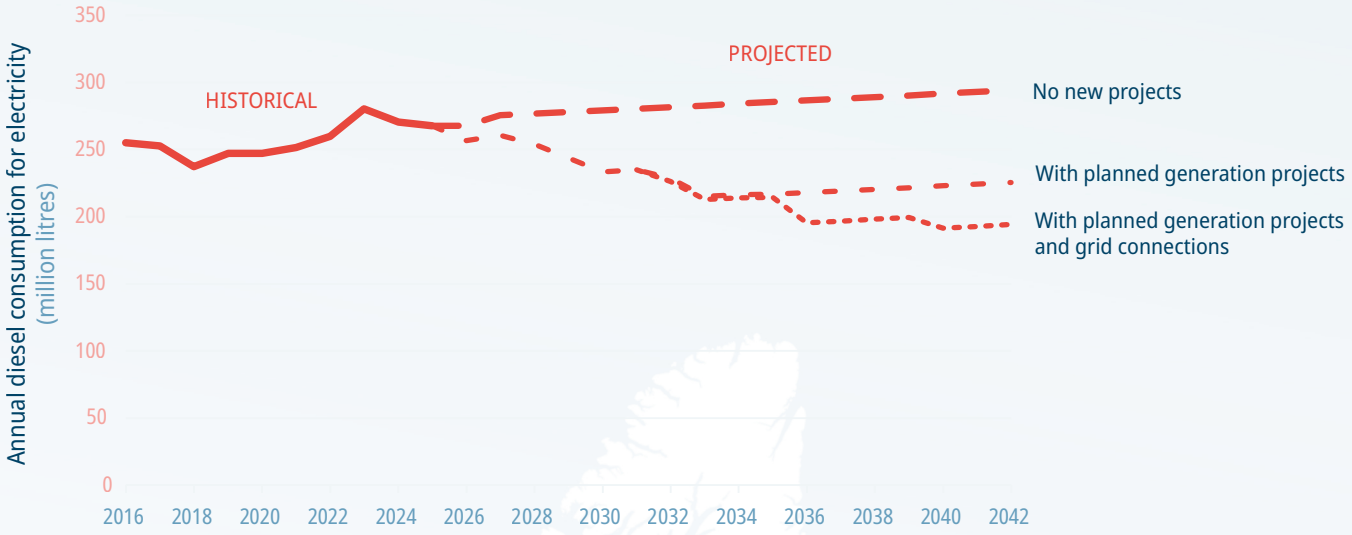


Figure 18. Expected annual diesel reduction impact of planned projects

Anuriqjuak Nukkiksautiit wind project in Nunavut

Key trends and observations

The clean energy transition has significantly advanced in the past decade

The data is clear: the clean energy transition is accelerating for remote communities. Successful clean energy initiatives are being designed and implemented by local and Indigenous leaders with the support of effective and innovative policy and funding from federal, provincial, and territorial governments.

Clean energy deployment in the decade from 2016 to 2025 outpaced the previous decade by 2,000%, with most of that growth (92%) taking place from 2020 to 2025. Solar projects have contributed the most in terms of installed capacity, but wind and hydro projects produce more energy and have offset roughly the same amount of diesel as solar. New grid connections have also played a significant role in displacing diesel and supplying communities with clean, abundant energy. This represents remarkable progress and shows the impact of tailored policy and funding to support local energy leadership.

Indigenous communities are leading the transition to clean energy

The majority of the clean energy buildout over the past decade has been achieved through community-led energy projects, four out of five of which are either fully or majority-owned by community-based Indigenous governments and corporations. Building, operating, and managing these projects helps build community buy-in, supports local employment and training, and brings in revenue for the local community.

Indigenous communities are also driving change through policy and advocacy. Indigenous leaders have worked with provincial, territorial, and federal governments to assert their rights to energy security and sovereignty under the United Nations Declaration on the Rights of Indigenous Peoples, modern treaties, and governance agreements. This work has been a major catalyst for the rollout of tailored programs and funding to serve remote community energy priorities.

Iqualuit community solar project

Funding is a key enabler of project deployment

The progress highlighted in this report is a direct result of the funding, as well as other supports, offered through federal, territorial, and provincial climate, energy, and reconciliation programs.[12]

These programs have enhanced community knowledge and capacity, made remote community projects possible, and allowed utilities to offer fair prices for community-owned clean energy and make necessary investments in microgrid modernization. They have also advanced government priorities by fostering reconciliation, reducing emissions, promoting Arctic and Canadian sovereignty, and investing in infrastructure for healthy, thriving communities.

Population and demand growth are outpacing clean energy adoption

Remote communities are expanding, especially in the North, and they require more energy.

Continuing to reduce diesel while providing reliable and affordable energy calls for a diverse, resilient energy supply, including solar, hydro, wind, battery storage, and diesel. There is significant momentum in the remote clean energy industry to meet these demands, but continued progress depends on government support and on favourable economic conditions.

