CHIEFS OF ONTARIO

FIRST NATIONS ENERGY TOOLKIT

Toolkit 1: Foundational energy knowledge for First Nations in Ontario

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Toolkit 1: Foundational energy knowledge for First Nations in Ontario

Toolkit 1 is designed to equip First Nations in Ontario with the foundational knowledge they need to understand, navigate, and engage with energy systems. Its primary goals are to:

- Empower First Nations communities to make informed decisions about energy policies, systems, and opportunities.
- Build awareness of how energy systems function and their direct and indirect impacts on First Nations and their respective territories.
- Support leaders in planning for energy sovereignty, ensuring affordability, and fostering long-term sustainability.
- Provide a steppingstone for communities embarking on energy planning, serving as a gateway to more advanced tools and actions introduced in subsequent toolkits.

This toolkit honors the importance of First Nations knowledge and cultural practices in shaping sustainable energy futures while supporting communities in asserting greater control over their energy systems and decisions.

This is the first in a three-part series addressing the diverse and evolving energy needs of First Nations communities:

- **Toolkit 2** explores practical energy planning, financing options, and renewable energy development.
- **Toolkit 3** highlights case studies, best practices, and strategies for long-term energy sovereignty and project implementation.

Together, the toolkit series forms a comprehensive guide for First Nations communities as they navigate the energy transition, assert control over their energy futures, and align energy development with their rights to land, self-determination, and sustainability.

We invite First Nations communities to use this toolkit as a foundation for building a sustainable energy vision, engaging with stakeholders, and taking meaningful steps toward energy sovereignty.

How to use this toolkit

Toolkit 1 is designed to be a practical, user-friendly guide for community leaders, citizens, and decision-makers. It provides actionable insights to help First Nations communities begin their journey toward energy sovereignty. To get the most value from this toolkit:

1. **Start with the Basics:** Review foundational concepts in energy systems and policies (Section 2) to gain a solid understanding of how energy systems work and their role in your community.
2. **Understand Your Local Context:** Reflect on your community's unique energy landscape, including current challenges, needs, and opportunities (Section 3).
3. **Learn About Policy and Rights:** Explore federal and provincial energy policies, regulations, and agreements, and learn how they impact your community (Section 4).

4. **Engage Your Community:** Use this toolkit as a conversation starter with community members citizen to discuss energy goals, challenges, and priorities, and gather input on collective energy planning.
5. **Build Toward Future Initiatives:** Treat this toolkit as the foundation for more advanced energy planning.
    - Toolkit 2: *Energy Planning and Clean Energy Practical Applications* focuses on project financing, renewable energy development, and practical implementation.
    - Toolkit 3: *Case Studies, Best Practices, and Long-Term Planning* provides real-world examples, strategies, and guidance for developing and implementing sustainable energy systems.

Each section of this toolkit builds on the last, creating a cohesive learning experience to help communities develop a strong foundation for energy planning. By connecting the lessons learned in Toolkit 1 with the more advanced resources in Toolkit 2 and Toolkit 3, communities will be better prepared to achieve energy sovereignty and sustainability.

1. Understanding energy systems

Developing a comprehensive understanding of energy systems is crucial for First Nations communities in Ontario as they navigate toward energy sovereignty. This section provides foundational knowledge on energy concepts, an overview of Ontario's energy infrastructure, the roles of key agencies, and the significance of energy independence.

1.1 Basics of energy and electricity

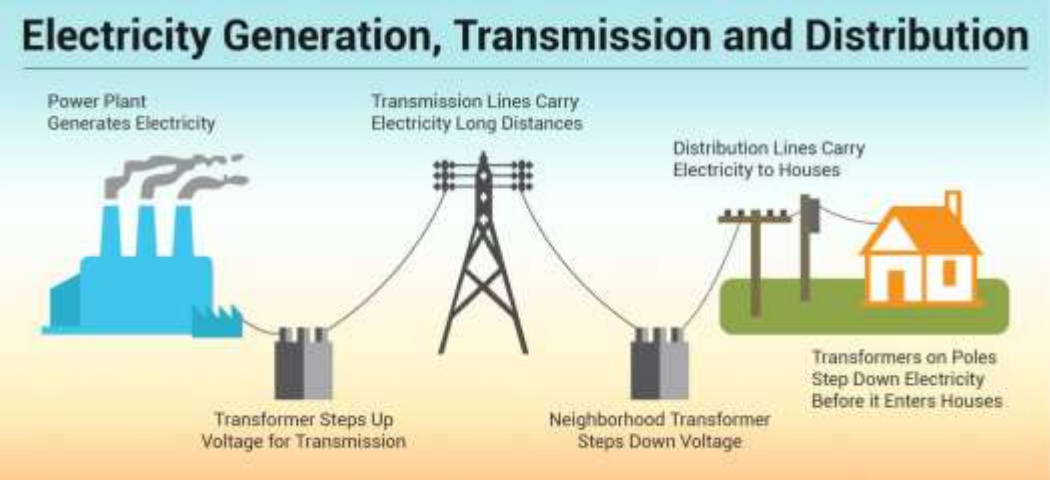
What is Energy? Definitions and key concepts

Energy is the capacity to perform work, enabling activities such as heating, transportation, and powering devices. It manifests in various forms, including thermal (heat), mechanical, chemical, and electrical energy. Understanding these forms is essential for effective energy planning and utilization.

For First Nations communities, energy is deeply connected to the land and customary ways of life. Recognizing the different types of energy and their applications supports informed decisions about energy use and development, aligning with cultural values and promoting sustainability.

Electricity: How It Is produced and delivered

Electricity is a secondary energy source produced by converting primary sources such as natural gas, nuclear, hydro, wind, and solar energy. In Ontario, the electricity generation mix includes a diverse range of sources, enhancing the province's energy reliability[1]. Once generated, electricity is transmitted through high-voltage power lines managed by Hydro One, which operates approximately 98% of Ontario's transmission capacity[2]. This network delivers electricity to local distribution companies (LDCs) that distribute power to consumers via local networks[3].



[1] Independent Electricity System Operator (IESO). (2024). *Supply mix and generation.* Retrieved from https://www.ieso.ca/Learn/Ontario-Electricity-Grid/Supply-Mix-and-Generation
[2] Hydro One. (2024). *Transmission services.* Retrieved from https://www.hydroone.com/about
[3] Burlington Hydro. (2024). *Ontario's electricity system.* Retrieved from https://www.burlingtonhydro.com/works/electricity-landscape/ontario-electricity-system.html

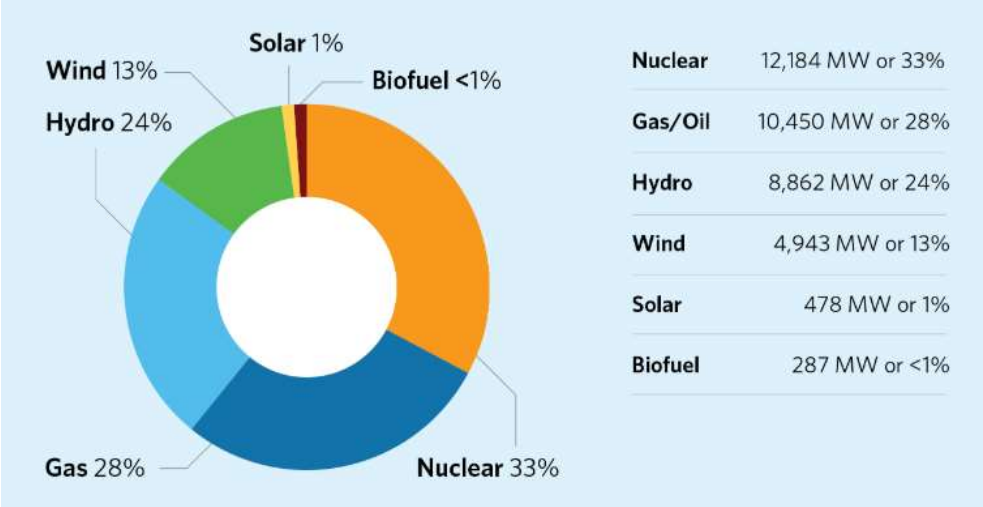
1.2 Overview of Ontario's energy system

Ontario's electricity system operates in three key stages: **generation, transmission, and distribution.** It integrates centralized and decentralized components to balance supply and demand, ensuring reliability, sustainability, and affordability.

i) Generation

Based on the latest data from the Independent Electricity System Operator (IESO), the **Transmission-Connected Capacity as of December 19, 2024**, for Ontario's electricity generation mix is as follows[4]:

- **Nuclear energy:** Approximately 53% of Ontario's electricity was generated from nuclear power plants.
- **Hydroelectric power:** Hydroelectric facilities contributed about 24% to the province's electricity generation.
- **Natural gas:** Natural gas-fired power plants accounted for approximately 13% of the electricity produced.
- **Wind energy:** Wind power contributed around 9% to Ontario's electricity generation.
- **Solar energy:** Solar power made up about 1% of the province's electricity generation.
- **Biofuel:** Biofuel sources contributed less than 1% to the overall electricity generation.



ii) Transmission

Electricity transmission in Ontario involves the high-voltage transportation of electricity from generating stations to local distribution networks. The transmission network ensures the efficient and

[4] Independent Electricity System Operator (IESO). (2024). *Supply Mix and Generation*. Retrieved from https://www.ieso.ca/Learn/Ontario-Electricity-Grid/Supply-Mix-and-Generation

reliable movement of electricity across long distances and is a critical component of the province's energy infrastructure. Key aspects include:

- **Transmission network management:** Hydro One, Ontario's largest electricity transmission provider, owns and operates approximately 97% of the province's transmission infrastructure, covering nearly 30,000 kilometers of high-voltage transmission lines. It plays a pivotal role in delivering electricity to local utilities and industrial customers across the province[5].
- **Grid reliability and operations:** The Independent Electricity System Operator (IESO) oversees the operation of Ontario's electricity grid, balancing supply and demand in real time to maintain system stability and reliability. The IESO coordinates with generators, transmitters, and local distributors to ensure grid resilience[6].
- **Interconnections with other jurisdictions:** Ontario's transmission system is interconnected with neighboring provinces (Quebec and Manitoba) and U.S. states (New York, Michigan, and Minnesota). These interconnections allow for electricity imports and exports, enhancing grid flexibility and stabilizing supply during peak demand periods or generation shortfalls[7].
- **Renewable energy integration:** The transmission network has been adapted to accommodate a growing share of renewable energy sources, such as wind and solar power, through upgrades and investments in smart grid technology and grid-scale storage solutions[8].

iii) Distribution

Electricity distribution is the final stage of delivering power from the high-voltage transmission network to homes, businesses, and industries through local utilities known as **Local Distribution Companies (LDCs).** Key elements of Ontario's electricity distribution system include:

- **Local Distribution Companies (LDCs):** Ontario has over **60 LDCs**, responsible for delivering electricity to end-users in urban, suburban, and rural areas. Some of the largest LDCs include Toronto Hydro, Alectra Utilities, and Hydro One Networks, which collectively serve millions of customers across the province[9].
- **Service to rural and remote areas:** Hydro One Remote Communities Inc. provides electricity to 24 isolated communities that are not connected to Ontario's main grid, using a combination of diesel generation and emerging renewable energy solutions such as microgrids[10].
- **Decentralized energy systems:** Ontario is witnessing a rise in decentralized energy solutions, including solar microgrids and community energy projects. These systems help reduce reliance

[5] Hydro One. (2024). *Transmission System Overview.* Retrieved from https://www.hydroone.com/about/transmission
[6] Independent Electricity System Operator (IESO). (2024). *Ontario's Electricity Grid.* Retrieved from https://www.ieso.ca/Learn/Ontario-Electricity-Grid
[7] Independent Electricity System Operator (IESO). (2024). *Ontario's Electricity Grid.* Retrieved from https://www.ieso.ca/Learn/Ontario-Electricity-Grid
[8] Independent Electricity System Operator (IESO). (2024). *Ontario's Electricity Grid.* Retrieved from https://www.ieso.ca/Learn/Ontario-Electricity-Grid
[9] Ontario Energy Board (OEB). (2024). *Local Distribution Companies in Ontario.* Retrieved from https://www.oeb.ca/ontarios-energy-sector/distributors
[10] Hydro One Remote Communities. (2024). *Remote Community Services.* Retrieved from https://www.hydrooneremotes.ca

on centralized generation, lower costs, and enhance local resilience, particularly in off-grid areas[11].

- **Smart grid and modernization efforts:** The distribution sector is undergoing significant modernization efforts, with investments in smart meters, grid automation, and demand response programs aimed at improving energy efficiency and customer engagement[12].

1.3 The Role of governments and key agencies in Ontario's energy sector

Ontario's energy sector is governed by multiple levels of government and regulatory agencies, each with distinct responsibilities. Understanding these roles is crucial for communities seeking to engage with the energy system and advocate for their interests effectively.

Roles of Federal, Provincial, and First Nations Governments

Energy governance in Ontario involves collaboration between the federal and provincial governments, alongside the active participation of First Nations governments.

FEDERAL GOVERNMENT

The federal government oversees national energy policy, environmental regulations, and infrastructure funding[13], including:

- Regulating major energy projects under the Impact Assessment Act (IAA) and environmental standards.
- Supporting Indigenous participation through initiatives like the Indigenous Services Canada's Clean Energy for Rural and Remote Communities Program.
- Enforcing climate commitments such as Canada's net-zero emissions goals and the Clean Electricity Regulations (CER).

PROVINCIAL GOVERNMENT

The Ontario Ministry of Energy develops and implements policies that ensure the province's electricity system remains affordable, reliable, and sustainable[14], including:

- Overseeing energy planning and conservation programs and encouraging clean energy development and Indigenous participation.
- Setting regulatory frameworks in collaboration with agencies like the Ontario Energy Board (OEB) and Independent Electricity System Operator (IESO).

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[11] Independent Electricity System Operator (IESO). (2024). *Ontario's Electricity Grid.* Retrieved from https://www.ieso.ca/Learn/Ontario-Electricity-Grid

[12] Ontario Energy Board (OEB). (2024). *Local Distribution Companies in Ontario.* Retrieved from https://www.oeb.ca/ontarios-energy-sector/distributors

[13] Government of Canada. (2024). *2030 Emissions Reduction Plan – Canada's Next Steps for Clean Air and a Strong Economy.* Retrieved from https://www.canada.ca/en/environment-climate-change/news/2022/03/2030-emissions-reduction-plan--canadas-next-steps-for-clean-air-and-a-strong-economy.html

[14] Ontario Ministry of Energy. (2024). *Ministry of Energy Overview.* Retrieved from https://www.ontario.ca/page/ministry-energy

FIRST NATIONS GOVERNMENTS

First Nations governments are increasingly asserting their role in energy planning and development, working toward energy sovereignty[15], including:

- Participating in consultation and negotiations for energy projects under Free, Prior, and Informed Consent (FPIC).
- Leading community-driven renewable energy initiatives.
- Developing and supplying energy independently or through strategic partnerships, ensuring greater control over energy production and distribution.
- Collaborating with federal and provincial programs to secure funding and technical support.

Key regulatory and operational agencies

Once the roles of governments are understood, it is important to explore the key agencies responsible for managing Ontario's energy infrastructure and policies:

[15] Assembly of First Nations. (2024). *Energy Sovereignty and First Nations Participation.* Retrieved from https://www.afn.ca

Ministry of Energy (MENER)

The Ontario Ministry of Energy (MENER) is responsible for setting the province's energy policy, overseeing electricity sector operations, and issuing directives that guide energy generation, transmission, conservation, and Indigenous participation[16].

MENER's Long-Term Energy Plan (LTEP) outlines the government's priorities, including energy conservation, the transition to renewable energy, and strengthening partnerships with Indigenous communities to enhance participation in energy projects. The ministry works closely with agencies like the Independent Electricity System Operator (IESO) and Hydro One to ensure First Nations communities are considered in energy planning and benefit from funding and technical support programs.

Independent Electricity System Operator (IESO)

The Independent Electricity System Operator (IESO) is responsible for ensuring a stable and cost-effective electricity supply across Ontario. The IESO manages the provincial electricity market, procures energy through long-term contracts, and administers programs that support Indigenous engagement in energy initiatives[17]. Key responsibilities include:

- Operating Ontario's electricity grid in real-time to balance supply and demand.
- Administering programs such as the Indigenous Energy Support Program (IESP) to provide funding and capacity-building for First Nations.
- Supporting the transition from diesel to renewable energy sources in remote communities.

Ontario Energy Board (OEB)

The Ontario Energy Board (OEB) is the regulatory authority overseeing the province's electricity and natural gas sectors. The OEB's mandate is to protect consumers by setting fair rates, ensuring service reliability, and overseeing infrastructure planning[18]. The board also ensures that Indigenous communities are consulted in energy planning processes that may affect their lands and resources.

Key functions of the OEB include:

- Licensing electricity retailers, distributors, and generators.
- Setting rates and approving energy projects, including transmission and distribution lines.
- Providing guidelines for Indigenous consultation requirements in energy project approvals.

[16] Government of Ontario. (2024). *Ministry of Energy.* Retrieved from https://www.ontario.ca/page/ministry-energy
[17] Independent Electricity System Operator (IESO). (2024). *Ontario's Electricity Market.* Retrieved from https://www.ieso.ca
[18] Ontario Energy Board. (2024). *Energy Regulation in Ontario.* Retrieved from https://www.oeb.ca

Ontario Power Generation (OPG)

Ontario Power Generation (OPG) is a Crown corporation that generates approximately 50% of Ontario's electricity[19]. OPG's generation portfolio includes:

- Nuclear power plants, such as Darlington and Pickering, which provide baseload electricity.
- Hydroelectric stations, including partnerships with First Nations, such as the Lower Mattagami River Project.
- Renewable energy projects, including wind, solar, and biomass initiatives to support Ontario's clean energy goals.

OPG collaborates with Indigenous communities to develop sustainable energy solutions that align with cultural values and environmental stewardship.

Hydro One

Hydro One is Ontario's largest electricity transmission and distribution company, owning 98% of the province's high-voltage transmission network and directly serving over 1.4 million customers, including many rural and First Nations communities[20].

Key roles of Hydro One include:

- Operating and maintaining transmission lines that connect power generation to local distribution systems.
- Managing the Hydro One Remote Communities Inc., which provides electricity to 24 remote First Nations communities in Northern Ontario.
- Partnering with Indigenous communities to develop energy infrastructure and transition to cleaner power sources.

Local Distribution Companies (LDCs)

Local Distribution Companies (LDCs) are responsible for delivering electricity from the provincial grid to end-users, including homes and businesses. Ontario has over 60 LDCs, each regulated by the OEB to ensure fair pricing and reliable service.

Some First Nations communities operate their own distribution companies, such as:

- Six Nations Power Corporation, which manages energy services for the Six Nations of the Grand River.
- Five Nations Energy Inc., which delivers power to James Bay coastal communities.

[19] Ontario Power Generation. (2024). *About OPG.* Retrieved from https://www.opg.com
[20] Hydro One. (2024). *Our Services.* Retrieved from https://www.hydroone.com

Canada Energy Regulator (CER)

The National Energy Board (NEB), now known as the Canada Energy Regulator (CER), oversees interprovincial and international pipelines and transmission infrastructure. The CER ensures environmental and social considerations are included in energy project approvals, with a focus on Indigenous engagement and consultation[21].

Canadian Nuclear Safety Commission (CNSC)

The Canadian Nuclear Safety Commission (CNSC) regulates the use of nuclear energy and materials to protect human health and the environment. It is responsible for licensing nuclear facilities and ensuring compliance with the Nuclear Safety and Control Act[22].

Hydro One Remote Communities Inc.

A subsidiary of Hydro One, Hydro One Remote Communities Inc. provides electricity to 24 off-grid First Nations communities that are not connected to the provincial grid[23]. These communities primarily rely on diesel generation, and efforts are underway to transition to renewable energy alternatives with First Nations leadership.

2. Energy sources for First Nations

Energy is central to the economic development, environmental stewardship, and self-determination of First Nations communities. Renewable energy offers a path to energy sovereignty by providing sustainable, affordable, and locally sourced power solutions.

2.1 Renewable energy sources

Renewable energy sources, including solar, wind, hydroelectric, biomass, and geothermal, are especially well-suited to the needs of First Nations communities. These technologies reduce reliance on external systems, align with environmental values, and offer long-term economic benefits.

2.1.1 Solar, Wind, Hydroelectric, Biomass, Geothermal energy

Solar

How it works: Solar energy harnesses sunlight through photovoltaic (PV) cells, which directly convert sunlight into electricity, or through solar thermal systems, which concentrate sunlight to produce heat for generating steam that drives turbines.

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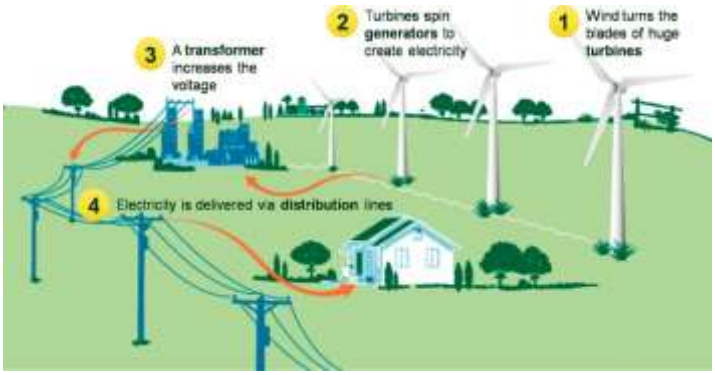
[21] Canada Energy Regulator. (2024). *Regulatory Framework.* Retrieved from https://www.cer-rec.gc.ca
[22] Canadian Nuclear Safety Commission. (2024). *Nuclear Regulation in Canada.* Retrieved from https://www.cnsc-ccsn.gc.ca
[23] Hydro One Remote Communities Inc. (2024). *Providing safe and reliable electricity to remote communities.* Retrieved from https://www.hydrooneremotes.ca/

Benefits
• Solar power generates clean electricity, eliminating greenhouse gas emissions from traditional diesel systems. • By reducing diesel use, solar energy lowers costs, especially in remote areas where fuel transport is expensive. • It enhances energy autonomy, offering reliable power and minimizing supply chain vulnerabilities. • Solar systems are versatile, scalable, and long-lasting, requiring little maintenance over their 20+ year lifespan. • Operating silently with minimal environmental impact, solar preserves the natural landscapes valued by First Nations[24].
Limitations
• Solar energy is weather-dependent and unavailable at night, requiring energy storage systems for consistent power supply. • Large-scale solar installations require significant land, potentially impacting agricultural use and ecosystems. • Solar technologies rely on materials like silicon and rare elements, which may face supply chain and production challenges. • Although costs have decreased, improving efficiency and scalability remains a critical research focus. • High penetration of solar energy requires advanced grid systems and energy storage to balance supply and demand[25].

[24] Robertson, B., Bekker, J., & Buckham, B. (2020). Renewable integration for remote communities: Comparative allowable cost analyses for hydro, solar and wave energy. *Applied Energy, 264*, 114677. https://doi.org/10.1016/j.apenergy.2020.114677
[25] Lewis, N. (2016). Research opportunities to advance solar energy utilization. *Science, 351*(6280). https://doi.org/10.1126/science.aad1920

Wind

How it works: Wind turbines capture the kinetic energy of moving air with their rotating blades. The blades drive a rotor connected to a generator, converting mechanical energy into electricity. Modern turbines are designed for efficiency across a wide range of wind speeds, while offshore wind farms utilize stronger, more consistent winds over open water to produce higher energy output.

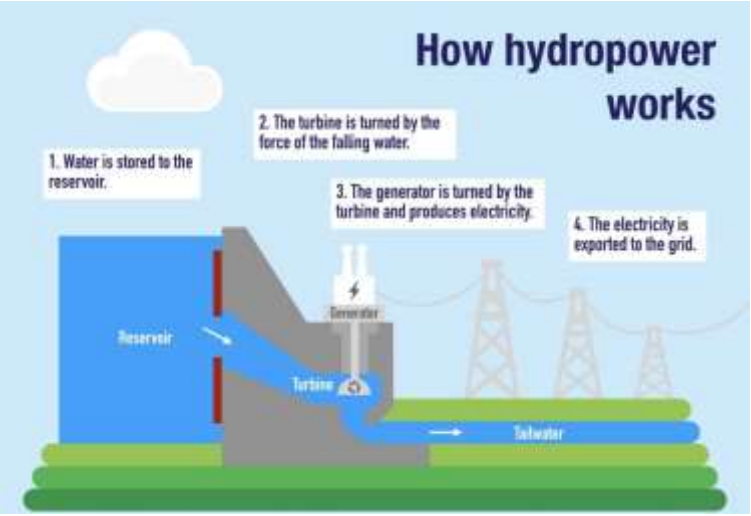


Benefits
• Wind energy produces no greenhouse gas emissions or air pollution during operation, making it a clean and environmentally friendly energy source. • It is a renewable resource, ensuring long-term sustainability without the risk of depletion[26]. • Wind projects contribute to economic growth by creating jobs in manufacturing, construction, and maintenance[27]. • Turbines can be deployed at various scales, from small installations for localized use to expansive wind farms supplying electricity to larger grids[28].
Limitations
• Wind energy is unpredictable and varies depending on weather, requiring backup systems to ensure consistent electricity supply[29]. • Its effectiveness depends on location, with low wind speeds and unsuitable terrain reducing viability. Remote optimal sites can also increase transmission costs[30]. • Turbines may affect wildlife, generate noise, and alter landscapes, which can lead to resistance from local communities[31]. • High installation costs and reliance on subsidies challenge economic feasibility, and the energy return on investment may be lower compared to other sources[32].

[26] Veers, P., Dykes, K., Lantz, E., Barth, S., Bottasso, C. L., Carlson, O., Clifton, A., Green, J., Green, P., & Wiser, R. et al. (2019). Grand challenges in the science of wind energy. Science, 366(6464), eaau2027. https://doi.org/10.1126/science.aau2027
[27] Mckenna, R., Ostman V.d. Leye, P., & Fichtner, W. (2016). Key challenges and prospects for large wind turbines. Renewable and Sustainable Energy Reviews, 53, 1212-1221. https://doi.org/10.1016/j.rser.2015.09.080
[28] Veers, P., Dykes, K., Lantz, E., Barth, S., Bottasso, C. L., Carlson, O., Clifton, A., Green, J., Green, P., & Wiser, R. et al. (2019). Grand challenges in the science of wind energy. Science, 366(6464), eaau2027. https://doi.org/10.1126/science.aau2027
[29] Rahimi, E., Rabiee, A., Aghaei, J., Muttaqi, K., & Nezhad, A. E. (2013). On the management of wind power intermittency. *Renewable & Sustainable Energy Reviews, 28*, 643-653. https://doi.org/10.1016/J.RSER.2013.08.034
[30] Dupont, E., Koppelaar, R., & Jeanmart, H. (2018). Global available wind energy with physical and energy return on investment constraints. *Applied Energy, 209*, 322-338. https://doi.org/10.1016/J.APENERGY.2017.09.085
[31] Veers, P., Dykes, K., Lantz, E., et al. (2019). Grand challenges in the science of wind energy. *Science, 366*. https://doi.org/10.1126/science.aau2027
[32] Arshad, M., & O'Kelly, B. (2019). Global status of wind power generation: Theory, practice, and challenges. *International Journal of Green Energy, 16*(11), 1073-1090. https://doi.org/10.1080/15435075.2019.1597369

Hydroelectric

How it works: Hydroelectric energy generates electricity by capturing the kinetic energy of flowing or falling water to turn turbines. Common methods include large dams, run-of-river systems, and pumped-storage systems.



Benefits
• Hydropower provides consistent electricity, ensuring a stable energy supply while complementing other renewable sources like solar and wind[33].
• It produces minimal greenhouse gas emissions during operation, contributing to cleaner energy systems[34].
• Reservoirs built for hydropower can support irrigation, flood management, and water supply for nearby communities[35].
• Hydropower plants are cost-effective in the long term due to their low operational costs and long lifespans[36].
Limitations
• Large dams can harm ecosystems, reduce biodiversity, and disrupt aquatic life, particularly in rivers with sensitive habitats[37].
• The creation of reservoirs often leads to the displacement of communities and significant land use changes[38].
• Depends on consistent water availability, making it less effective in regions prone to drought or water scarcity[39].

[33] Sayed, E., Wilberforce, T., Elsaid, K., et al. (2020). A critical review on environmental impacts of renewable energy systems and mitigation strategies: Wind, hydro, biomass, and geothermal. *Science of the Total Environment, 766*, 144505. https://doi.org/10.1016/j.scitotenv.2020.144505.

[34] Grubert, E. (2020). Conventional hydroelectricity and the future of energy: Linking national inventory of dams and energy information administration data to facilitate analysis of hydroelectricity. *The Electricity Journal, 33*, 106692.

[35] Moran, E., Lopez, M., Moore, N., Müller, N., & Hyndman, D. (2018). Sustainable hydropower in the 21st century. *Proceedings of the National Academy of Sciences of the United States of America, 115*, 11891–11898. https://doi.org/10.1073/pnas.1809426115.

[36] Grubert, E. (2020). Conventional hydroelectricity and the future of energy: Linking national inventory of dams and energy information administration data to facilitate analysis of hydroelectricity. *The Electricity Journal, 33*, 106692.

[37] Moran, E., Lopez, M., Moore, N., Müller, N., & Hyndman, D. (2018). Sustainable hydropower in the 21st century. *Proceedings of the National Academy of Sciences of the United States of America, 115*, 11891–11898. https://doi.org/10.1073/pnas.1809426115.

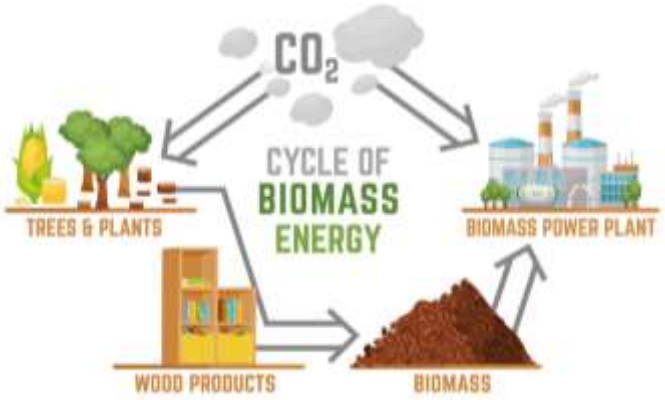
[38] Grubert, E. (2020). Conventional hydroelectricity and the future of energy: Linking national inventory of dams and energy information administration data to facilitate analysis of hydroelectricity. *The Electricity Journal, 33*, 106692. https://doi.org/10.1016/j.tej.2019.106692

[39] Mitsubishi, S., Okamoto, M., Takahashi, H., & Imai, H. (2009). Potential maximum hydroelectric energy development in Japan. *Hydrological Research Letters, 3*, 14–17. https://doi.org/10.3178/HRL.3.14

- The construction of hydropower facilities requires substantial investment and planning, including environmental assessments and mitigation measures[40].

Biomass

How it works: Biomass energy involves burning organic material, such as agricultural residues, wood, or waste, to generate heat and electricity. Anaerobic digestion processes can also convert organic matter into biogas.



Benefits

- Biomass is derived from organic materials such as agricultural residues, wood, and waste, making it a renewable energy source when managed sustainably[41].
- Biomass energy utilizes agricultural and industrial waste, reducing landfill dependency and contributing to better waste management[42].
- When sourced sustainably, biomass can be carbon-neutral, as the carbon released during combustion is offset by the carbon absorbed during the growth of the biomass.
- Supports rural economies by creating jobs in harvesting, processing, and energy production[43].

Limitations

- Biomass production can compete with food crops for arable land, potentially impacting food security.
- While often considered carbon-neutral, biomass combustion still releases CO_2, and improper sourcing can lead to deforestation and increased emissions[44].
- Biomass conversion to energy is less efficient compared to other renewables, requiring advancements in technology to improve energy output.
- Combustion of biomass can produce particulate matter and other air pollutants, requiring careful management and emission controls[45].

[40] Sayed, E., Wilberforce, T., Elsaid, K., et al. (2020). A critical review on environmental impacts of renewable energy systems and mitigation strategies: Wind, hydro, biomass, and geothermal. *Science of the Total Environment, 766*, 144505. https://doi.org/10.1016/j.scitotenv.2020.144505.

[41] Alper, K., Tekin, K., Karagöz, S., & Ragauskas, A. (2020). Sustainable energy and fuels from biomass: A review focusing on hydrothermal biomass processing. *Sustainable Energy and Fuels, 4*, 4390-4414. https://doi.org/10.1039/d0se00784f.

[42] Deitos, M., Araújo, A., & Silva, R. (2024). Sustainability and innovation in green energy: Biomass as a pathway for a renewable future. *Green Energy Review, 12*, 215-234. https://doi.org/10.24857/rgsa.v18n10-169

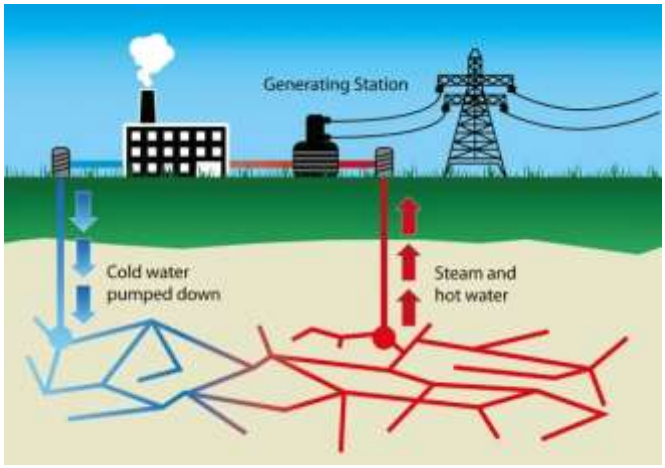
[43] Deitos, M., Araújo, A., & Silva, R. (2024). Sustainability and innovation in green energy: Biomass as a pathway for a renewable future. *Green Energy Review, 12*, 215-234. https://doi.org/10.24857/rgsa.v18n10-169

[44] Alper, K., Tekin, K., Karagöz, S., & Ragauskas, A. (2020). Sustainable energy and fuels from biomass: A review focusing on hydrothermal biomass processing. *Sustainable Energy and Fuels, 4*, 4390-4414. https://doi.org/10.1039/d0se00784f.

[45] Deitos, M., Araújo, A., & Silva, R. (2024). Sustainability and innovation in green energy: Biomass as a pathway for a renewable future. *Green Energy Review, 12*, 215-234. https://doi.org/10.24857/rgsa.v18n10-169

Geothermal

How it works: Geothermal energy uses heat from beneath the Earth's surface to generate electricity or provide direct heating. It typically involves tapping into hot water or steam reservoirs deep underground.



Benefits
• Geothermal energy provides stable baseload electricity, unaffected by weather or seasonal changes, ensuring a consistent energy supply[46]. • Geothermal systems emit significantly fewer greenhouse gases compared to fossil fuels, making them an environmentally friendly energy source[47]. • Geothermal plants require less land, preserving natural landscapes[48]. • In addition to electricity generation, geothermal energy can be used directly for heating homes, greenhouses, and industrial processes[49].
Limitations
• Geographically limited, requiring access to suitable underground heat reservoirs, which may not be available in all regions[50]. • Exploration, drilling, and infrastructure development for geothermal plants involve substantial upfront investments[51]. • Geothermal activities can lead to subsurface water contamination and induced seismicity if not carefully managed[52]. • Expanding geothermal capacity is challenging due to the dependency on specific geological conditions and the need for detailed exploration[53].

[46] Moya, D., Aldas, C., & Kaparaju, P. (2018). Geothermal energy: Power plant technology and direct heat applications. *Renewable and Sustainable Energy Reviews*. https://doi.org/10.1016/J.RSER.2018.06.047.
[47] Sayed, E., Wilberforce, T., Elsaid, K., et al. (2020). A critical review on environmental impacts of renewable energy systems and mitigation strategies: Wind, hydro, biomass, and geothermal. *Science of the Total Environment, 766*, 144505. https://doi.org/10.1016/j.scitotenv.2020.144505.
[48] Anderson, A., & Rezaie, B. (2019). Geothermal technology: Trends and potential role in a sustainable future. *Applied Energy*. https://doi.org/10.1016/J.APENERGY.2019.04.102
[49] Moya, D., Aldas, C., & Kaparaju, P. (2018). Geothermal energy: Power plant technology and direct heat applications. *Renewable and Sustainable Energy Reviews*. https://doi.org/10.1016/J.RSER.2018.06.047.
[50] Anderson, A., & Rezaie, B. (2019). Geothermal technology: Trends and potential role in a sustainable future. *Applied Energy*. https://doi.org/10.1016/J.APENERGY.2019.04.102.
[51] Moya, D., Aldas, C., & Kaparaju, P. (2018). Geothermal energy: Power plant technology and direct heat applications. *Renewable and Sustainable Energy Reviews*. https://doi.org/10.1016/J.RSER.2018.06.047.
[52] Sayed, E., Wilberforce, T., Elsaid, K., et al. (2020). A critical review on environmental impacts of renewable energy systems and mitigation strategies: Wind, hydro, biomass, and geothermal. *Science of the Total Environment, 766*, 144505. https://doi.org/10.1016/j.scitotenv.2020.144505.
[53] Anderson, A., & Rezaie, B. (2019). Geothermal technology: Trends and potential role in a sustainable future. *Applied Energy*. https://doi.org/10.1016/J.APENERGY.2019.04.102.

2.2 Non-Renewable Energy Sources

Non-renewable energy sources include fossil fuels (diesel, natural gas, coal) and nuclear energy. These sources have historically been integral to global energy systems but pose challenges such as environmental degradation, resource dependency, and long-term sustainability.

2.2.1 Diesel, Natural Gas, Coal, and Nuclear

Diesel

How it works: Diesel energy is generated by burning diesel fuel in internal combustion engines, which produce mechanical energy converted into electricity. Diesel generators are commonly used in remote First Nations communities due to their portability and reliability[54].

Benefits
• Diesel generators are a well-established technology, providing reliable electricity generation in remote areas. This reliability is crucial for communities that are not connected to the main power grid, ensuring a consistent power supply[55]. • Diesel generation contributes to local employment and community resilience. It is a familiar technology that communities have adapted to over time, providing a sense of security and stability in energy supply[56]. • Many remote communities already have the infrastructure in place for diesel power, which can be a cost-effective solution compared to the initial investment required for renewable energy systems[57].
Limitations
• Diesel power generation is associated with significant greenhouse gas emissions, oil spills, and black carbon, contributing to environmental degradation and climate change[58]. • The high cost of diesel fuel, coupled with transportation and operational expenses, poses an economic burden on remote communities. These costs are often subsidized by the government, which is not a sustainable long-term solution[5960].

[54] Smith, C., & Kumar, S. (2021). The economics of diesel power generation in off-grid communities. *Energy Policy, 146*, 111-120. https://doi.org/10.1016/j.enpol.2021.111120

[55] Mercer, N., Parker, P., Hudson, A., & Martin, D. (2020). Off-grid energy sustainability in Nunatukavut, Labrador: Centering Inuit voices on heat insecurity in diesel-powered communities. Energy research and social science, 62, 101382. https://doi.org/10.1016/j.erss.2019.101382

[56] Mercer, N., Parker, P., Hudson, A., & Martin, D. (2020). Off-grid energy sustainability in Nunatukavut, Labrador: Centering Inuit voices on heat insecurity in diesel-powered communities. Energy research and social science, 62, 101382. https://doi.org/10.1016/j.erss.2019.101382

[57] Elsaraf, H., Jamil, M., & Pandey, B. (2021). Techno-Economic Design of a Combined Heat and Power Microgrid for a Remote Community in Newfoundland Canada. IEEE Access, 9, 91548-91563. https://doi.org/10.1109/ACCESS.2021.3091738

[58] Karanasios, K., & Parker, P. (2018). Tracking the transition to renewable electricity in remote indigenous communities in Canada. Energy Policy. https://doi.org/10.1016/J.ENPOL.2018.03.032

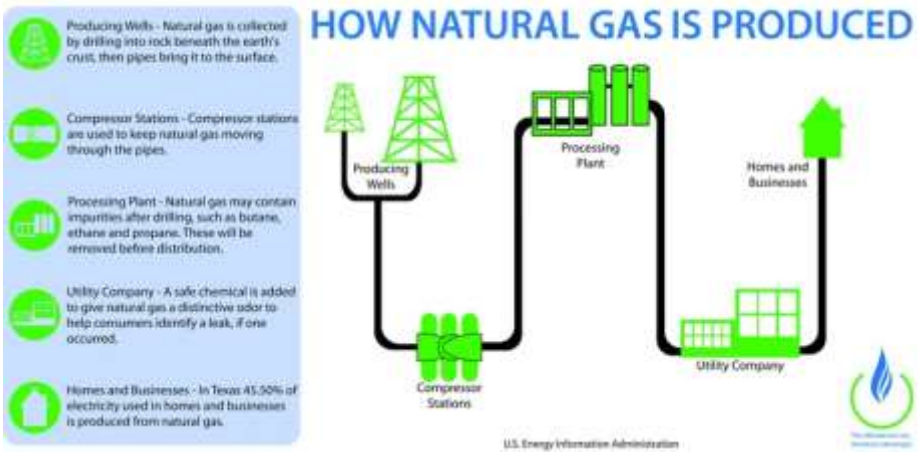
[59] Arriaga, M., Cañizares, C., & Kazerani, M. (2013). Renewable Energy Alternatives for Remote Communities in Northern Ontario, Canada. IEEE Transactions on Sustainable Energy, 4, 661-670. https://doi.org/10.1109/TSTE.2012.2234154

[60] Das, I., & Cañizares, C. (2019). Renewable Energy Integration in Diesel-Based Microgrids at the Canadian Arctic. Proceedings of the IEEE, 107, 1838-1856. https://doi.org/10.1109/JPROC.2019.2932743

- Dependence on diesel can lead to energy insecurity due to external control and the need for fuel imports. This reliance can be problematic, especially in harsh weather conditions that can disrupt supply chains[61] (Mercer et al., 2020).
- Diesel combustion can lead to air pollution, which poses health risks to community citizens.