More focus on heat is urgently needed

Heating oil accounts for the lion's share of fossil fuels burned in remote communities. While biomass boilers, district heating, and energy-efficient building upgrades have displaced some heating oil, the extent of this displacement is uncertain given limited data. However, the existing data suggests that the scale of fossil fuel reductions from biomass heating and energy efficiency initiatives is small relative to diesel reduction activities on the electricity side.

Better data collection on heating fuel use, the benefits of energy efficiency programs, and the potential for expanded use of sustainable heating options (such as biomass or high-efficiency electric heat) are sorely needed to fully understand the benefits of switching from fossil-fuel-based heating.

Nevertheless, despite the data constraints, upgrading heating systems and improving energy efficiency offer clear benefits, including lower energy costs for residents and improvements in health, comfort, and overall quality of life. For instance, replacing oil or propane furnaces with electric heat pumps can reduce household expenses and emissions while enhancing indoor living conditions. However, increasing electric demand on diesel-powered microgrids, many of which are already at capacity, is not an effective solution in isolation.

One-week supply of bulk wood chips for the biomass boilers at Teslin, Yukon

Conclusion

Comprehensive, locally rooted approaches are needed for resilient, energy secure remote communities

Local leadership and government supports have been the foundation for successful diesel reduction projects in remote communities. A holistic approach to accelerating diesel reduction would include empowering local and Indigenous leadership, advancing integrated energy solutions, and coordinating policy reforms with sustained funding.

Local leadership and ownership are at the core of reducing diesel reliance. Over the past decade, local leaders, especially Indigenous leaders, have advanced the challenging work of community energy planning, home retrofits, sustainable heating, and renewable energy generation. An auxiliary benefit of local energy planning and community-led and -owned renewable projects is that they can inspire young residents to pursue an energy career and stay in their home community.

A holistic approach also calls for integrating electricity generation, heating, and energy efficiency. For example, the viability of an electricity project improves when it is designed at a sufficient scale to include high-efficiency electric heating. At the same time, retrofitting homes with better insulation reduces costs and fuel consumption while improving quality of life. Combined, these integrated measures deliver greater community benefits than standalone initiatives.

Coordinated policies and reliable funding are vital to enabling energy solutions in remote communities. When favourable policies backed by funding align across housing, energy, and infrastructure, they empower local leaders to pursue integrated projects that compound benefits to community resilience and energy security. Additionally, as the federal government looks to strengthen Canada through building Arctic sovereignty and investing in community infrastructure, such funded policies represent the surest way to resilient, energy-secure, thriving remote communities.

Three Nations Energy Solar, Fort Chipewyan, Alberta

Endnotes

1 Dave Lovekin, *Diesel Subsidies, Simplified, Part I* (Pembina Institute, 2021). https://www.pembina.org/pub/diesel-subsidies-simplified-part-i

2 Lynne Couves, "Diesel Dependency: the hidden cost of living in remote communities," *Pembina Institute,* March 20, 2025. https://www.pembina.org/blog/diesel-dependency-hidden-cost-living-remote-communities

3 Arthur Bledsoe, Emily He, and Rosa Brown, *Restoring the Flow* (Pembina Institute, 2025). https://www.pembina.org/pub/restoring-flow

4 Chris Windeyer, "5 things to know about the Senate's territorial energy report," *CBC News*, June 21, 2015. https://www.cbc.ca/news/canada/north/5-things-to-know-about-the-senate-s-territorial-energy-report-1.3121231

5 Ollie Williams, "Norman Wells reinstates local state of emergency," *Cabin Radio*, January 23, 2025. https://cabinradio.ca/219652/news/politics/norman-wells-reinstates-local-state-of-emergency/

6 In our data set, the utility hydro category includes hydro plants owned by independent power producers (IPPs) that sell power to the utility, if the IPP is not partially or majority community owned.

7 *Restoring the Flow.*

8 Arctic Energy Alliance, "Annual Reports." https://aea.nt.ca/about/annual-reports/

9 Electricity data was compiled from a combination of utility and federal sources, which for most communities was only available for 2016 and 2023. Heating data is based on a study conducted by CANMETEnergy. See the appendix for methodology.

10 In a report that we released in 2020, our diesel consumption estimate was 655 million litres. Our upward revision of this estimate (to 694 million litres) is due to more comprehensive data sources and improved modelling assumptions. Dave Lovekin et al., *Diesel Reduction Progress in Remote Communities* (Pembina Institute, 2020). https://www.pembina.org/pub/diesel-reduction-progress-remote-communities

11 Northwest Territories Power Corporation, "Talston Hydro Unit Returns to Service Following Overhaul," news release, April 1, 2025. https://www.ntpc.com/about-ntpc/news-releases/2025/04/01/taltson-hydro-unit-returns-service-following-overhaul

Northwest Territories Power Corporation, "Talston Hydro Unit Back in Service," news release, March 13, 2026. https://www.ntpc.com/about-ntpc/news-releases/2026/03/13/taltson-hydro-unit-back-Service

12 We detail these programs in our report *Restoring the Flow.*

Northern wind turbine construction

Appendix A. Methodology

We compiled a comprehensive database of remote communities, their energy systems, and renewable energy projects using a variety of sources. Modelling was done to fill in any data gaps.