Natural Gas

How it works: Natural gas is extracted from underground reservoirs and burned in turbines or power plants to generate electricity. Advanced combined-cycle plants improve efficiency by using waste heat to generate additional power[62].



Benefits

- Natural gas emits less CO2 compared to coal and oil, making it a cleaner fossil fuel option for electricity generation and other uses[63].
- It provides essential load balancing services, supporting the integration of renewable energy sources by using existing infrastructure[64].
- Natural gas is abundant and domestically available in many regions, offering economic benefits and energy security[65].

[61] Mercer, N., Parker, P., Hudson, A., & Martin, D. (2020). Off-grid energy sustainability in Nunatukavut, Labrador: Centering Inuit voices on heat insecurity in diesel-powered communities. Energy research and social science, 62, 101382. https://doi.org/10.1016/j.erss.2019.101382

[62] McJeon, H., Edmonds, J., & Clarke, L. (2019). Natural gas and the energy transition. *Nature Climate Change, 9*(1), 34-38. https://doi.org/10.1038/s41558-019-0430-4

[63] Hausfather, Z. (2015). Bounding the climate viability of natural gas as a bridge fuel to displace coal. Energy Policy, 86, 286-294. https://doi.org/10.1016/J.ENPOL.2015.07.012

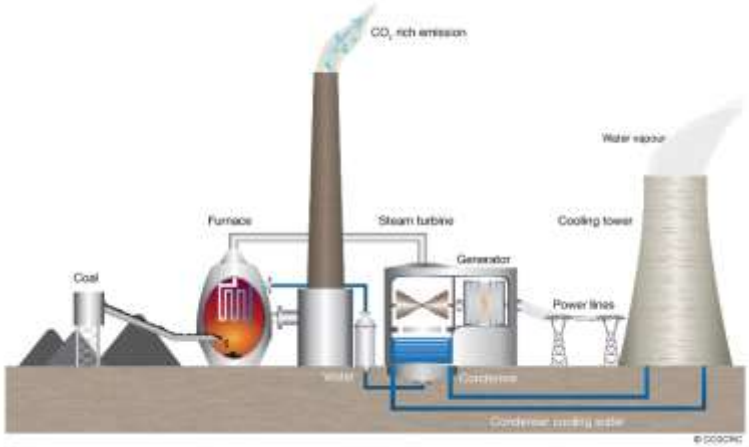
[64] Kinnon, M., Brouwer, J., & Samuelsen, S. (2018). The role of natural gas and its infrastructure in mitigating greenhouse gas emissions, improving regional air quality, and renewable resource integration. Progress in Energy and Combustion Science, 64, 62-92. https://doi.org/10.1016/J.PECS.2017.10.002

[65] Chong, Z., Yang, S., Babu, P., Linga, P., & Li, X. (2016). Review of natural gas hydrates as an energy resource: Prospects and challenges. Applied Energy, 162, 1633-1652. https://doi.org/10.1016/J.APENERGY.2014.12.061

• Switching from coal to natural gas can significantly reduce emissions of harmful pollutants like SO2 and NOx, leading to substantial health benefits[66].
Limitations
• Methane, a potent greenhouse gas, can leak during production and distribution, potentially offsetting the climate benefits of using natural gas over coal[67]. • The long-lived nature of natural gas infrastructure can delay the transition to near-zero carbon technologies, potentially locking in emissions levels above long-term targets[68]. • While natural gas can reduce emissions in the short term, its role in achieving ambitious climate stabilization goals is limited without carbon capture and sequestration technologies[69]. • Although cleaner than coal, natural gas still emits more GHGs and pollutants compared to renewable energy sources[70].

Coal

How it works: Coal-fired power plants burn coal to produce heat, which converts water into steam. The steam drives turbines connected to generators, producing electricity. Although Ontario has phased out coal, it remains widely used globally for electricity generation[71].



[66] Lueken, R., Klima, K., & Griffin, M. (2014). The climate and health effects of a USA switch from coal to gas electricity generation. Energy, 109, 1160-1166. https://doi.org/10.1016/J.ENERGY.2016.03.078

[67] Hausfather, Z. (2015). Bounding the climate viability of natural gas as a bridge fuel to displace coal. Energy Policy, 86, 286-294. https://doi.org/10.1016/J.ENPOL.2015.07.012

[68] Zhang, X., Myhrvold, N., Hausfather, Z., & Caldeira, K. (2016). Climate benefits of natural gas as a bridge fuel and potential delay of near-zero energy systems. Applied Energy, 167, 317-322. https://doi.org/10.1016/J.APENERGY.2015.10.016

[69] Levi, M. (2013). Climate consequences of natural gas as a bridge fuel. Climatic Change, 118, 609-623. https://doi.org/10.1007/s10584-012-0658-3

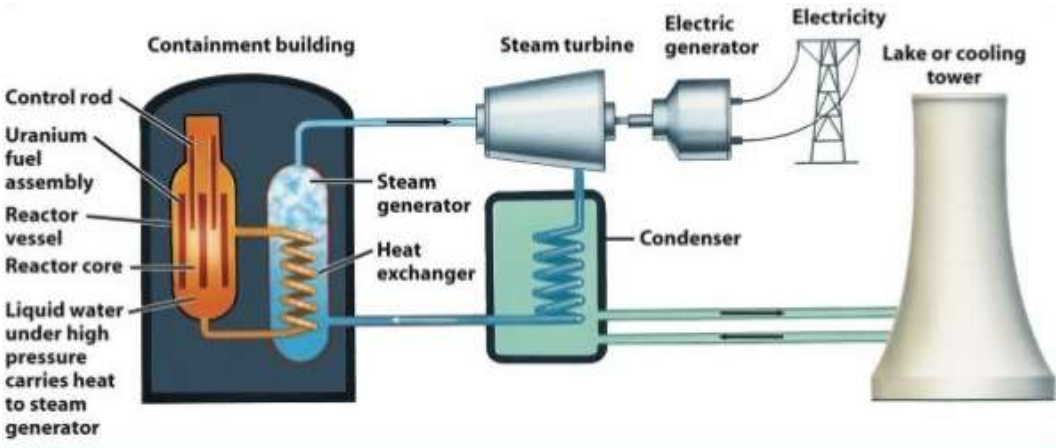
[70] Kinnon, M., Brouwer, J., & Samuelsen, S. (2018). The role of natural gas and its infrastructure in mitigating greenhouse gas emissions, improving regional air quality, and renewable resource integration. Progress in Energy and Combustion Science, 64, 62-92. https://doi.org/10.1016/J.PECS.2017.10.002

[71] Shindell, D., Faluvegi, G., Seltzer, K., & Shindell, C. (2020). Coal and air pollution in rural energy systems. *Journal of Cleaner Production, 277*, 124-137. https://doi.org/10.1016/j.jclepro.2020.124137

Benefits
• Provides a stable source of baseload electricity, ensuring consistent power supply. • Coal reserves are abundant globally, ensuring long-term supply security. • Historically, coal has been a cost-effective energy source for large-scale power generation.
Limitations
• Coal combustion is one of the largest sources of greenhouse gas emissions, significantly contributing to climate change. • Pollutants such as sulfur dioxide (SO_2) and nitrogen oxides (NOx) from coal burning cause serious respiratory and cardiovascular health problems. • Coal mining disrupts landscapes and First Nations land use, causing environmental and cultural harm.

Nuclear

How it works: Nuclear power plants generate electricity by using the heat released during the process of atom splitting to produce steam, which drives a turbine. The fission process itself emits no greenhouse gases, and the overall emissions throughout the nuclear lifecycle are minimal. As a result, nuclear energy is considered environmentally friendly and does not contribute to air pollution. In 2018, nuclear power accounted for 10.5% of global electricity production[72].



Benefits
• Produces very low greenhouse gas emissions, making it an effective solution for reducing carbon footprints[73].

[72] World Nuclear Association. (2024). *Where does our electricity come from?* Retrieved from https://world-nuclear.org/nuclear-essentials/where-does-our-electricity-come-from

[73] World Nuclear Association. (2024). *Where does our electricity come from?* Retrieved from https://world-nuclear.org/nuclear-essentials/where-does-our-electricity-come-from

- A small amount of uranium can generate a large amount of energy due to its high energy density.
- Nuclear power provides consistent baseload electricity, ensuring reliability for long-term energy needs.

Limitations

- Building and decommissioning nuclear plants require high initial costs and lengthy timelines.
- Managing radioactive waste poses long-term storage and safety challenges[74].
- Public concerns over safety, driven by accidents like Fukushima and Chernobyl, create social and political barriers to nuclear energy adoption.

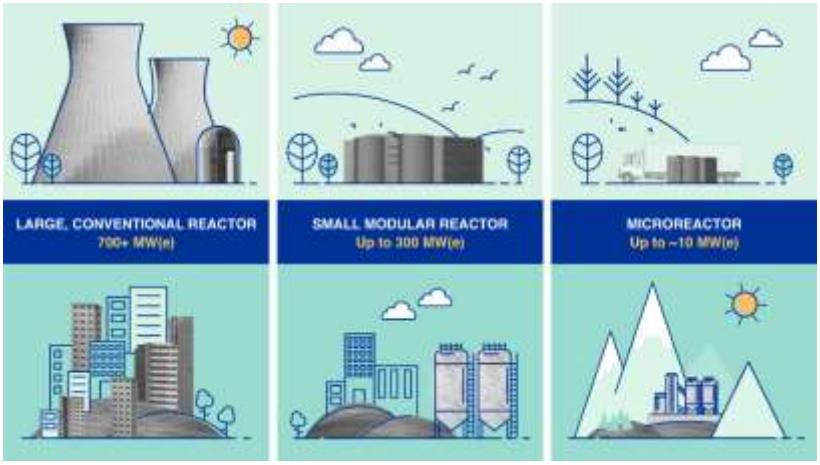
2.3 Emerging energy technologies

Emerging technologies like **Small Modular Reactors (SMRs)** and **Hydrogen Energy** offer innovative solutions that complement traditional renewable and non-renewable energy sources.

2.3.1 Small Modular Reactors (SMRs) and Hydrogen energy

Small Modular Reactors (SMRs)

How it works: SMRs are advanced nuclear reactors with a capacity of less than 300 megawatts (MW). They are designed for modular deployment, meaning they can be factory-assembled and transported to sites for quick installation. SMRs use pressurized water or other coolants to maintain safety and ensure efficient energy generation.



Considerations for First Nations:

While SMRs are being explored by industry and government as a potential energy source, particularly for mining operations in Northern Ontario and the Ring of Fire region, it is essential to critically assess their long-term impacts, costs, and alignment with First Nations values and rights. The Ontario Power Generation (OPG) report suggests that SMRs could provide power for remote mining projects and communities in Northern

[74] Froese, S., Kunz, N. C., & Ramana, M. V. (2020). Too small to be viable? The potential market for small modular reactors in mining and remote communities in Canada. Energy Policy, 144, 111587. https://doi.org/10.1016/j.enpol.2020.111587

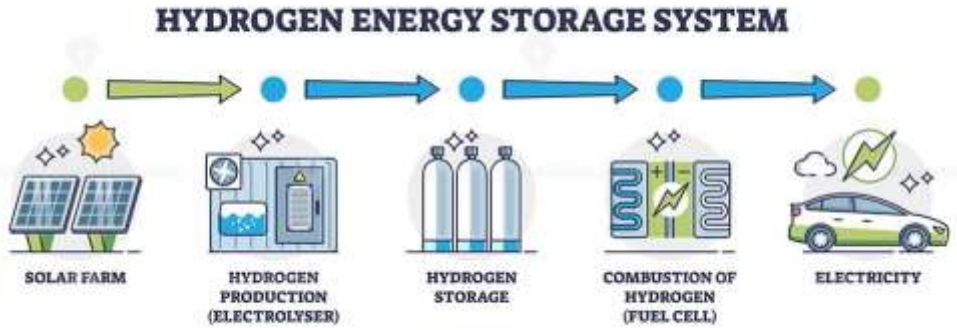
Ontario[75], but concerns remain regarding nuclear waste management, environmental risks, and the need for Free, Prior, and Informed Consent (FPIC).

Benefits
• SMRs provide consistent and low-carbon electricity, supporting Ontario's emissions reduction goals[76]. • Their modular design allows flexible and incremental deployment, making them suitable for remote and off-grid communities, including those in Northern Ontario[77]. • SMRs can lower upfront capital costs compared to traditional nuclear plants and create jobs in construction and operation[78]. • They reduce reliance on diesel generators in remote communities, cutting costs and environmental harm[79].
Limitations
• SMRs face higher per-unit costs compared to larger reactors, which can challenge their economic competitiveness[80]. • Managing nuclear waste from SMRs is more complex due to its volume and reactivity, requiring advanced disposal strategies[81]. • Licensing and public acceptance present challenges, as concerns about safety and proliferation risks persist[82]. • Limited operational experience increases uncertainty about long-term performance and costs[83].

[75] Ontario Power Generation. (2024). Made-in-Ontario northern hydroelectric opportunities: Securing a clean energy future through hydropower. Ontario Power Generation. https://www.opg.com/projects-services/projects/hydroelectric-development/new-hydro/
[76] Colterjohn, C., Nagasaki, S., & Fujii, Y. (2023). Optimizing the Implementation of Small Modular Reactors into Ontario's Future Energy Mix. Nuclear Technology, 210, 23 - 45. https://doi.org/10.1080/00295450.2023.2217390.
[77]Ghimire, L., & Waller, E. (2023). Small Modular Reactors: Opportunities and Challenges as Emerging Nuclear Technologies for Power Production. Journal of Nuclear Engineering and Radiation Science. https://doi.org/10.1115/1.4062644.
[78]Colterjohn, C., Nagasaki, S., & Fujii, Y. (2023). Optimizing the Implementation of Small Modular Reactors into Ontario's Future Energy Mix. Nuclear Technology, 210, 23 - 45. https://doi.org/10.1080/00295450.2023.2217390.
[79] Wieser, E. (2023). The economics of small modular reactors at coal sites: A program-level analysis. *University of Texas at Austin*. http://dx.doi.org/10.2139/ssrn.4984434
[80] Ghimire, L., & Waller, E. (2023). Small modular reactors: Opportunities and challenges as emerging nuclear technologies for power production. *Journal of Nuclear Engineering and Radiation Science*. https://doi.org/10.1115/1.4062644
[81] Krall, L., Macfarlane, A., & Ewing, R. (2022). Nuclear waste from small modular reactors. *Proceedings of the National Academy of Sciences of the United States of America, 119*. https://doi.org/10.1073/pnas.2111833119
[82] Crețulescu, A. (2024). Small modular reactors in Romania's energy future: Capital costs and public perception. *Proceedings of the International Conference on Business Excellence, 18*, 1765–1775. https://doi.org/10.2478/picbe-2024-0148
[83] Momin, R. T. (2023). Physics-driven cost optimization and advanced R&D strategies for small modular reactors. Retrieved from: https://arxiv.org/pdf/2307.12989

Hydrogen Energy

How it works: Hydrogen is primarily produced via electrolysis, where electricity from renewable sources like solar, wind, or nuclear energy splits water into hydrogen and oxygen. Another method is steam methane reforming (SMR), which extracts hydrogen from natural gas, though this method generates carbon emissions. Green hydrogen, produced entirely using renewable energy, is emerging as a key focus for decarbonization efforts[84].



Benefits
• Hydrogen generates no greenhouse gas emissions during use, making it a clean energy solution for transportation, industry, and power generation[85]. • It can store surplus energy from renewables, helping to stabilize power grids and address variability in solar and wind generation[86]. • Hydrogen is versatile and can be used across multiple sectors, including heating, industrial processes, and as fuel for vehicles[87]. • It supports a transition to a low-carbon economy when produced using renewable electricity via water electrolysis[88].
Limitations
• Hydrogen production, storage, and transportation remain expensive, particularly for renewable-based production methods[89]. • Significant infrastructure investment is required to develop production facilities, pipelines, and refueling stations[90].

[84] Marouani, I., Guesmi, T., Alshammari, B., Alqunun, K., Alzamil, A., Alturki, M., & Abdallah, H. (2023). Integration of Renewable-Energy-Based Green Hydrogen into the Energy Future. Processes. https://doi.org/10.3390/pr11092685.
[85] Marouani, I., Guesmi, T., Alshammari, B., et al. (2023). Integration of renewable-energy-based green hydrogen into the energy future. *Processes*. https://doi.org/10.3390/pr11092685.
[86] Wang, D., Muratori, M., Eichman, J., et al. (2018). Quantifying the flexibility of hydrogen production systems to support large-scale renewable energy integration. *Journal of Power Sources*. https://doi.org/10.1016/j.jpowsour.2018.07.101
[87] Ball, M., and Weeda, M. (2015). The hydrogen economy – Vision or reality? *International Journal of Hydrogen Energy, 40*, 7903–7919. https://doi.org/10.1016/J.IJHYDENE.2015.04.032
[88] Kovač, A., Paranos, M., and Marciuš, D. (2021). Hydrogen in energy transition: A review. *International Journal of Hydrogen Energy, 46*, 10016–10035. https://doi.org/10.1016/J.IJHYDENE.2020.11.256
[89] Marouani, I., Guesmi, T., Alshammari, B., et al. (2023). Integration of renewable-energy-based green hydrogen into the energy future. *Processes*. https://doi.org/10.3390/pr11092685.
[90] Ball, M., and Weeda, M. (2015). The hydrogen economy – Vision or reality? *International Journal of Hydrogen Energy, 40*, 7903–7919. https://doi.org/10.1016/J.IJHYDENE.2015.04.032

- The process of producing, compressing, and converting hydrogen into energy can result in low overall efficiency, with substantial energy losses[91].
- Hydrogen's flammability poses safety concerns, requiring rigorous handling and storage protocols[92].

3. First Nations energy landscape

Understanding the energy landscape of First Nations in Ontario requires an exploration of historical practices, current challenges, and emerging opportunities in clean and renewable energy.

3.1 Historical context: Energy and First Nations in Ontario

Pre-colonial energy practices

Before European contact, First Nations Peoples practiced sustainable energy use rooted in ecological knowledge. They relied on renewable resources such as wood for heating, water for mechanical power, and solar energy for drying food and materials. Controlled burning techniques were also employed to maintain healthy forests, enhance soil fertility, and manage resources sustainably[9394].

These practices prioritized environmental stewardship and resource renewal, ensuring long-term sustainability while fostering harmony with nature[95]. Conservation remains a fundamental tenet of First Nations' relationship with the environment, underscoring the importance of integrating Indigenous knowledge into contemporary environmental and energy planning efforts[96].

Impact of colonial energy policies

Colonial expansion disrupted First Nations energy systems, leading to displacement and loss of resource control. Government policies marginalized Indigenous communities from decision-making processes, leading to the dispossession of land and control over natural resources[97]. Large-scale

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[91] Rolo, I., Costa, V. A. F., and Brito, F. P. (2023). Hydrogen-based energy systems: Current technology development status, opportunities and challenges. *Energies*. https://doi.org/10.3390/en17010180

[92] Ahad, M. T., Bhuiyan, M. M. H., Sakib, A., et al. (2023). An overview of challenges for the future of hydrogen. *Materials, 16*. https://doi.org/10.3390/ma16206680

[93] First Nations Development Institute. (2018) "Leveraging Native Lands, Sovereignty and Traditions: Models and Resources for Tribal Ecological Stewardship." Longmont, CO: First Nations Development Institute. Retrieved from https://www.firstnations.org/publications/leveraging-native-lands-sovereignty-and-traditions-models-and-resources-for-tribal-ecological-stewardship/

[94] Vox. (2024). *How Indigenous controlled burns can prevent megafires*. Retrieved from https://www.vox.com/climate/366765/megafires-climate-indigenous-controlled-burns

[95] Stefanelli, R., Castleden, H., Harper, S., Martin, D., & Cunsolo, A. (2019). "Experiencing the social determinants of health in Indigenous communities: A systematic review of qualitative literature." *Social Science & Medicine, 230*, 143-157. https://doi.org/10.1016/j.socscimed.2019.02.009

[96] Assembly of First Nations. (2024). *Environmental protection and climate action*. Retrieved from https://afn.ca/environment/environmental-protection-climate-action/

[97] Taylor, J. L. (2021). *Indigenous peoples and government policy in Canada*. The Canadian Encyclopedia. Retrieved from https://www.thecanadianencyclopedia.ca/en/article/aboriginal-people-government-policy

hydroelectric projects and fossil fuel-based infrastructures marginalized Indigenous participation and forced reliance on high-emission energy sources, such as diesel generators[98].

The imposition of centralized, externally controlled energy infrastructures replaced self-reliant energy systems with those dependent on fossil fuels, particularly diesel generators. This shift has created a long-standing reliance on high-emission energy sources, especially in remote First Nations communities that remain off-grid[99]. Many of these communities continue to face significant challenges resulting from this transition:

High costs: Transporting diesel fuel to remote areas, often by ice roads or air freight, drives up energy costs, creating significant financial burdens for communities. For example, some remote communities pay two to three times more for energy than urban areas, severely limiting economic opportunities and household budgets[100].

Environmental risks: Diesel fuel poses significant ecological threats, including the risk of spills that contaminate land and water. These spills compromise traditional hunting and fishing practices and disrupt local ecosystems that are vital to Indigenous cultural and economic sustainability[101]. Additionally, diesel emissions contribute to greenhouse gas emissions and local air pollution.

Energy insecurity: Dependence on external supply chains makes communities vulnerable to disruptions caused by fuel shortages, extreme weather, or logistical issues. The increasing unpredictability of winter road seasons due to climate change further exacerbates these vulnerabilities, leaving communities without reliable access to fuel when it is most needed[102].

[98] Jacob, M., Gonzales, K., Belcher, D., Ruef, J., & Johnson, S. (2020). Indigenous cultural values counter the damages of white settler colonialism. Environmental Sociology, 7, 134 - 146. https://doi.org/10.1080/23251042.2020.1841370.
[99] He, E. (2021). *Reducing emissions from diesel generators in remote communities*. Pembina Institute. Retrieved from https://www.pembina.org/pub/reducing-emissions-diesel-generators-remote-communities
[100] Pembina Institute. (2023). *Reducing energy poverty in remote Indigenous communities*. Retrieved from https://www.pembina.org/pub/energy-poverty-indigenous-communities
[101] Cook, K. (2019). The impacts of diesel on Indigenous communities: Environmental risks and traditional practices. *Journal of Environmental Policy and Indigenous Rights, 45*(2), 87-102. Retrieved from https://doi.org/10.20381/ruor-25247
[102] Pembina Institute. (2023). *Reducing energy poverty in remote Indigenous communities*. Retrieved from https://www.pembina.org/pub/energy-poverty-indigenous-communities

3.2 Current challenges

First Nations communities in Ontario face long-standing energy challenges, largely shaped by historical marginalization and limited access to sustainable solutions. These challenges include:

- **High Energy Costs:** Reliance on diesel generators leads to significantly higher energy prices compared to urban areas.
- **Infrastructure Gaps:** Aging and inadequate power systems contribute to unreliable energy access and hinder economic development.
- **Energy Insecurity:** Dependence on external fuel supplies leaves communities vulnerable to disruptions caused by logistical challenges and climate change.

Further exploration of these challenges, their impacts, and potential solutions are discussed in **Section 5: Challenges and Opportunities.**

3.3 Opportunities for clean and renewable energy

Transitioning to clean energy presents a pathway for First Nations to achieve greater energy sovereignty and sustainability. Renewable resources such as solar, wind, and hydroelectric power offer opportunities to:

- **Enhance Energy Independence:** Reducing reliance on diesel fosters economic resilience and self-sufficiency.
- **Support Environmental Stewardship:** Aligning energy projects with First Nations ecological knowledgehelps preserve natural resources for future generations.
- **Foster Economic Growth:** Clean energy projects create job opportunities and build local capacity.

Detailed pathways and actionable recommendations for maximizing these opportunities are discussed in **Section 5: Challenges and Opportunities.**

4. Policy and regulatory frameworks

Understanding the intersection of energy policies, First Nations' rights, and energy agreements is crucial for fostering equitable and sustainable energy development. Federal and provincial policies must align with Canada’s climate commitments, Indigenous rights, and First Nations' aspirations for energy sovereignty.

4.1 Federal and provincial energy policies affecting First Nations

Energy policies at both federal and provincial levels significantly influence First Nations' participation in energy projects and their path to energy sovereignty. While these policies support decarbonization, renewable energy initiatives, and Indigenous engagement, implementation gaps remain.

Federal energy policies

At the federal level, Canada's energy policy framework prioritizes reconciliation, environmental sustainability, and the transition to a low-carbon economy. Key elements include:

- **UNDRIP Implementation (Bill C-15):** Adopted into federal law in 2021 through Bill C-15, this legislation aligns Canadian laws with UNDRIP principles, emphasizing Free, Prior, and Informed Consent (FPIC) and ensuring deeper collaboration with First Nations[103].
- **Clean Electricity Regulations (CER):** Aiming for a net-zero electricity grid by 2035, these regulations encourage Indigenous participation and phase out high-emission fuels like coal and diesel[104].
- **Indigenous Climate Leadership Agenda (ICLA):** This program supports First Nations-led renewable energy projects with funding and technical assistance, promoting culturally aligned energy solutions[105].
- **Canadian Green New Deal:** This initiative prioritizes Indigenous leadership in energy transitions, with investments in clean energy that align with reconciliation efforts[106].

Provincial energy policies in Ontario

Ontario's energy policies include a range of initiatives aimed at improving energy affordability, sustainability, and Indigenous participation. These policies are intended to support First Nations communities in addressing energy challenges; however, their effectiveness in meeting community-specific needs depends on accessible funding, culturally appropriate implementation, and meaningful collaboration.

1. Legislative Frameworks

Affordable Energy Act, 2024
This legislation focuses on improving energy affordability for remote and underserved communities, including First Nations, by promoting equitable energy access and supporting efforts to transition away from diesel dependency. It includes funding mechanisms for renewable energy projects and efficiency upgrades[107].

Ontario Aboriginal Loan Guarantee Program (ALGP)
The ALGP provides loan guarantees for up to 75% of an Indigenous entity's equity investment in

[103] Adkins, S., Jamieson, L., Oleniuk, T., & Spencer, S. (2020). UNDRIP as a Framework for Reconciliation in Canada: Challenges and Opportunities for Major Energy and Natural Resources Projects. Alberta Law Review. https://doi.org/10.29173/alr2621
[104] Canada.ca. (2024). Clean electricity regulations and Canada's net-zero target. Retrieved from https://www.canada.ca/en/environment-climate-change/news/2024/12/powering-canadas-futurecanadas-final-clean-electricity-regulations.html
[105] Reed, G., Brunet, N., Mcgregor, D., Scurr, C., Sadik, T., Lavigne, J., & Longboat, S. (2022). *Toward Indigenous visions of nature-based solutions: an exploration into Canadian federal climate policy.* Climate Policy. https://doi.org/10.1080/14693062.2022.2047585
[106] MacArthur, J., Hoicka, C., Castleden, H., Das, R., & Lieu, J. (2020). *Canada's Green New Deal: Forging the socio-political foundations of climate resilient infrastructure?* Energy Research & Social Science. https://doi.org/10.1016/j.erss.2020.101442
[107] Government of Ontario. (2024). *Affordable Energy Act.* Retrieved from https://www.ontario.ca/page/manage-energy-costs-your-home

renewable energy and transmission projects, helping to lower financial barriers and encourage Indigenous ownership in clean energy initiatives[108].

2. Indigenous Energy Programs

Administered by the **Independent Electricity System Operator (IESO),** these programs aim to support Indigenous energy initiatives with financial and technical assistance[109]. The programs include:

Indigenous Energy Support Program (IESP):
Provides funding for energy audits, feasibility studies, and renewable energy planning for First Nations.

Legacy IESO Programs:

- **Community Energy Champion (CEC):** Supports hiring energy champions within communities to lead energy planning efforts.
- **Education and Capacity Building (ECB):** Provides funding for training programs to enhance Indigenous knowledge of energy systems.
- **Indigenous Community Energy Plan (ICEP):** Assists in the development of community-driven energy plans tailored to local needs and priorities.
- **Indigenous Energy Projects (IEP):** Provides financial support for implementing renewable energy projects such as solar, wind, and hydro.

3. Energy efficiency initiatives

Save on Energy for Indigenous Communities:
This initiative offers incentives for energy efficiency upgrades such as LED lighting, insulation, and heating systems, aimed at reducing energy costs and improving sustainability in First Nations communities[110].

4.2 First Nations rights and energy development

First Nations in Ontario have constitutionally protected rights to land and resources that play a critical role in energy development. These rights are enshrined in Section 35 of the Constitution Act, 1982 and strengthened by international frameworks such as the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). Energy projects on First Nations lands must respect these rights, ensuring alignment with community values and promoting energy sovereignty. However, challenges remain in fully realizing these rights, highlighting the need for stronger consultation processes, enforcement of Free, Prior, and Informed Consent (FPIC), and enhanced community capacity.

[108] Ontario Financing Authority. (2024). *Aboriginal Loan Guarantee Program.* Retrieved from https://www.ofina.on.ca/algp
[109] IESO. (2024). *Indigenous Energy Support Programs.* Retrieved from https://www.ieso.ca/Get-Involved/Indigenous-Relations/Indigenous-Energy-Support-Program/Support-Programs-in-Action
[110] Save on Energy. (2024). *Programs for Indigenous Communities.* Retrieved from https://saveonenergy.ca/First-Nations-Energy-Programs

Legal foundations of First Nations rights

First Nations' rights, which may include energy development, are protected under Section 35 of the *Constitution Act, 1982,* which recognizes and affirms Aboriginal and Treaty rights. These legal protections provide the common law foundation for First Nations' participation in resource and energy projects across Canada. The adoption of the *United Nations Declaration on the Rights of Indigenous Peoples Act* (Bill C-15) in 2021 further reinforces these rights by emphasizing the principle of Free, Prior, and Informed Consent (FPIC), requiring First Nations' consent to proposed government decisions or actions, which may include impacts to their lands and resources[111]. Further, First Nations' own inherent jurisdiction and sovereignty, and traditional laws and customary practices may inform and govern their expectations when it comes to energy development.

FPIC marks a shift from Crown consultation to consent-based processes, promoting Indigenous sovereignty over energy decisions. However, challenges persist, including unclear definitions of FPIC in Canadian law, differing jurisdictional application of UNDRIP, inconsistent adherence by developers, and limited capacity for meaningful engagement. These barriers highlight the need for stronger enforcement and clearer guidelines to ensure effective participation in energy development.

Duty to consult and accommodate

The duty to consult and accommodate is a cornerstone of Canadian law, ensuring Indigenous peoples are involved in decisions that may affect their rights. Landmark Supreme Court rulings, such as *Haida Nation v. British Columbia* (2004) and *Taku River Tlingit First Nation v. British Columbia* (2004), established that consultation must be meaningful and conducted in good faith before projects proceed [112][113].

In Ontario, meaningful consultation is required throughout all energy project phases, from initial planning to long-term operation. Effective engagement involves recognizing Indigenous knowledge, addressing community concerns, and fostering collaboration to align projects with Indigenous cultural values, environmental stewardship, and economic goals. Provincial and federal regulatory frameworks, such as Ontario's *Environmental Assessment Act* and the federal *Impact Assessment Act*, provide guidelines to uphold Indigenous rights and promote sustainable development[114][115].

The Crown's duty to consult cannot be delegated to third parties.[116] Only specific procedural process can be delegated to municipalities and/or project proponents.[117] Where procedural aspects of the duty are delegated to a third-party, the Crown must monitor and supervise the delegated process to ensure that the First Nation's concerns are fully addressed.

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[111] Government of Canada. (2021). *United Nations Declaration on the Rights of Indigenous Peoples Act*. Retrieved from https://www.parl.ca/DocumentViewer/en/43-2/bill/C-15/royal-assent

[112] Supreme Court of Canada. (2004a). *Haida Nation v. British Columbia (Minister of Forests), 2004 SCC 73.* Retrieved from https://scc-csc.lexum.com/scc-csc/scc-csc/en/item/2189/index.do

[113] Supreme Court of Canada. (2004b). *Taku River Tlingit First Nation v. British Columbia (Project Assessment Director), 2004 SCC 74.* Retrieved from https://scc-csc.lexum.com/scc-csc/scc-csc/en/item/2190/index.do

[114] Government of Canada. (2019). *Impact Assessment Act.* Retrieved from https://laws-lois.justice.gc.ca/eng/acts/I-2.75/

[115] Government of Ontario. (2024). *Environmental Assessment Act.* Retrieved from https://www.ontario.ca/laws/statute/90e18

[116] Haida Nation at para 53.

[117] Ibid.

Free, Prior, and Informed Consent (FPIC)

Free, Prior, and Informed Consent (FPIC) is a fundamental principle enshrined in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and recognized in Canadian law through the United Nations Declaration on the Rights of Indigenous Peoples Act (Bill C-15). FPIC ensures that First Nations have the right to:

- Be informed about proposed projects in their territories.
- Provide or withhold consent based on a full understanding of the project's potential impacts.
- Influence project development to align with their cultural, environmental, and social values[118][119].

Despite its legal recognition, FPIC's implementation in Canada faces several challenges, including:

1. **Inconsistent interpretation:** The application of FPIC varies across projects and jurisdictions. While internationally recognized, its domestic implementation remains inconsistent, leading to varying degrees of consultation and consent[120].
2. **Capacity gaps:** Many First Nations communities experience barriers such as limited financial and technical resources, hindering their ability to fully engage in FPIC processes. The Assembly of First Nations has called for increased capacity-building to support Indigenous participation in energy governance[121].
3. **Consent disputes:** Large-scale projects, including the Coastal GasLink and Trans Mountain pipelines, have demonstrated tensions between economic development and Indigenous consent. The United Nations Committee on the Elimination of Racial Discrimination has urged Canada to halt projects lacking proper consent from affected First Nations[122].

To address these challenges, there is a need for clearer guidelines, stronger enforcement, and enhanced support mechanisms to ensure FPIC is effectively implemented in energy projects involving First Nations communities.

4.3 Understanding energy contracts and agreements

Energy contracts and agreements play a crucial role in ensuring that First Nations' interests, rights, and economic aspirations are respected and integrated into energy project development. These agreements serve as frameworks for financial participation, benefit-sharing, and long-term sustainability, aligning with Indigenous values and community priorities.

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[118] United Nations. (2007). *United Nations Declaration on the Rights of Indigenous Peoples.* Retrieved from https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html

[119] Government of Canada. (2021). *United Nations Declaration on the Rights of Indigenous Peoples Act.* Retrieved from https://www.parl.ca/DocumentViewer/en/43-2/bill/C-15/royal-assent

[120] Papillon, M., & Rodon, T. (2016). Proponent-Indigenous agreements and the implementation of the right to free, prior, and informed consent in Canada. Environmental Impact Assessment Review, 62, 216-224. https://doi.org/10.1016/j.eiar.2016.06.009

[121] Assembly of First Nations. (2024). *First Nations' Right to Free, Prior and Informed Consent.* Retrieved from https://www.afn.ca/wp-content/uploads/2018/09/2018-06-03-FPIC-factsheet.pdf

[122] United Nations Committee on the Elimination of Racial Discrimination (CERD). (2020). *Concerns on Canada's energy projects.* Retrieved from https://www.ohchr.org/en/treaty-bodies/cerd

1. Impact Benefit Agreements (IBAs)

Impact Benefit Agreements (IBAs) are confidential contracts negotiated between Indigenous communities and project developers, such as mining or energy companies. These agreements aim to formalize the relationship between the parties, mitigate anticipated project impacts, and secure economic benefits for the affected communities[123].

Key components of IBAs include:

- **Employment and training:** Providing job opportunities and skill development programs for community members to enhance local employment prospects.
- **Economic development opportunities:** Ensuring that Indigenous-owned businesses have access to procurement and contracting opportunities related to the project.
- **Environmental management:** Involving communities in environmental monitoring and stewardship to protect traditional lands and resources.
- **Financial compensation:** Offering monetary benefits, such as royalties or profit-sharing, to support community development initiatives[124].

Negotiating IBAs can be complex and resource intensive. To assist communities, organizations like the First Nations of Quebec and Labrador Sustainable Development Institute (FNQLSDI) have established the Centre of Expertise on Impact and Benefit Agreements (CEIBA)[125]. CEIBA provides multidisciplinary support to communities in the negotiation and implementation of IBAs, particularly in the mining, forestry, and energy sectors.

2. Equity Ownership Agreements

Equity ownership agreements allow First Nations to hold ownership stakes in energy projects, providing them with governance rights and a share of the profits. This model promotes economic reconciliation and enables communities to have a direct role in project decision-making. For example, the Waasigan Transmission Line project offers participating First Nations the opportunity to invest in a 50% equity stake, fostering economic growth and capacity building in northwest Ontario[126].

3. Joint Venture Agreements

Joint ventures involve partnerships between First Nations and energy companies, where both parties collaborate on project development and share in the risks and rewards. These agreements can provide communities with access to technical expertise and financial resources, while ensuring that projects align with their cultural and environmental values.

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[123] National Aboriginal Economic Development Board. (2019). *Impact Benefit Agreements: A tool for Indigenous engagement and community development.* Retrieved from https://www.edo.ca/downloads/impact-benefit-agreements-2.pdf
[124] Government of Canada. (2022). *Impact Benefit Agreements (IBA): Support for Indigenous Communities.* Indigenous Services Canada. Retrieved from https://sac-isc.gc.ca/eng/1645561183367/1645561204248
[125] First Nations of Quebec and Labrador Sustainable Development Institute (FNQLSDI). (2021). *Centre of Expertise on Impact and Benefit Agreements (CEIBA).* Retrieved from https://www.fnqlsdi.ca/en/centre-of-expertise-on-impact-and-benefit-agreements/
[126] Electricity Canada. (2023). *First Nations Equity Partnership Model Project.* Retrieved from https://www.electricity.ca/programs/centre-of-excellence/first-nations-equity-partnership-model-project/

An example is the partnership between Suncor and the Fort McKay and Mikisew Cree First Nations, where the communities acquired a 49% interest in the East Tank Farm development, representing a significant investment in energy infrastructure[127].

In Ontario, a key example is Coral Rapids Power, a wholly owned subsidiary of Taykwa Tagamou Nation (TTN). Coral Rapids Power partnered with Ontario Power Generation (OPG) to develop the 28-megawatt Peter Sutherland Sr. Generating Station, ensuring First Nations participation in hydroelectric development while upholding environmental and cultural priorities[128].

4. Power Purchase Agreements (PPAs)

Power Purchase Agreements (PPAs) are long-term contracts between energy producers and purchasers that define the terms under which energy is sold and purchased over a set period. For First Nations developing renewable energy projects, PPAs can provide a stable revenue stream and facilitate financing by guaranteeing a market for the energy produced[129][130].

While there are limited examples of First Nations in Ontario engaging in PPAs, successful projects in other provinces demonstrate their potential in fostering energy sovereignty and economic growth. Notable examples include:

- **Awasis Solar Project (Saskatchewan):**
  Cowessess First Nation spearheaded this 10 MW solar initiative and signed a PPA with SaskPower in October 2020. The agreement supports economic development by providing a reliable income stream and increasing the community's capacity in the renewable energy sector[131].

These cases provide valuable insights into how PPAs can benefit First Nations in Ontario by offering financial stability and facilitating investment in clean energy projects. With growing interest in renewable energy and evolving regulatory frameworks, Ontario First Nations can explore similar opportunities to enhance their energy sovereignty.

Key Considerations

When entering into these agreements, First Nations should consider:

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[127] Bourque, J., & Exner-Pirot, H. (2023). *Completing Transactions, Building Relationships: Lessons from Indigenous Equity Deals in the Oil and Gas Sector.* Macdonald-Laurier Institute. Retrieved from https://macdonaldlaurier.ca/completing-transactions-building-relationships-lessons-from-indigenous-equity-deals-in-the-oil-and-gas-sector-justin-bourque-and-heather-exner-pirot/

[128] Coral Rapids Power. (2024). Peter Sutherland Sr. Generating Station. Retrieved from https://coralrapidspower.com/index.php/new-post-creek/peter-sutherland-sr-generating-station

[129] Pembina Institute. (2024). *Power Purchase Agreements — Part I: An Introductory Guide.* Retrieved from https://www.pembina.org/sites/default/files/2024-10/PPA_guide_for_Indigenous_proponents_pt_1_0.pdf

[130] Pembina Institute. (2024). *Power Purchase Agreements — Part II: An Overview of Contract Terms and Conditions.* Retrieved from https://www.pembina.org/sites/default/files/2024-10/PPA_guide_for_Indigenous_proponents_pt_2.pdf

[131] First Nations Power Authority. (2021). *FNPA Renewable Energy Projects.* Retrieved from https://fnpa.ca/2021/12/09/fnpa-renewable-energy-projects/

- **Legal rights:** Ensuring that agreements respect Indigenous rights and are aligned with legal frameworks, such as the duty to consult and accommodate[132].
- **Capacity building:** Developing the necessary skills and knowledge to effectively participate in negotiations and project implementation. Organizations like CEIBA provide support in this area[133].
- **Long-term benefits:** Assessing how agreements will provide sustainable economic, social, and environmental benefits for the community.

5. Analysis of challenges and opportunities in achieving energy sovereignty for First Nations

Energy sovereignty is crucial for First Nations communities, offering pathways to self-determination, economic development, and environmental stewardship. This section analyzes the current challenges and opportunities in transitioning to clean energy, building upon the 2016 electricity report and incorporating recent developments up to 2025.

Progress since 2016

Since the publication of the 2016 Chiefs of Ontario Electricity report, several initiatives have been undertaken to address these challenges. Key developments include:

GRID EXPANSION PROJECTS

The completion of the **Wataynikaneyap Power Project**, which connected multiple remote First Nations communities to the provincial grid, reducing diesel reliance and enhancing energy security.