Data sources

The database draws primarily on Natural Resources Canada's Remote Community Energy Database (RCED), incorporating data published in the 2016, 2019, and 2026 versions. We also pulled annual data from the following sources.

Data source	Data type	Time period
BC Hydro	Annual energy and diesel consumption for non-integrated areas, as well as expected clean energy projects (B.C.)	2016–2024
Hydro-Québec	Annual energy consumption for remote communities (Quebec)	2016–2023
Hydro One Remote Communities Inc.	Annual energy and diesel consumption for service area communities (Ontario)	2016–2024
Government of Newfoundland and Labrador Open Data Portal	Annual energy and diesel consumption for service area communities (Newfoundland and Labrador)	2016–2021
Arctic Energy Alliance Community Profiles	Total community energy consumption by fuel source for heating and electricity (Northwest Territories)	2018 and 2023
Arctic Energy Alliance Annual Reports	Annual energy and fuel savings from energy efficiency programs (Northwest Territories)	2018–2024
Qulliq Energy Corporation	Annual diesel consumption for communities (Nunavut)	2020–2024
Yukon Territorial Energy Profiles	Total annual energy production by source for the Yukon (no community/microgrid-level data)	2016–2024
Statistics Canada	Census data Population growth projections Basemaps for Canada's territorial borders	2006, 2011, 2016, 2021 (census) 2024–2049 (population)
Torchlight Bioresources and CanmetENERGY Canadian Bioheat Database	Location, capacity, and sector (residential/non-residential) of all biomass boilers in remote communities	
CanmetENERGY	Estimated annual heat load for 139 remote communities in Canada	

Modelling

As well as filling in data gaps, modelling was done to determine the following, annually from 2016 to 2025:

- diesel consumption (litres) for electricity generation and heating in remote communities
- megawatt-hours of energy produced by renewable energy projects
- litres of diesel reduced from renewable energy projects

Community diesel consumption for electricity generation

To determine total diesel consumption for electricity across remote communities, the model used reported data for annual electricity use and diesel use at the community or microgrid level from 2016 to 2024. Data from utilities, local non-profits, and provincial or territorial governments was prioritized over values reported in the RCED. Within the RCED, the datasets for 2016 and 2023 were the most consistently reported.

For communities with no reported data for 2016 or 2023 in any source dataset (17 of 210 communities), we estimated values using provincial or territorial averages. Estimates were based on the average ratio of peak demand to annual energy consumption. Where peak demand data was not available, we used the province's or territory's average per-capita energy consumption.

If no diesel consumption was reported for 2016 or 2023, then the average provincial or territorial generator efficiency was used to estimate the annual diesel consumption based on annual energy generation.

For charts in this report that show aggregate annual data, missing values for 2017–2022 were filled in using linear interpolation, while data for 2024 onward was generated using linear projection.

Energy generation and diesel displacement from clean energy projects

If a clean energy project reported expected annual energy production or diesel offset based on an engineering estimate or actual data, that value was used. Otherwise, capacity, technology, and location were used to estimate annual energy production, as indicated below.

Solar

The U.S. National Renewable Energy Laboratory's PVWatts calculator was used to estimate generation below the 60th parallel, and the System Advisor Model was used to estimate generation above the 60th parallel.

Wind

The Canadian Wind Atlas, developed by Environment and Climate Change Canada, was used to estimate wind generation.

Hydro

Capacity factors for hydro projects were assumed to be 40% for storage hydro and 33% for run-of-river hydro.

Diesel consumption for heating

Data on diesel use for heating in remote communities is limited. We therefore based our model on the following research done by CanmetENERGY to model heating loads (annual diesel and energy use for heating) for remote communities:

- Richardson et. al, *Characterizing Building Footprints for Heat Load Modelling in Remote Communities* (Natural Resources Canada, CanmetENERGY Ottawa, 2023)
- Brown et. al, *Characterizing Heating Energy for Residential and Commercial Buildings in Canada's Remote Communities* (Natural Resources Canada, CanmetENERGY Ottawa, 2023)

This research used data from the Government of Nunavut's Petroleum Products Division to establish a representative dataset of heating loads based on remote community attributes. This data was supplemented by data from the RCED, where available, and the Arctic Energy Alliance in the Northwest Territories. Like with our approach on electricity, for communities with no annual heat load data, estimates were made using average per-capita heat load for each province or territory.

Heat source profiles for both residential and non-residential buildings in each community were established using data from the RCED, the Government of Yukon, Arctic Energy Alliance, the Bioheat Database, and targeted community-level research.

Fossil fuel conversions

Heating oil, diesel, and heavy fuel oil all have very similar energy densities and were therefore treated as a single fuel type. Liquified natural gas and propane were converted to diesel equivalents using energy density.

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