RENEWABLE ENERGY INITIATIVES

Programs such as the **Indigenous Energy Support Program (IESP)** and the **Ontario Aboriginal Loan Guarantee Program (ALGP)** have provided financial and technical assistance to support community-led renewable energy projects.

POLICY AND REGULATORY IMPROVEMENTS

The adoption of **Bill C-15**, incorporating the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) into Canadian law, has strengthened Indigenous rights in energy project decision-making.

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[132] National Aboriginal Lands Managers Association. (2017). *Impact Benefit Agreements - NALMA.* Retrieved from https://nalma.ca/wp-content/uploads/2016/01/ImpactBenefitAgreements_AdamMunnings.pdf

[133] Crown-Indigenous Relations and Northern Affairs Canada. (2022). *Centre of Expertise on Impact and Benefit Agreements: An Important Ally.* Retrieved from https://sac-isc.gc.ca/eng/1645561183367/1645561204248

BUILDING AND TRAINING PROGRAMS

Capacity-building initiatives have empowered communities with the skills and knowledge needed to participate effectively in energy development.

5.1 Challenges

First Nations communities in Ontario continue to face significant energy challenges despite progress in recent years. These challenges stem from historical marginalization, limited access to clean energy solutions, and systemic barriers within policy frameworks.

5.1.1 High energy costs and limited access

First Nations communities in remote areas of Ontario face significant challenges due to their reliance on diesel generators for energy. Transporting diesel fuel via unreliable ice roads or expensive air freight results in energy costs that are two to three times higher than in urban areas, placing a heavy financial burden on communities and limiting economic development[134][135]. Climate change further exacerbates these challenges by making ice roads less dependable, increasing logistical costs and uncertainties.

In addition to high costs, inadequate energy infrastructure contributes to frequent power outages and service disruptions. Many First Nations communities experience unreliable energy access due to aging diesel generators and a lack of modern grid infrastructure[136]. These challenges strain local economies and hinder access to essential services such as healthcare, education, and clean water supply, further deepening socio-economic disparities[137].

5.1.2 Policy and regulatory barriers

Despite Canada's commitments to Indigenous energy sovereignty, several policy and regulatory hurdles persist. Indigenous utility providers face regulatory frameworks that reinforce settler sovereignty, limiting their self-determination in energy projects. However, inquiries such as the British Columbia Utilities Commission's Indigenous Utilities Regulation Inquiry provide opportunities to

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[134] Hosszu, M. (2017). The economic feasibility of replacing diesel with renewable energy resources in remote First Nation communities in Northern Ontario. Retrieved from https://thesis.lakeheadu.ca/bitstream/handle/2453/4205/HosszuM2017m-1b.pdf

[135] Karanasios, K., & Parker, P. (2018). Tracking the transition to renewable electricity in remote indigenous communities in Canada. Energy Policy. https://doi.org/10.1016/J.ENPOL.2018.03.032.

[136] Rakshit, R., Shahi, C., Smith, M., & Cornwell, A. (2019). Energy transition complexities in rural and remote Indigenous communities: A case study of Poplar Hill First Nation in Northern Ontario. *Local Environment, 24*(8), 809-824. https://doi.org/10.1080/13549839.2019.1648400

[137] [137] Hosszu, M. (2017). The economic feasibility of replacing diesel with renewable energy resources in remote First Nation communities in Northern Ontario. Retrieved from https://thesis.lakeheadu.ca/bitstream/handle/2453/4205/HosszuM2017m-1b.pdf

challenge these barriers and push for greater autonomy[138]. While many Indigenous communities engage in renewable energy projects to achieve autonomy and economic benefits, concerns remain about whether these initiatives genuinely support reconciliation without overlooking potential shortcomings[139]. Successful energy partnerships require meaningful community engagement, financial capital, and equitable benefit-sharing, yet policy disconnects often hinder Indigenous ownership and control[140]. Environmental risks, such as pipeline spills, further threaten Indigenous lands and livelihoods, highlighting the need for Indigenous-led monitoring and response programs[141]. In addition, bioenergy development faces challenges such as high initial costs and logistical barriers, which require community-based solutions and traditional knowledge for successful implementation[142].

5.1.3 Infrastructure and technological gaps

Aging and inadequate energy infrastructure in many First Nations communities pose significant challenges to the integration of renewable energy technologies. These challenges include transmission and storage issues that hinder the deployment of solar and wind energy projects. Despite efforts such as the Wataynikaneyap Power Project, many remote areas remain underserved, facing persistent barriers related to historical, geographic, and technological limitations in transitioning from off-grid to grid-connected systems[143]. A key issue is the lack of Indigenous ownership and control in renewable energy projects, limiting the economic and social benefits that communities can derive from such initiatives[144]. Furthermore, many Indigenous communities express a strong desire to achieve energy autonomy and reduce dependence on colonial energy structures, yet this transition requires significant planning, resources, and external support[145].

5.1.4 Capacity and funding constraints

First Nations communities in Ontario and across Canada encounter significant challenges in initiating and sustaining clean energy projects due to capacity and funding constraints. Despite the availability of government funding initiatives, such as the Indigenous Leadership Fund, which provides up to

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[138] Midzain-Gobin, L., & McEvoy, J. (2024). Contesting colonial beachheads: Settler colonial (in)security professionals and Indigenous peoples' energy infrastructure. *Security Dialogue.* https://doi.org/10.1177/09670106241229889

[139] Stefanelli, R., Walker, C., Kornelsen, D., Lewis, D., Martin, D., Masuda, J., Richmond, C., Root, E., Neufeld, H., & Castleden, H. (2019). Renewable energy and energy autonomy: how Indigenous peoples in Canada are shaping an energy future. *Environmental Reviews.* https://doi.org/10.1139/ER-2018-0024

[140] Yalamala, R., Zurba, M., Bullock, R., & Diduck, A. (2023). A review of large-scale renewable energy partnerships with Indigenous communities and organizations in Canada. *Environmental Reviews.* https://doi.org/10.1139/er-2022-0011

[141] Datta, R., & Hurlbert, M. (2019). Pipeline spills and Indigenous energy justice. *Sustainability, 12*, 47. https://doi.org/10.3390/su12010047

[142] Buss, J., Mansuy, N., & Madrali, S. (2021). De-risking wood-based bioenergy development in remote and Indigenous communities in Canada. *Energies, 14*, 2603. https://doi.org/10.3390/EN14092603

[143] Rakshit, R., Shahi, C., Smith, M., & Cornwell, A. (2019). Energy transition complexities in rural and remote Indigenous communities: A case study of Poplar Hill First Nation in northern Ontario. *Local Environment, 24*(8), 809-824. https://doi.org/10.1080/13549839.2019.1648400

[144] Hoicka, C., Savić, K., & Campney, A. (2021). Reconciliation through renewable energy? A survey of Indigenous communities, involvement, and peoples in Canada. *Energy Research and Social Science, 74*, 101897. https://doi.org/10.1016/J.ERSS.2020.101897

[145] Agu, O., Tabil, L., & Mupondwa, E. (2023). Actualization and adoption of renewable energy usage in remote communities in Canada by 2050: A review. *Energies.* https://doi.org/10.3390/en16083601

$180 million to support Indigenous-owned and led renewable energy projects[146], and the $300 million investment over five years aimed at reducing diesel reliance in rural, remote, and Indigenous communities[147], the administrative burden of securing and managing these funds remains a major obstacle. Additionally, limited technical capacity and access to training and workforce development programs hinder progress. Addressing these challenges requires tailored financial mechanisms and capacity-building efforts to support sustainable energy development in Indigenous communities.

5.2 Opportunities

Despite the challenges, First Nations communities in Ontario are increasingly leveraging renewable energy to achieve economic and environmental benefits.

5.2.1 Indigenous ownership and leadership

First Nations in Ontario are increasingly leading clean energy projects, fostering economic self-sufficiency and sustainability. The Wataynikaneyap Power Project, the largest Indigenous-led energy initiative, connects 17 remote communities to the provincial grid, reducing diesel dependence[148]. The Henvey Inlet Wind Project, a 300 MW wind farm co-owned by Henvey Inlet First Nation, demonstrates Indigenous leadership in large-scale renewable energy[149]. Other notable projects include the Gull Bay First Nation Diesel Offset Microgrid and the Aroland First Nation Solar Project, showcasing Indigenous commitment to clean energy and economic empowerment[150].

5.2.2 Government support and funding

Federal and provincial programs provide crucial financial and technical support for First Nations' clean energy initiatives in Ontario, fostering sustainable development and energy independence. Various funding programs and initiatives have been established to support Indigenous participation in the clean energy transition, including:

- Indigenous Energy Support Program (IESP)
- Aboriginal Loan Guarantee Program (ALGP)
- Indigenous Leadership Fund
- Smart Renewables and Electrification Pathways Program (SREPs)
- First Nations Clean Energy Business Fund (FNCEBF)
- Remote Electrification Readiness Program (RERP)
- Ontario Indigenous Economic Development Fund (IEDF)

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[146] Government of Canada. (2023, November 14). *Government of Canada launches the Indigenous Leadership Fund to support First Nations, Inuit, and Métis climate action*. https://www.canada.ca/en/environment-climate-change/news/2023/11/government-of-canada-launches-the-indigenous-leadership-fund-to-support-first-nations-inuit-and-metis-climate-action.html

[147] Government of Canada. (2022, April 25). *Government of Canada investing $300 million in clean energy projects in Indigenous, rural, and remote communities*. https://www.canada.ca/en/natural-resources-canada/news/2022/04/government-of-canada-investing-300-million-in-clean-energy-projects-in-indigenous-rural-and-remote-communities.html

[148] Government of Ontario. (2024). *Wataynikaneyap Power Project.* Retrieved from https://news.ontario.ca/en/release/1005040/ontario-supporting-the-largest-indigenous-led-energy-project-in-provinces-history

[149] Henvey Inlet First Nation. (2024). *Henvey Inlet Wind Project.* Retrieved from https://www.hifn.ca.

[150] Lim, A. B., Poelzer, G., & Noble, B. (2024). *Social value of renewable energy in remote northern Indigenous communities.* Journal of Aboriginal Economic Development. Retrieved from https://www.erudit.org/en/journals/jaed/2024-v14-n1-jaed09454/1112519ar/abstract/.

- Community Energy Champion (CEC) Program
- Green Infrastructure Stream of the Investing in Canada Plan

These programs collectively contribute to the advancement of Indigenous clean energy projects in Ontario, driving environmental sustainability, job creation, and community empowerment.

5.2.3 Economic development benefits

Indigenous clean and renewable energy projects in Ontario have created significant job opportunities and economic benefits for First Nations communities. The Henvey Inlet Wind Project, Ontario's largest First Nations wind energy project, generated over 1,000 jobs during its construction and continues to provide operational employment. The Wataynikaneyap Power Project, which aims to connect remote Indigenous communities to the provincial power grid through renewable sources, has provided employment for over 750 Indigenous workers**,** with ongoing opportunities in infrastructure maintenance. Additionally, geothermal and solar initiatives in the Niagara region have resulted in around 200 permanent jobs, while solar installations within the Whitefish River First Nation have created between 50–100 jobs. These projects, supported by government initiatives such as the Indigenous Clean Energy Initiative (ICEI), foster skills development and long-term employment opportunities in sustainable energy[151].

5.2.4 Capacity building and collaboration

Capacity-building programs focused on community engagement, education, and workforce training empower First Nations to shape their energy future. The Indigenous Workforce Development Program, with $1.9 million in funding, creates employment opportunities in the energy sector[152]. The 20/20 Catalysts Program**,** by Indigenous Clean Energy Inc., provides hands-on training and mentorship to advance renewable projects and leadership capacity[153]. Additionally, the Save on Energy First Nations Community Building Retrofit Program offers funding and technical support to improve energy efficiency in band-owned facilities, fostering local expertise[154].

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[151] Bauche, M. (2024). *Clean Energy Funding in Saskatchewan*. Policy Commons. Retrieved from https://policycommons.net/artifacts/12368113/clean-energy-funding-in-saskatchewan-contents/13264576/.
[152] Government of Canada. (2024). *Indigenous Leadership Fund.* Retrieved from https://www.canada.ca/en/environment-climate-change/services/climate-change/low-carbon-economy-fund/indigenous-leadership.html
[153] Indigenous Clean Energy. (2024). *20/20 Catalysts Program.* Retrieved from https://indigenouscleanenergy.com/2020-catalysts-program/
[154] Independent Electricity System Operator (IESO). (2024). *First Nations Community Building Retrofit Program.* Retrieved from https://saveonenergy.ca/en/First-Nations-Energy-Programs/First-Nations-Community-Building-Retrofit-Program

5.3 Recommendations

To address these challenges and maximize opportunities, the following strategic recommendations are proposed:

5.3.1 Policy reform and regulatory improvements

To facilitate greater Indigenous participation in energy development, it is crucial to streamline regulatory processes and remove bureaucratic barriers that hinder First Nations' involvement. Strengthening the enforcement of Free, Prior, and Informed Consent (FPIC) is essential to ensure that Indigenous communities have a meaningful voice in energy projects that affect their lands and resources. Additionally, policies must be introduced to provide long-term, flexible funding arrangements that support not only project development but also ongoing maintenance and operational sustainability. This will help address the financial uncertainty that often undermines long-term planning efforts.

5.3.2 Strengthening financial and technical capacity

Expanding access to funding programs tailored to the specific needs of First Nations communities is vital to empower them in the clean energy transition. Many communities face financial constraints that limit their ability to develop and sustain energy projects. In addition to funding, dedicated technical assistance programs should be developed to support communities throughout the project lifecycle; from planning and implementation to long-term management. Establishing partnerships with industry stakeholders and government agencies can further enhance capacity-building efforts by providing mentorship opportunities and fostering knowledge exchange, ultimately enabling First Nations to lead their energy initiatives with confidence.

5.3.3 Infrastructure investment and modernization

Investing in modern energy infrastructure is critical to ensuring reliable and sustainable energy solutions for First Nations communities. Prioritizing the deployment of technologies such as microgrids and smart grid systems can enhance energy efficiency and reliability, particularly in remote areas. Equitable distribution of resources is necessary to ensure that all communities, regardless of their geographic location, have access to clean and affordable energy. Furthermore, promoting energy storage solutions, such as battery storage systems, can help address the intermittency challenges associated with renewable energy sources, improving energy security and resilience in off-grid and underserved areas.

5.4 Conclusion

Achieving energy sovereignty for First Nations communities in Ontario is a multifaceted endeavor requiring a coordinated effort among Indigenous leadership, government, and industry partners. Addressing key challenges such as policy barriers, infrastructure limitations, and funding constraints will pave the way for meaningful participation in the clean energy transition. By leveraging available opportunities, such as Indigenous ownership models, government support, and capacity-building initiatives, First Nations can achieve long-term sustainability and self-determination in energy development.

CHIEFS OF ONTARIO

FIRST NATIONS ENERGY TOOLKIT

Toolkit 2: Energy planning and clean energy practical applications

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Toolkit 2: Energy planning and clean energy practical applications

Purpose and overview

Toolkit 2 serves as a step-by-step guide to help First Nations communities in Ontario transition to sustainable and energy-efficient solutions. Building on the foundational knowledge from Toolkit 1, this guide emphasizes the practical implementation of modern technologies such as heat pumps, energy recovery ventilators (ERVs), and smart thermostats. These solutions are designed to address the unique cultural, geographic, and energy needs of First Nations, enabling them to reduce energy costs, increase energy independence, and promote environmental sustainability.

Key insights

- **Planning for energy independence**: Introduces key concepts like energy sovereignty and tools such as the GridWatch App to support informed decision-making.
- **Practical energy systems**: Explains how specific technologies work, highlighting their benefits, maintenance needs, and available rebate opportunities.
- **Energy efficiency programs**: Showcases Ontario's key programs and funding options to support community energy projects.
- **Financial resources and partnerships**: Connects communities with banks, Indigenous financial institutions, and technical support resources.
- **Key organizations**: Provides a directory of energy consultants, engineering experts, and advocacy groups to assist with project implementation.

How to use this toolkit

This toolkit is designed to empower community leaders, energy champions, and decision-makers with the tools to:

- Plan and implement energy systems effectively, tailored to community priorities.
- Access funding, technical support, and partnerships to drive project success.
- Leverage additional resources outlined in Toolkit 1 (foundational knowledge) and Toolkit 3 (case studies and best practices).

1. Planning for energy independence

1.1 Understanding energy independence

Energy independence is a cornerstone of self-determination, economic resilience, and environmental sustainability for First Nations communities in Ontario. By transitioning from reliance on diesel and other external energy sources to renewable energy systems tailored to specific needs, communities can reduce costs, improve energy security, and enhance long-term economic opportunities. This transition also strengthens cultural preservation by aligning with First Nation Knowledge and community values.

First Nation Knowledge refers to the accumulated and living knowledge systems of Indigenous Peoples, encompassing cultural practices, methodologies, and beliefs rooted in relationships with the environment. It provides a deep understanding of local ecosystems, species, and environmental interconnections[1]. Integrating First Nation Knowledge into energy planning ensures that energy systems are not only sustainable but also reflective of community priorities and respectful of cultural traditions.

Energy sovereignty, a vital component of energy independence, refers to the right of communities to make decisions about energy use and production that reflect their unique social, cultural, and environmental priorities. Locally governed energy projects enable First Nations to take greater control of their energy future, ensuring systems align with their values and support sustainable growth.

One notable example is the Gull Bay First Nation Microgrid in Northern Ontario. This innovative project integrates solar power with battery storage, reducing diesel consumption by approximately 25,000 liters annually[2]. By replacing diesel reliance with clean energy, the microgrid has improved air quality, decreased greenhouse gas emissions, and created local economic opportunities. It serves as a model of how renewable energy systems can be designed to meet the unique needs of First Nations communities[3].

By prioritizing energy independence and sovereignty, First Nations can build sustainable energy strategies that support self-reliance and environmental stewardship. This approach ensures the long-term resilience of their communities while promoting culturally aligned energy solutions. For instance, energy independence fosters local job creation in renewable energy sectors, such as solar installation, maintenance, and energy project management[4].

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[1] Chiefs of Ontario. (2024). *Aboriginal Traditional Knowledge (ATK)*. Retrieved from https://chiefs-of-ontario.org/priorities/environment/

[2] Independent Electricity System Operator. (2018). *Fully integrated microgrid at Gull Bay First Nation: First of its kind in Canada*. Retrieved from https://www.ieso.ca/en/Powering-Tomorrow/2018/Fully-integrated-microgrid-at-Gull-Bay-First-Nation-first-of-its-kind-in-Canada

[3] IESO. (2024). *Indigenous Community Energy Projects*. Retrieved from https://www.ieso.ca/get-involved/indigenous-relations

[4] The Canadian Press. (2017). *First Nations turn to renewable energy projects to build economic independence*. CBC News. Retrieved from https://www.cbc.ca/news/politics/first-nations-renewable-energy-projects-1.4348595

1.2 Community Energy Planning (CEP)

This section follows the guidelines of the Indigenous Community Energy Plan (ICEP) program, which provides funding and support to First Nations communities for energy planning initiatives.

A Community Energy Plan (CEP) is a strategic document that outlines pathways for transitioning to renewable energy systems while prioritizing energy sovereignty and sustainability. It aligns with a community's cultural values, priorities, and technical needs, serving as a roadmap to energy independence, economic resilience, and environmental sustainability. By identifying energy needs, setting priorities, and implementing tailored solutions, CEPs enable First Nations to develop energy strategies that respect their traditions and aspirations.

By integrating technical innovation with cultural preservation, CEPs empower communities to reduce reliance on external energy sources, lower costs, and improve quality of life.

Provincial and federal support for CEPs

CEPs are not strictly federal or provincial documents; instead, they are community-driven plans that can be supported by both provincial and federal initiatives.

In Ontario, CEPs are primarily supported through provincial programs such as the Indigenous Community Energy Plan (ICEP) program, funded by the Independent Electricity System Operator (IESO). The ICEP program provides financial and technical assistance for First Nations to develop localized energy strategies.

At the national level, agencies such as Indigenous Services Canada (ISC) and Natural Resources Canada (NRCan) offer funding, policy support, and resources for community energy planning. Additionally, a 2016 pre-budget submission to the House of Commons Standing Committee on Finance emphasized the importance of federal, provincial, and territorial collaboration in advancing community energy plans across Canada[5]. Additionally, the National Report on Community Energy Plan Implementation (2015) highlights that over 170 communities in Canada have developed CEPs with support from federal, provincial, and municipal programs[6].

[5] Getting to Implementation (GTI). (2016). Community energy planning: Getting to implementation in Canada. Pre-budget submission to the House of Commons Standing Committee on Finance. Retrieved from https://www.ourcommons.ca/content/Committee/421/FINA/Brief/BR8398218/br-external/Community%20Energy%20Planning-Getting%20to%20Implementation%20in%20Canada-e.pdf

[6] QUEST, Community Energy Association, & Sustainable Prosperity. (2015). National report on community energy plan implementation. Retrieved from http://www.gettingtoimplementation.ca

Key components of a CEP

Community profile

A detailed community profile helps establish the context for energy planning by identifying:

- **Geographic features**: describe the community's location, terrain, and climate, as these factors influence energy options (e.g., suitability for solar, wind, or hydropower).
- **Demographic data**: include population size, age distribution, and household characteristics to gauge energy demand.
- **Infrastructure overview**: document transportation linkages (e.g., road access, air routes), housing stock, community buildings, and existing energy infrastructure (e.g., diesel generators, solar panels).

Baseline energy assessment

This assessment provides a snapshot of the community's current energy consumption and costs. Key elements include:

- **Energy sources**: break down energy usage by source (e.g., electricity, diesel, propane, wood, solar, wind).
- **Energy demand**: assess usage across sectors such as residential, commercial, and public services (e.g., schools, health centers).
- **Cost analysis**: calculate the financial burden of energy use, including fuel transportation and maintenance costs.

Community's future energy needs

Projecting future energy needs ensures the plan remains relevant as the community grows and evolves. Consider:

- **Population growth**: use demographic trends to estimate changes in energy demand.
- **Development goals**: align projections with planned infrastructure expansions, such as new housing or community facilities.
- **Economic activities**: account for energy requirements linked to local industries or new business ventures.

Community energy vision and goals

Establishing a clear vision and goals provides a roadmap for achieving energy, independence and sustainability:

- **Vision statement**: define the community's aspirations (e.g., "achieve 100% renewable energy by 2035").
- **Goal-setting**: develop specific, measurable, achievable, relevant, and time-bound (smart) goals.

Implementation plan

The implementation plan translates the vision into actionable steps. Key components include:

- **Actionable steps**: break down goals into specific tasks, such as installing solar panels or conducting training programs.
- **Timelines**: establish short-, medium-, and long-term milestones to track progress.
- **Resource allocation**: identify funding sources, technical expertise, and materials required for each action.
- **Stakeholder responsibilities**: assign roles to community members, leadership, and external partners to ensure accountability.
- **Monitoring mechanisms**: include systems for tracking progress and adapting the plan as needed.

1.3 Steps to developing a Community Energy Plan (CEP)

To effectively develop a CEP, communities can follow a structured process that ensures cultural alignment, technical feasibility, and long-term success. The flowchart below illustrates the essential steps involved:

1) ENGAGE THE COMMUNTIY	Involve elders, youth, and leaders through workshops and consultations to ensure the plan reflects community priorities.
2) CONDUCT A BASELINE ENERGY ASSESSMENT	Measure energy use by type and building category.
3) SET ENERGY GOALS	Collaborate with the community to establish clear, measurable goals.
4) DRAFT THE CEP	Document the findings, goals, and action plans into a structured framework.
5) MONITOR AND UPDATE	Regularly review the CEP to address emerging challenges and opportunities.

Where to collect the above information required for energy planning?

- ❑ Electricity bills
- ❑ Utility bills
- ❑ Energy utility
- ❑ Audits for buildings (representative sample of community buildings and houses)
- ❑ Physical inspections
- ❑ Discussions with Chief and Council
- ❑ Discussions with relevant departments (economic development, community development, environment focal points, housing, land-use, public works, water treatment plant operators etc.)
- ❑ Community engagement sessions, energy shows/fairs, open houses, surveys.

For more detailed information on the IESO Indigenous Community Energy Plan (ICEP) program, including eligibility criteria, funding details, and application guidelines, please refer to the official program guidelines available at the following link: ICEP Program Guidelines.

Key benefits of a CEP

ECONOMIC DEVELOPMENT

A CEP opens pathways to skills development and employment opportunities such as:

- **Energy sector roles**: Power plant operators, renewable energy technicians, electricians.
- **Planning and development**: Community energy champions, GIS mapping technicians, project managers.
- **Support services**: Mechanics, welders, and surveyors for infrastructure upkeep.

REDUCED ENVIRONMENTAL IMPACT

Transitioning from diesel and other fossil fuels to renewable energy systems significantly reduces greenhouse gas emissions, helping mitigate climate change and promoting environmental stewardship.

IMPROVED HEALTH
Reducing reliance on traditional energy sources minimizes exposure to harmful pollutants, leading to better air quality and improved overall health for community members.

COMMUNITY EMPOWERMENT
Implementing a Community Energy Plan fosters self-determination by enabling communities to take control of their energy future. Aligning strategies with Aboriginal Traditional Knowledge (ATK) strengthens cultural preservation while addressing community priorities.

1.4 Funding opportunities for CEP development

First Nations in Ontario can access several funding programs to support the development and enhancement of Community Energy Plans (CEPs) and energy initiatives. The table below outlines available programs, funding amounts, eligibility, and application details to assist communities in achieving energy independence and sustainability.

PROGRAM	FUNDING AMOUNT	ELIGIBILITY	WEBSITE
IESO Indigenous Community Energy Plan (ICEP) Program	Up to $90,000 for developing a new Community Energy Plan; up to $25,000 for updating an existing plan.	First Nations in Ontario.	https://www.ieso.ca/ Search for "Indigenous Community Energy Plan (ICEP) Program"
Municipal Energy Plan (MEP) Program	Covers 50% of eligible costs, up to $90,000 for creating a new plan; up to $25,000 for updating an existing plan.	Ontario municipalities.	https://www.ontario.ca/page/municipal-energy-plan-program
Indigenous Energy Projects (IEP) Program	Up to $200,000 per calendar year for energy projects, including CEP development.	Indigenous communities and organizations in Ontario.	https://www.ieso.ca/ Search for "Indigenous Energy Projects (IEP) Program"
Aboriginal Loan Guarantee Program (ALGP)	Provides loan guarantees to support Indigenous	Indigenous communities and organizations in Ontario.	https://www.ofina.on.ca/algp/

	participation in energy infrastructure projects.		
Indigenous Community Capital Grants Program (ICCGP)	Funding for infrastructure and energy projects; specific amounts vary based on project scope.	Indigenous communities in Ontario.	https://forms.mgcs.gov.on.ca/en/dataset/on00361

2. Using technology in energy planning: The GridWatch App (Ontario Edition)

The **GridWatch app** is a real-time energy monitoring tool that provides insights into Ontario's electricity grid, including data on generation, demand, and emissions intensity. By categorizing energy sources like nuclear, hydro, wind, solar, and gas, it helps First Nations communities make informed decisions about energy use, efficiency, and planning while monitoring environmental impacts.

Using the GridWatch app

The app is user-friendly and allows communities to monitor electricity demand, emissions, and generation sources. This information can be leveraged to optimize energy use and integrate renewable energy effectively.

Benefits of using GridWatch

GridWatch offers several benefits for First Nations communities, including:

ENERGY MONITORING

- ❑ Track real-time electricity generation and demand, identifying peak usage periods to optimize energy use.

CARBON FOOTPRINT AWARENESS

- ❑ Monitor emissions intensity in real-time to help prioritize renewable energy during periods of low emissions.

ENERGY PLANNING

- ❑ Evaluate the energy supply mix to understand the role of renewables and reduce reliance on fossil fuels.

Step-by-Step Guide to Using GridWatch

1. **Download the app**: Available on the iOS App Store or through alternative platforms for non-iOS users.
2. **Explore key features**: Review energy generation by source, emissions graphs, and electricity demand levels in real time.
3. **Plan energy activities**: Use app data to schedule high-energy activities during periods of renewable availability or low emissions.
4. **Support decision-making**: Track grid stability and identify opportunities to reduce reliance on high-emission energy sources for improved sustainability.

2.1 How to incorporate GridWatch in a Community Energy Plan (CEP)

Integrating **GridWatch** into a CEP empowers communities with data-driven tools for energy planning:

1. **Baseline energy assessment**
   - ❑ Use GridWatch to collect real-time data on electricity use and power sources.
   - ❑ Include insights in the CEP to identify current energy patterns and emissions levels.

2. **Goal Setting and planning**
   - ❑ Set measurable goals (e.g., reduce reliance on non-renewable energy or lower peak demand) using GridWatch's emissions and energy source data.

3. **Implementation and monitoring**
   - ❑ Track progress toward CEP goals and adjust strategies using GridWatch data.
   - ❑ Share updates with community members to ensure transparency and accountability.

4. **Community engagement**
   - ❑ Host workshops to teach community members how to use GridWatch for monitoring and reducing energy use.

5. **Advocacy and reporting**
   - ❑ Use GridWatch data to create reports for stakeholders, funders, or government bodies.
   - ❑ Leverage findings to advocate for cleaner energy policies or infrastructure upgrades.

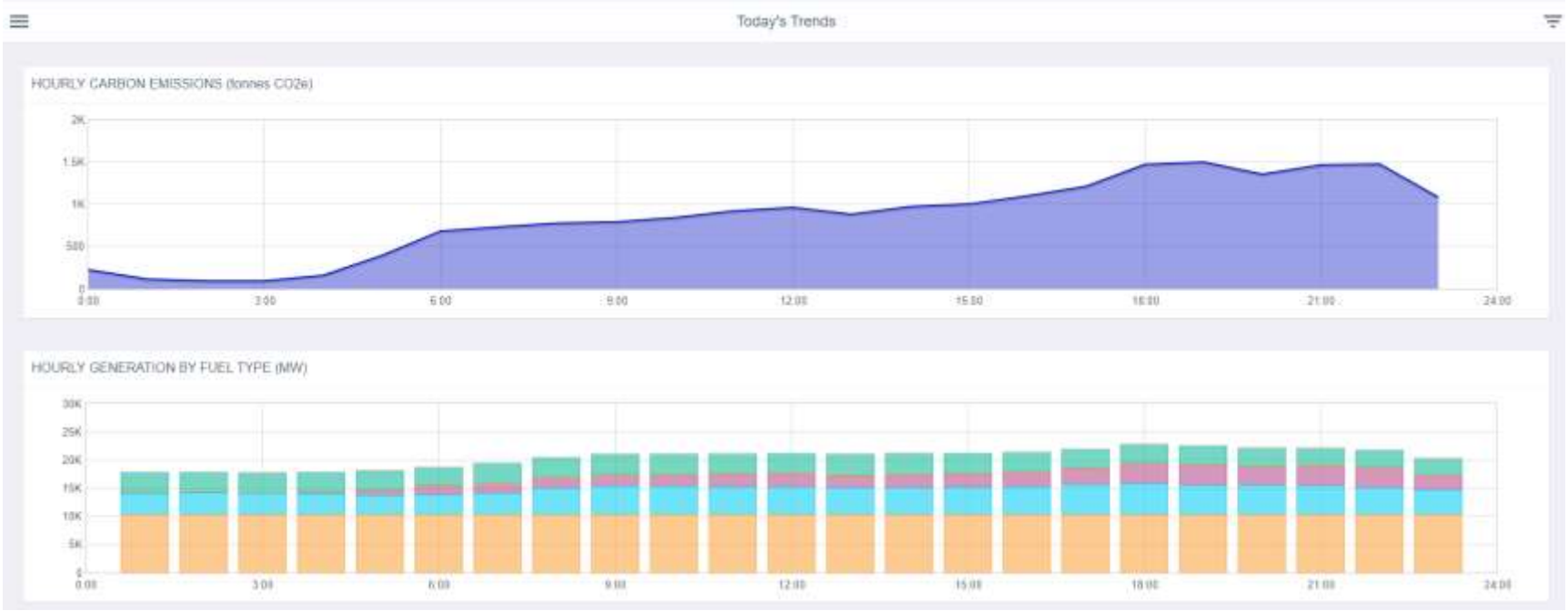
2.2 Explaining the GridWatch tabs

The GridWatch app provides a suite of tools to help communities monitor Ontario's electricity grid in real time. Each tab offers specific insights—ranging from carbon emissions and energy generation trends to grid stability and resource allocation.

TAB 1: HOURLY CARBON EMISSIONS AND ENERGY GENERATION TRENDS

This tab provides two essential insights:

1. **Hourly Carbon Emissions**: Tracks emissions (tonnes CO2e) from Ontario's electricity grid (top chart).
2. **Hourly Generation by Fuel Type**: Shows electricity generation by source, such as nuclear, hydro, wind, solar, and gas (bottom chart).



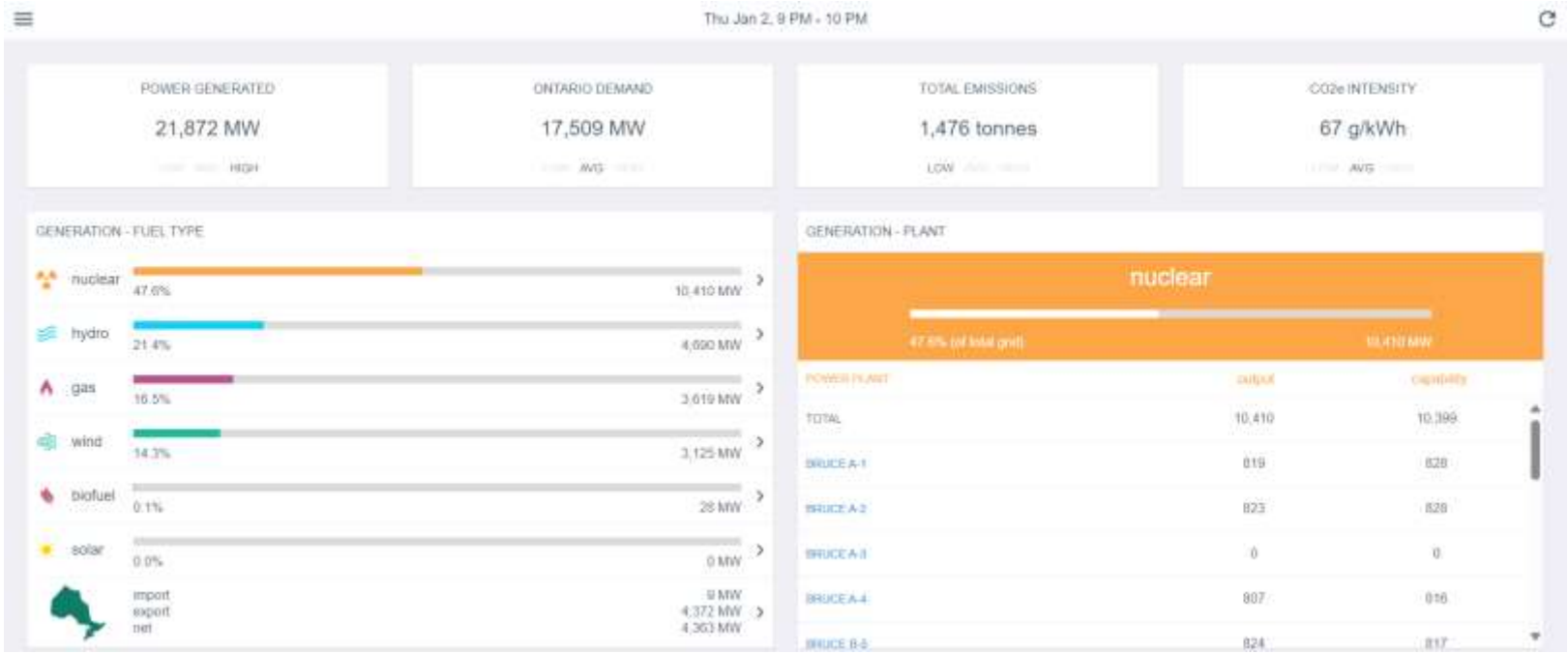
How to apply in energy planning

- ❑ **Emissions awareness**: Monitor carbon emissions throughout the day to schedule energy-intensive activities during lower-emission periods.
- ❑ **Resource optimization**: Use fuel type data to align energy use with renewable availability (e.g., wind or hydro dominance).

TAB 2: REAL-TIME ENERGY OVERVIEW (GENERATION, DEMAND, AND EMISSIONS)

This tab provides real-time data on Ontario's electricity grid, including:

- **Power generated**: Total electricity output, broken down by source (e.g., nuclear, hydro, wind, gas).
- **Ontario demand**: Current electricity demand across the province.
- **Emissions data**: Real-time carbon emissions (tonnes) and CO2 intensity (g/kWh).

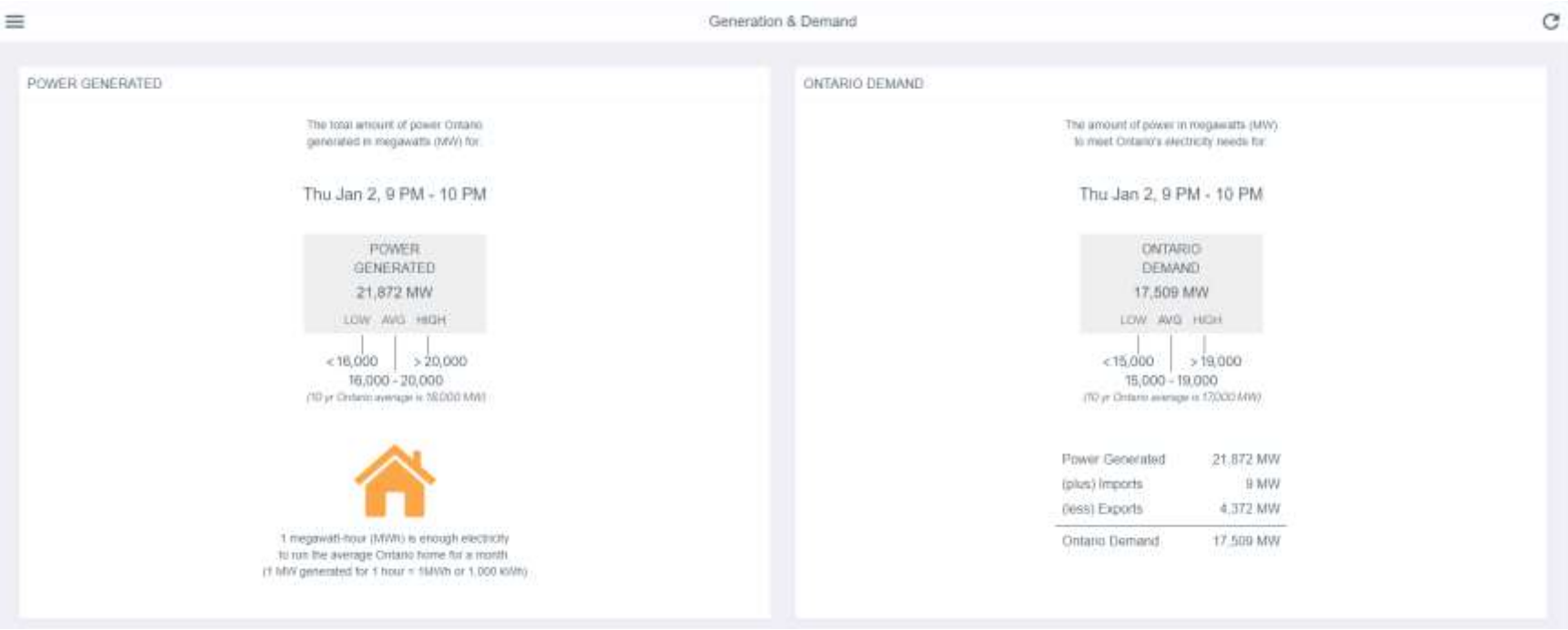


How to apply in energy planning

- ❑ **Informed decision-making**: Monitor grid conditions to identify optimal times for energy-intensive operations, reducing environmental impact.
- ❑ **Energy mix awareness**: Use insights on fossil fuel versus renewable reliance to guide long-term energy strategies.

TAB 3: TOTAL INSTALLED CAPACITY AND SUPPLY MIX

This tab provides real-time data on Ontario's electricity generation and demand, highlighting total power generated and consumed across the grid. It also offers insights into supply and demand trends to help communities better understand the province's energy capacity.



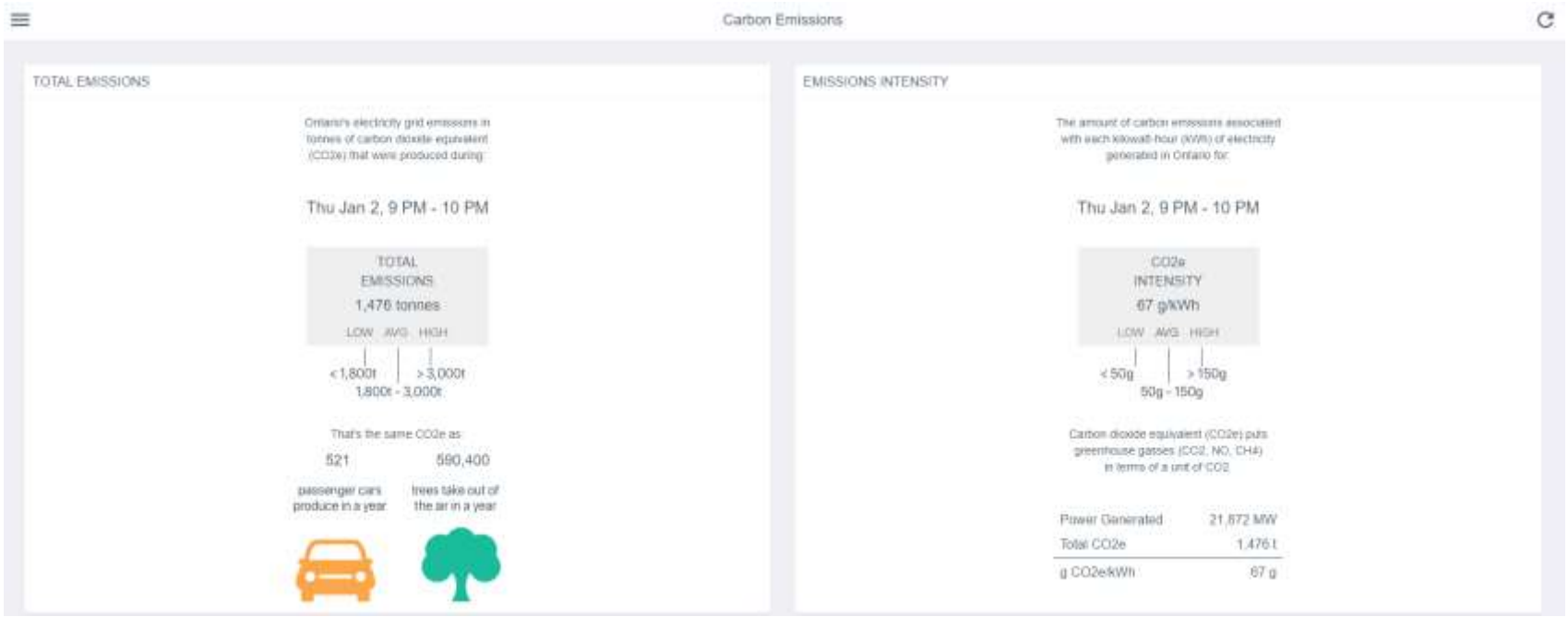
How to apply in energy planning

- ❑ **Capacity insights**: Understand provincial generation capacity and identify opportunities for local energy projects.
- ❑ **Distributed generation**: Explore potential for small-scale systems like solar panels or wind turbines to reduce reliance on centralized grids.

TAB 4: TOTAL EMISSIONS AND CARBON INTENSITY

This tab provides real-time data on Ontario's electricity grid emissions, including:

- **Total Emissions**: Carbon dioxide equivalent (CO2e) emissions in tonnes during a specific time period.
- **Emissions Intensity**: CO2e emissions (grams per kilowatt-hour) linked to electricity generation.
- **Comparative Metrics**: Real-world comparisons, such as emissions equivalent to passenger vehicles or trees' carbon sequestration over a year.

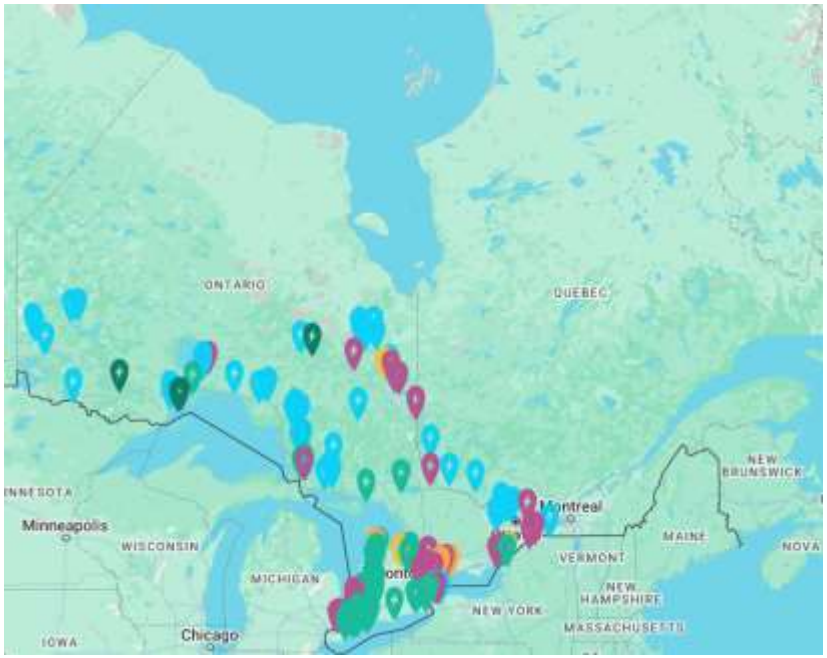


How to apply in energy planning

- ❑ **Sustainability awareness**: Use emissions data to educate communities about electricity's environmental impact and identify areas for improvement.
- ❑ **Energy-efficient practices**: Schedule energy-intensive activities during low-emission periods to minimize carbon footprints.
- ❑ **Strategic advocacy**: Leverage data to advocate for cleaner energy sources and renewable investment.
- ❑ **Community engagement**: Use relatable comparisons (e.g., cars, trees) to foster understanding and participation in sustainability efforts.

TAB 5: REGIONAL PLANT DISTRIBUTION MAP

The **GridWatch app** features an interactive map that provides an overview of Ontario's energy landscape. It highlights the geographical distribution of power generation facilities by energy type, including nuclear, hydro, solar, wind, biofuel, and gas.



How to apply in energy planning

- ❑ **Site feasibility analysis**: Assess proximity to generation facilities to determine grid connection or the potential for local energy projects.
- ❑ **Resource availability**: Identify nearby renewable resources to support localized energy planning and sustainability efforts.

TAB 6: TOTAL CAPACITY AND SUPPLY MIX OVERVIEW

This tab offers an overview of Ontario's installed electricity generation capacity and supply mix:

- **Installed capacity**: Displays total generation capacity (MW) across energy sources (nuclear, gas, hydro, wind, biofuel, solar), with contributions shown as percentages.
- **Supply mix**: Explains how electricity sources are used dynamically to meet daily energy demands, including embedded generation like solar and wind.
- **Embedded generation**: Highlights smaller, localized sources (e.g., combined heat and power systems, biofuel plants) that reduce grid congestion and support renewables.

How to apply in energy planning

- ❑ **Energy diversity awareness**: Understand the grid's renewable vs. non-renewable mix to assess environmental impacts.
- ❑ **Infrastructure planning**: Identify areas to expand renewable capacity (e.g., solar or wind projects) to enhance sustainability.
- ❑ **Community energy projects**: Explore embedded generation options (e.g., local solar or wind) to improve resilience and independence.

3. Practical energy systems for First Nations communities in Ontario

First Nations communities in Ontario are increasingly adopting modern energy technologies to achieve energy independence, reduce costs, and transition away from traditional energy sources like diesel. Systems such as heat pumps, energy recovery ventilators (ERVs), smart thermostats, and solar panels offer sustainable solutions tailored to community needs, fostering environmental stewardship and long-term resilience.

Successful implementation of these technologies requires more than installation. Ensuring that community citizens have the knowledge and tools to operate and maintain these systems is critical. Proper usage and upkeep not only enhance device lifespans but also maximize efficiency and cost savings. For instance, maintaining clean filters in heat pumps and ERVs or optimizing smart thermostat settings can significantly lower energy consumption and expenses.

This section outlines various energy systems, explaining how they work, their applications, benefits, available rebate programs, and essential maintenance practices to ensure their long-term effectiveness in First Nations communities.

3.1 Heat Pumps

Heat pumps are energy-efficient systems for heating and cooling, transferring heat between indoor and outdoor spaces without combustion. They offer significant energy savings, making them an excellent choice for First Nations communities aiming to reduce costs and environmental impacts[7].

Types of Heat Pumps

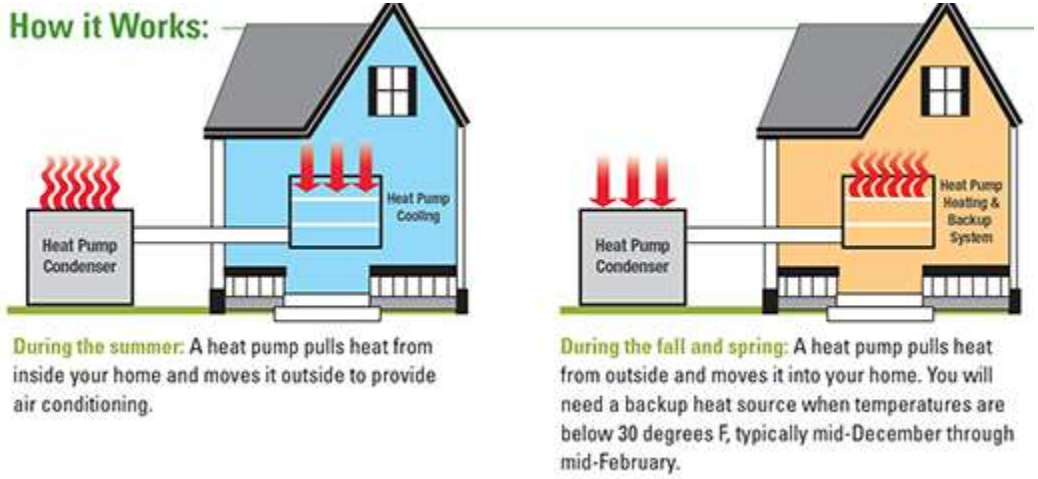
A) Cold Climate Air Source Heat Pumps (CC-ASHP)

These systems extract heat from the air, even in cold climates, and transfer it indoors. They are specifically designed to operate efficiently in extreme temperatures as low as -25°C.

[7] Natural Resources Canada. (2023). *Energy Efficiency with Heat Pumps*. Retrieved from https://natural-resources.canada.ca/energy-efficiency/electric-heat-pumps/25587

How it works

CC-ASHPs use a refrigeration cycle, including a compressor, evaporator, and condenser, to extract heat from outdoor air. During summer, the process reverses to expel heat, providing cooling[8].



Performance and operating conditions

- Operate efficiently in temperatures as low as -25°C with reduced efficiency below that range.
- Best suited for moderate to cold climates where outdoor air remains a viable heat source[9].

Applications

- **Residential**: Heating and cooling for homes.
- **Supplemental Heating**: Ideal for homes with existing electric or propane heating systems.

[8] Natural Resources Canada. (2023). *Electric Heat Pumps*. Retrieved from: https://natural-resources.canada.ca/energy-efficiency/electric-heat-pumps/heat-pump-basics/25589
[9] Enercare. (2023). *How Heat Pumps Work*. Retrieved from https://www.enercare.ca/cooling/heat-pump

Benefits	Limitations
Reduces energy consumption by up to 50% compared to traditional heating systems[10].	High upfront installation costs, although rebates help mitigate these[11].
Dual functionality for heating and cooling.	Reduced efficiency in temperatures below -20°C without supplemental heating[12].
Environmentally friendly, especially when paired with renewable energy sources like solar panels[13].	

Rebate programs

- Up to $7,500 through the Canada Greener Homes Grant[14].
- Additional provincial rebates may apply.

Maintenance

- Replace or clean filters every 1–3 months to ensure efficient airflow and maintain indoor air quality[15].
- Schedule annual servicing for refrigerant checks, coil cleaning, and system optimization to prevent malfunctions and maximize efficiency[16].
- Clear debris from outdoor units to avoid obstructions that can impact airflow and reduce system performance[17].
- For more detailed guidance on heat pump operation and maintenance, visit: Natural Resources Canada - Heat Pumps.

B) Ground Source Heat Pumps (GSHP)

These systems extract heat from the ground using underground pipes filled with a heat transfer fluid, making them more stable in extreme weather conditions.

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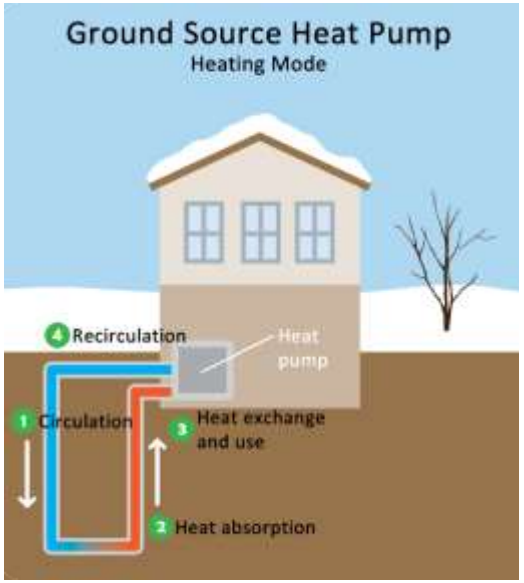
[10] Natural Resources Canada. (2023). *Energy Efficiency with Heat Pumps*. Retrieved from https://natural-resources.canada.ca/energy-efficiency/electric-heat-pumps/25587
[11] Save on Energy. (2023). *Air Source Heat Pumps*. Retrieved from https://saveonenergy.ca/For-Your-Home/Energy-Affordability-Program/Air-Source-Heat-Pumps
[12] Enercare. (2023). *How Heat Pumps Work*. Retrieved from https://www.enercare.ca/cooling/heat-pump
[13] Save on Energy. (2023). *Air Source Heat Pumps*. Retrieved from https://saveonenergy.ca/For-Your-Home/Energy-Affordability-Program/Air-Source-Heat-Pumps
[14] Save on Energy. (2023). *Home Renovation Savings Program*. Retrieved from https://saveonenergy.ca/For-Your-Home/Home-Renovation-Savings
[15] Natural Resources Canada. (2023). *Energy Efficiency with Heat Pumps*. Retrieved from https://natural-resources.canada.ca/energy-efficiency/electric-heat-pumps/25587
[16] Enercare. (2023). *How Heat Pumps Work*. Retrieved from https://www.enercare.ca/cooling/heat-pump
[17] Save on Energy. (2023). *Air Source Heat Pumps*. Retrieved from https://saveonenergy.ca/For-Your-Home/Energy-Affordability-Program/Air-Source-Heat-Pumps

How it works

GSHPs rely on geothermal energy, using buried loops to absorb or expel heat. They provide consistent heating and cooling regardless of outdoor air temperature[18].



Performance and operating conditions

- Operate efficiently year-round, unaffected by outdoor temperature fluctuations.
- Suitable for all climates, particularly areas with long winters or high heating needs[19].

Applications

- **Residential and commercial**: Heating, cooling, and water heating for large spaces.
- **Off-grid systems**: Ideal for remote or rural locations with limited energy infrastructure.

Benefits	Limitations
Higher energy efficiency compared to air source systems.	Higher upfront costs due to the need for excavation and installation of ground loops.
Long lifespan of 20+ years for underground components.	Longer payback period compared to CC-ASHPs[20].
Stable performance in extreme weather conditions[21].	

Rebate programs

- Home Renovation Savings Program offers up to $12,000 through the Canada Greener Homes Grant[22].
- Enbridge Home Efficiency Rebate Plus provides incentives for GSHP installations[23].

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[18] Natural Resources Canada. (2023). *Electric Heat Pumps*. Retrieved from: https://natural-resources.canada.ca/energy-efficiency/electric-heat-pumps/heat-pump-basics/25589
[19] Natural Resources Canada. (2018). *Ground Source Heat Pumps*. Retrieved from https://natural-resources.canada.ca/energy-efficiency/products/heating-equipment-for-residential-use/ground-source-heat-pumps/16028
[20] Natural Resources Canada. (2018). *Ground Source Heat Pumps*. Retrieved from https://natural-resources.canada.ca/energy-efficiency/products/heating-equipment-for-residential-use/ground-source-heat-pumps/16028
[21] Natural Resources Canada. (2023). *Electric Heat Pumps*. Retrieved from: https://natural-resources.canada.ca/energy-efficiency/electric-heat-pumps/heat-pump-basics/25589
[22] Save on Energy. (2023). *Home Renovation Savings Program*. Retrieved from https://saveonenergy.ca/For-Your-Home/Home-Renovation-Savings
[23] Enbridge Gas. (2023). *Home Efficiency Rebate Plus*. Retrieved from https://www.enbridgegas.com/ontario/rebates-energy-conservation/home-efficiency-rebate-plus

Maintenance

- Annual system inspection, including heat pump performance and ground loop integrity.
- Periodic cleaning of heat exchangers and fluid checks[24].

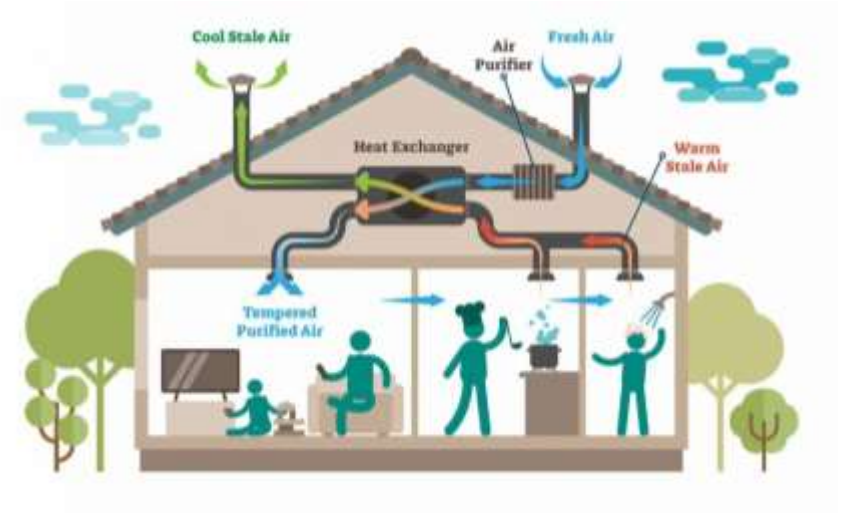
3.2 Energy Recovery Ventilators (ERVs) and Heat Recovery Ventilators (HRVs)

Energy Recovery Ventilators (ERVs) and Heat Recovery Ventilators (HRVs) are systems designed to improve indoor air quality by exchanging stale indoor air with fresh outdoor air while recovering energy. ERVs transfer both heat and moisture, making them ideal for homes in climates with high humidity. HRVs focus solely on heat transfer, which is better suited for colder, drier climates[25].

How They Work

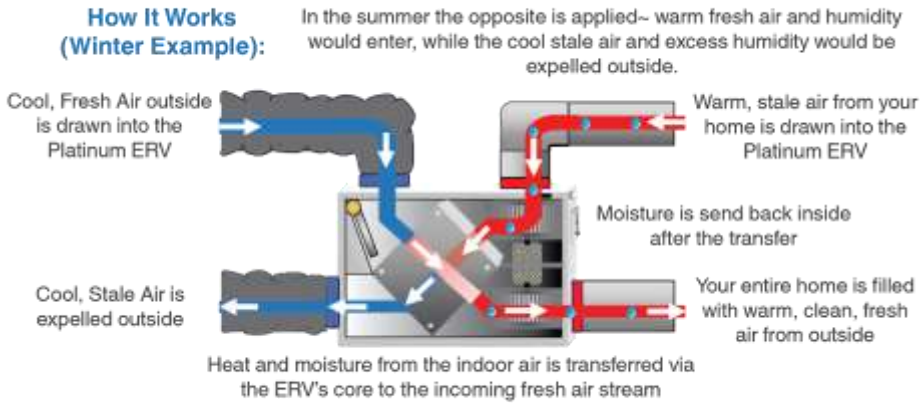
Both systems use a heat exchanger to transfer energy between incoming and outgoing air streams:

- **ERVs** recover heat and moisture, balancing indoor humidity and reducing heating/cooling loads.



[24] Evolved Thermal. (2022). *What maintenance is needed on a geothermal heat pump?* Retrieved from https://evolvedthermal.com/what-maintenance-is-needed-on-a-geothermal-heat-pump/
[25] HVAC.com. (n.d.). *Energy Recovery Ventilators vs. Heat Recovery Ventilators.* Retrieved from https://www.hvac.com/expert-advice/energy-recovery-ventilators-vs-heat-recovery-ventilators/

- **HRVs** recover only heat, reducing energy demands during cold weather.



Placement

- **Unit Location**:
  - Install in a mechanical or utility room, away from living spaces to reduce noise.
  - Ensure the unit is easily accessible for maintenance, such as filter replacement and cleaning[26].
- **Outdoor Vents**:
  - Position the intake vent away from pollution sources like chimneys or vehicle exhaust.
  - Ensure the exhaust vent is not near windows or doors to avoid recirculating stale air.
- **Ductwork**:
  - Use insulated ducts in unconditioned spaces (e.g., basements or attics) to prevent energy loss[27].

Performance and operating conditions

ERVs (Energy Recovery Ventilators)

Energy recovery ventilators (ERVs) are a type of HRV that can exchange both heat and moisture.

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[26] Fine Homebuilding. (2015). *Ducting HRVs and ERVs.* Retrieved from https://www.finehomebuilding.com/project-guides/energy-retrofit/ducting-hrvs-and-ervs
[27] Panasonic. (2025). *Energy Recovery Ventilators (ERVs).* Retrieved from https://iaq.na.panasonic.com/erv

- **Moisture control:** An ERV can give you more control over moisture levels in your home during warm and humid weather, by keeping excess moisture out of your home. Because less energy is required to lower the temperature of dry air compared to moist air, an ERV can reduce the work your air conditioner needs to do and save you money.
- **Moisture recovery:** If your winter climate is extremely dry, ERVs recover some of the moisture that would leave your house through a regular HRV. This helps you maintain a comfortable humidity level within your home, avoiding static electricity, sore throats and other discomforts caused by air that is too dry[28].

HRVs (Heat Recovery Ventilators)

- A heat recovery ventilator (HRV) is a ventilation device that helps make your home healthier, cleaner, and more comfortable by continuously replacing stale indoor air with fresh outdoor air. New homes built since 1977 are more airtight, which helps save energy but can make the inside air stale. To complement this airtightness, modern homes use HRVs to distribute fresh air throughout the house.
- **Recovering the heat:** During the heating season, the HRV captures heat from the stale air leaving your house and uses it to preheat the fresh air coming into your house. Similarly, an HRV can reverse this process during the cooling season, removing some of the heat from the incoming air and transferring it to the outgoing air[29].

Benefits	Limitations
ERVs: • Recover up to 80% of exhaust air energy[30]. • Maintain balanced indoor humidity and improve comfort[31].	Higher initial costs compared to traditional ventilation systems.
HRVs: • Prevent excessive moisture buildup in colder climates[32].	Regular maintenance is required, including filter and heat exchanger cleaning[34].

[28] Natural Resources Canada. (2022). *Heat/Energy Recovery Ventilators.* Retrieved from https://natural-resources.canada.ca/energy-efficiency/products/cooling-and-ventilating-equipment-for-residential-use/heatenergy-recovery-ventilators/16197
[29] Natural Resources Canada. (2022). *Heat/Energy Recovery Ventilators.* Retrieved from https://natural-resources.canada.ca/energy-efficiency/products/cooling-and-ventilating-equipment-for-residential-use/heatenergy-recovery-ventilators/16197
[30] Natural Resources Canada. (2023). *Heat/Energy Recovery Ventilators*. Retrieved from https://natural-resources.canada.ca/energy-efficiency/products/cooling-and-ventilating-equipment-for-residential-use/heatenergy-recovery-ventilators/16197
[31] Enercare. (2023). *How to Maintain Your ERV or HRV for Optimal Performance*. Retrieved from https://www.enercare.ca
[32] Natural Resources Canada. (2023). *Heat/Energy Recovery Ventilators*. Retrieved from https://natural-resources.canada.ca/energy-efficiency/products/cooling-and-ventilating-equipment-for-residential-use/heatenergy-recovery-ventilators/16197
[34] Enercare. (2023). *How to Maintain Your ERV or HRV for Optimal Performance*. Retrieved from https://www.enercare.ca

• Reduce heating and cooling costs by recovering heat from exhaust air[33].	

Rebate programs

Canada Greener Homes Grant:

- Provides rebates for ventilation system upgrades, including ERVs and HRVs, as part of energy-efficient retrofits[35].
- Rebates cover a portion of the cost for installing energy recovery or heat recovery ventilators.

Enbridge Gas Home Efficiency Rebate Plus:

- Offers rebates for ERVs and HRVs when included in larger home energy retrofit projects[36].
- Eligibility is contingent on a home energy audit and meeting specific retrofit requirements.

Maintenance

Your ERV needs to be regularly maintained to keep it running efficiently. Homeowners should perform the following tasks:

- Never turn your HRV/ERV off (other than for servicing), it should always be running.
- Arrange for annual servicing by an accredited contractor. If possible, have your furnace and HRV/ERV serviced at the same time. This will reduce the inconvenience and cost of two service visits.
- Clean your unit regularly, including the air filters every 1-3 months
- Consult your owner's manual for detailed instructions[37].

[33] HVAC.com. (2023). *Energy Recovery Ventilators vs. Heat Recovery Ventilators*. Retrieved from https://www.hvac.com/expert-advice/energy-recovery-ventilators-vs-heat-recovery-ventilators/

[35] Todo Canada. (2025). *You Can Now Signup for Ontario's New Energy Efficiency Rebates for Home Renovations*. Retrieved from https://www.todocanada.ca/you-can-now-signup-for-ontarios-new-energy-efficiency-rebates-for-home-renovations/

[36] Todo Canada. (2025). *You Can Now Signup for Ontario's New Energy Efficiency Rebates for Home Renovations*. Retrieved from https://www.todocanada.ca/you-can-now-signup-for-ontarios-new-energy-efficiency-rebates-for-home-renovations/

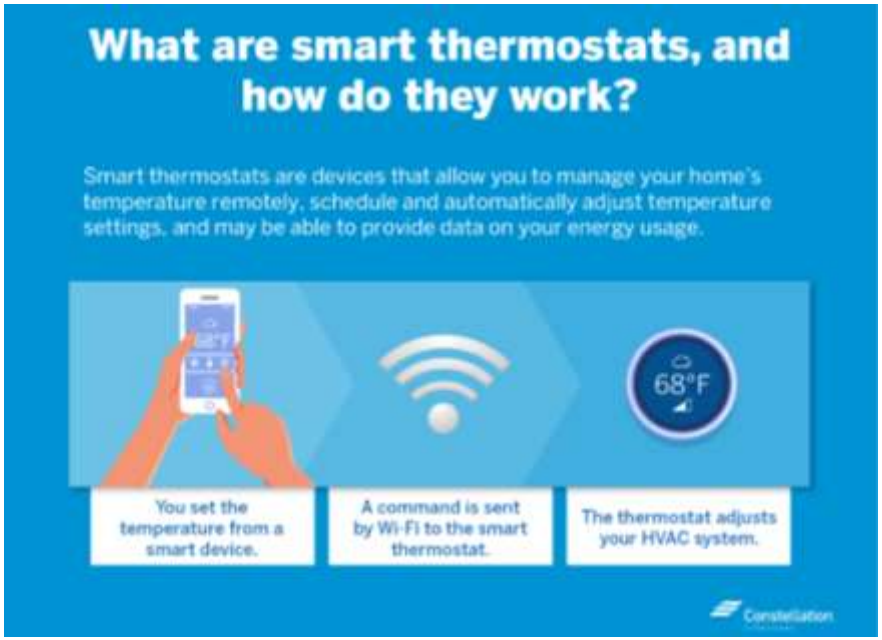
[37] Natural Resources Canada. (2022). *Heat/Energy Recovery Ventilators.* Retrieved from https://natural-resources.canada.ca/energy-efficiency/products/cooling-and-ventilating-equipment-for-residential-use/heatenergy-recovery-ventilators/16197

3.3 Smart Thermostats

A smart thermostat is a Wi-Fi-enabled device that allows for precise control of a home's heating and cooling systems. These devices can be programmed to optimize energy use based on occupancy, time of day, or preferences. Smart thermostats operate effectively in standard indoor temperatures (15°C to 30°C) and can adjust heating and cooling systems to maintain desired comfort levels year-round[38].

How it works

Smart thermostats use sensors to detect occupancy and automatically adjust temperature settings based on the presence or absence of people in the home. Users can create custom schedules or remotely control their systems via apps, ensuring optimal comfort and efficiency even when away from home[39]. Additionally, many models offer detailed energy usage reports to help users track and improve energy efficiency.



[38] Ward, Lauren. (2024). *Everything to Know About Smart Thermostats*. This Old House. Retrieved from https://www.thisoldhouse.com/smart-homes/21097136/everything-to-know-about-smart-thermostats

[39] Ayes, Rayn. (2024). *What Are Smart Thermostats and How Do They Work?* Retrieved from https://www.carrier.com/residential/en/us/products/thermostats/smart-thermostats/what-are-they-how-do-they-work/

Placement

Select an optimal location on an interior wall away from direct sunlight, drafts, doorways, and windows. The spot should provide consistent temperature reading[40].

Applications

- Suitable for residential homes and community facilities to optimize HVAC systems.

Performance and operating conditions

- Perform well in homes with Wi-Fi connectivity and modern HVAC systems.
- Depend on the compatibility with heating/cooling systems (e.g., multi-stage systems, heat pumps).
- Indoor temperatures need to remain within HVAC operating limits for consistent performance.

Benefits	Limitations
Reduces heating and cooling costs by up to 15% by optimizing system performance[41].	Requires a reliable internet connection for full functionality.
Control your thermostat from anywhere via smartphone apps or voice assistants[42].	May not work with older HVAC systems, requiring upgrades or additional components[43].
Provides detailed reports on energy usage, helping users identify inefficiencies and potential savings[44].	Some users may find advanced features difficult to set up and fully utilize.
Allows users to program specific settings for different times of the day or week to suit their lifestyle.	

[40] Enercare (2024). *How Smart Thermostats Work and Placement Tips*. Retrieved from https://www.enercare.ca/ecobee-smart-home-solutions
[41] Power Efficiency. (2024). *Pros and Cons of Smart Thermostat.* Retrieved from https://powerefficiency.com/pros-and-cons-of-smart-thermostat/
[42] Power Efficiency. (2024). *Pros and Cons of Smart Thermostat.* Retrieved from https://powerefficiency.com/pros-and-cons-of-smart-thermostat/
[43] Power Efficiency. (2024). *Pros and Cons of Smart Thermostat.* Retrieved from https://powerefficiency.com/pros-and-cons-of-smart-thermostat/
[44] Power Efficiency. (2024). *Pros and Cons of Smart Thermostat.* Retrieved from https://powerefficiency.com/pros-and-cons-of-smart-thermostat/

Rebate Programs

- **Save on Energy Smart Thermostat Rebate:** Up to $75 for eligible thermostats[45].

Maintenance

- Dust and debris can accumulate on the thermostat's sensors and screen. Clean the device gently with a microfiber cloth every few months to ensure optimal performance.
- Regularly check for and install firmware updates via the app or thermostat settings to improve functionality and security.
- Ensure the thermostat is connected to Wi-Fi to avoid disruptions in remote control capabilities and energy-saving features.
- For models with backup batteries, replace them annually or as needed to maintain uninterrupted operation[46].

[45] Save on Energy. (2025). *Home Renovation Savings Program*. Retrieved from https://saveonenergy.ca/For-Your-Home/Home-Renovation-Savings
[46] Jones, Marcus P.(2023). *Thermostat Maintenance: Frequency and Costs*. Retrieved from https://smartlivingway.com/thermostat-maintenance-frequency-and-costs/

4. Ontario's energy efficiency programs and savings opportunities

Ontario's energy efficiency programs offer a transformative pathway for First Nations communities to reduce energy costs, promote environmental sustainability, and enhance energy independence. These initiatives are supported by a $10.9 billion investment over 12 years to modernize energy systems, encourage conservation, and expand access to energy-saving technologies. Programs like Save on Energy and the Canada Greener Homes Grant provide valuable incentives for upgrading to efficient systems such as heat pumps, energy recovery ventilators (ERVs), and smart thermostats, while reducing reliance on traditional energy sources like diesel[47][48][49]. By leveraging these opportunities, First Nations can not only achieve significant cost savings but also advance local energy sovereignty and create community-based economic opportunities.

4.1 Key programs

PROGRAM NAME	DETAILS	MORE INFORMATION
Home Renovation Savings Program	Launching January 28, 2025, this program offers rebates of up to 30% for upgrades like windows, doors, insulation, heat pumps, smart thermostats, rooftop solar panels, and battery storage.	Save on Energy - Home Renovation Savings Program https://www.saveonenergy.ca/homerenovationsavings Home Renovation Savings Program | Ontario | Enbridge Gas https://www.enbridgegas.com/homerenovationsavings
Peak Perks Program	Aimed at small businesses, this program offers $75 upon enrollment and $20 annually for each eligible smart thermostat connected to central air or heat pump systems.	Save on Energy https://www.saveonenergy.ca/
Save on Energy Programs	Existing programs offering incentives for energy-efficient upgrades for low-income households, municipalities, on-reserve communities, and agricultural sectors.	Save on Energy Programs https://www.saveonenergy.ca/
Affordable Energy Act Expansion	Ensures rebates are extended to homeowners using propane and oil for heating, making these	Ontario Government - Affordable Energy Act https://www.ontario.ca/page/manage-energy-costs-your-home

[47] Natural Resources Canada. (2023). *Canada Greener Homes Grant: Save energy and reduce costs.* Retrieved from https://www.nrcan.gc.ca/energy-efficiency/homes/canada-greener-homes-grant/23441

[48] Save on Energy. (2023). *Home Renovation Savings Programs.* Retrieved from https://saveonenergy.ca/For-Your-Home/Home-Renovation-Savings

[49] Government of Ontario. (2023). *Investing in Ontario's Clean Energy Future.* Retrieved from https://www.ontario.ca/page/energy-efficiency-programs

	programs more accessible to First Nations communities.	
Additional Information	Visit the Ontario government's resources for more details:	Manage Energy Costs for Homes Manage Energy Costs for Businesses Ontario's Affordable Energy Future

4.2 Eligible energy upgrades and rebates

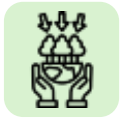
UPGRADE	REBATE DETAILS	REFERENCES
Windows and doors	Up to 30% rebate for replacing inefficient windows and doors.	Ontario Home Renovation Savings Program https://www.enbridgegas.com/homerenovationsavings
Insulation and air sealing	Rebates for improving home insulation and sealing to prevent energy loss.	Save on Energy Home Renovation Savings Program https://www.saveonenergy.ca/homerenovationsavings
Heat pumps	Incentives for installing high-efficiency air-source, ground-source, or hybrid heat pumps.	Canada Greener Homes Grant https://www.nrcan.gc.ca/energy-efficiency/homes/canada-greener-homes-grant/23441
Smart thermostats	Financial incentives of up to $75 for installing Wi-Fi-enabled thermostats.	Peak Perks Program - Save on Energy https://www.saveonenergy.ca/
Solar panels and battery storage	Rebates for rooftop solar panel installations and energy storage systems.	Affordable Energy Act Expansion https://www.ontario.ca/page/manage-energy-costs-your-home

4.3 Benefits for First Nations communities

Energy cost reductions: By participating in these programs, households and businesses can significantly lower energy bills and reduce reliance on costly diesel or propane systems.

Increased accessibility: Rebates are now extended to homeowners using propane and oil heating systems.

Economic opportunities: The Home Renovation Savings Program creates job opportunities for local contractors, electricians, and HVAC professionals within First Nations communities.



Environmental impact: Access to solar panels, battery storage, and energy-efficient technologies aligns with First Nations' cultural values of sustainability

4.4 Challenges and solutions in accessing programs

While energy efficiency programs offer transformative opportunities for First Nations communities, accessing these programs can present certain challenges:

- **Eligibility requirements**: Strict eligibility criteria, such as income thresholds or specific project guidelines, can exclude some applicants.
- **Geographic limitations**: Remote or rural communities may face difficulties accessing contractors, services, or materials required to implement upgrades.
- **Application complexities**: Navigating paperwork and technical requirements for funding applications can be time-intensive and overwhelming.

To overcome these barriers, communities are encouraged to:

- **Leverage support from Technical Advisors**: Organizations like the Ontario First Nations Technical Services Corporation (OFNTSC) and Indigenous Clean Energy (ICE) offer guidance to navigate eligibility requirements and simplify application processes.
- **Utilize local resources**: Partner with local contractors, utility providers, and community organizations to develop feasible projects and streamline material acquisition.
- **Applications guidance**: Work with program administrators to organize community-accessible workshops to clarify funding opportunities.

By addressing these barriers, communities can maximize the benefits of energy efficiency programs, ensuring more equitable access and long-term success.

5. Financial resources and support for First Nations energy projects

Access to financial and technical resources is key to supporting First Nations energy initiatives. This section outlines banks, funding programs, and technical partnerships tailored to meet community needs.

5.1 National banks and financial institutions

BANK/INSTITUTION	CATEGORY	WEBSITE	CONTACT INFORMATION
Royal Bank of Canada (RBC)	Indigenous financial services	https://www.rbc.com/indigenous/	1-800-769-2511 (Customer Care)
Toronto-Dominion Bank (TD)	Indigenous banking group	https://www.td.com/ca/en/personal-banking/indigenous	1-866-222-3456
Bank of Montreal (BMO)	Indigenous Partnerships and Services	https://www.bmo.com/main/business/indigenous-banking/	1-877-225-5266
Canadian Imperial Bank of Commerce (CIBC)	Indigenous markets group	https://www.cibc.com/en/business/indigenous-banking.html	1-888-947-9025
Scotiabank	Indigenous Banking Services	https://www.scotiabank.com/indigenous	1-800-472-6842

5.2 Indigenous-specific financial institutions

INSTITUTION	DESCRIPTION	WEBSITE	CONTACT INFORMATION
First Nations Bank of Canada (FNBC)	A Canadian chartered bank focused on Indigenous communities.	https://www.fnbc.ca	Phone: 1-888-454-3622
Aboriginal Financial Institutions (AFIs)	A network providing loans and financial support to Indigenous entrepreneurs.	https://nacca.ca	Contact through website
First Nations Finance Authority (FNFA)	Provides financing for infrastructure and economic development.	https://fnfa.ca	Phone: 1-250-768-5253

5.3 Programs and funds

PROGRAM/FUND	DESCRIPTION	ELIGIBILITY	WEBSITE
Canada Infrastructure Bank (CIB)	Indigenous Infrastructure Initiative for clean energy projects.	Open to First Nations and Métis communities.	https://cib-bic.ca/en/indigenous-community/
Clean Energy for Rural and Remote Communities (CERRC)	Supports renewable energy projects in Indigenous communities to reduce diesel reliance.	First Nations in remote communities.	https://natural-resources.canada.ca/reducingdiesel
Indigenous Services Canada (ISC)	Provides funding for capital and infrastructure projects.	Open to Indigenous communities.	https://www.canada.ca/en/environment-climate-change/services/climate-change/low-carbon-economy-fund/indigenous-leadership.html
Aboriginal Loan Guarantee Program (ALGP)	Supports Indigenous participation in renewable energy and transmission projects by providing loan guarantees for up to 75% of an Indigenous entity's equity investment.	Indigenous communities and businesses with equity stakes in renewable energy projects.	https://www.ofina.on.ca/algp
Smart Renewables and Electrification Pathways (SREPs)	Supports renewable energy and grid modernization projects to enhance the integration of clean energy solutions, reduce greenhouse gas emissions, and improve energy security in Indigenous and remote communities.	Open to Indigenous communities, utilities, and project developers leading renewable energy initiatives.	https://natural-resources.canada.ca/climate-change/green-infrastructure-programs/sreps/23566
Indigenous Community Capital Grants Program (ICCGP)	Provides funding for feasibility studies, design, and construction of community infrastructure	Open to First Nations, Métis, and Inuit communities for capital or infrastructure projects.	https://www.ontario.ca/page/indigenous-economic-development-fund

	projects, including those related to energy.		
New Relationship Fund (NRF)	Assists First Nations and Métis communities in building consultation and engagement capacity, which can be applied to energy project planning.	Indigenous communities looking to develop consultation and engagement capacity.	https://www.ontario.ca/page/new-relationship-fund
Indigenous Energy Support Programs (IESP)	Offered by Ontario's Independent Electricity System Operator (IESO), these programs provide funding for energy education, capacity building, and project development support.	Open to First Nations organizations and communities participating in energy projects.	https://www.ieso.ca/en/Sector-Participants/Indigenous-Relations/Support-Programs
First Nations Community Building Retrofit Program	Provides up to $100,000 in funding and technical support to improve energy efficiency in band-owned facilities.	First Nations communities and organizations managing band-owned facilities.	https://www.daisyenergy.ca/
Indigenous Economic Development Fund (IEDF)	Offers grants and financing to support economic development projects, including energy initiatives, within Indigenous communities.	Indigenous communities and organizations undertaking economic development initiatives.	https://www.ontario.ca/page/indigenous-economic-development-fund

5.4 Provincial programs

ORGANIZATION	DESCRIPTION	ELIGIBILITY	WEBSITE
Ontario's Independent Electricity System Operator (IESO)	Indigenous Energy Support Programs (IESP). Provides technical and financial assistance.	Open to Indigenous organizations.	https://www.ieso.ca/Get-Involved/Indigenous-Relations/Indigenous-Energy-Support-Program/IESP-Overview https://www.ieso.ca/en/Sector-Participants/Indigenous-Relations/Programs-and-Initiatives

5.5 Technical support and partnerships

ORGANIZATION	DESCRIPTION	WEBSITE	CONTACT PAGE
Ontario First Nations Technical Services Corporation (OFNTSC)	Provides project planning, engineering support, and training for First Nations communities.	https://ofntsc.org	https://ofntsc.org/contact-us
First Nations Power Authority (FNPA)	Assists in developing Indigenous-led power projects and partnerships.	https://fnpa.ca	https://fnpa.ca/contact-us
First Nation Power Development Inc. (FNPower)	Supports First Nations participation in the clean energy market.	https://fnpower.ca	N/A
Indigenous Clean Energy (ICE)	Provides funding programs and capacity-building for clean energy projects.	https://indigenouscleanenergy.com	N/A

5.6 Additional resources

RESOURCE	DESCRIPTION	WEBSITE
Environment and Climate Change Canada (ECCC)	Programs for renewable energy under climate initiatives.	https://www.canada.ca/en/environment-climate-change.html

6. Key organizations and resources for First Nations energy and infrastructure projects in Ontario

This section highlights key organizations, consulting firms, and project developers specializing in energy and infrastructure initiatives with First Nations communities in Ontario. These groups provide essential expertise in renewable energy, infrastructure development, and advocacy, enabling communities to achieve energy independence and sustainability.

Each table is categorized by service type, making it easier for communities to quickly find relevant resources, contact details, and services. Use this section as a guide to connect with experienced professionals who can support your energy and infrastructure goals.

6.1 Energy consulting

ORGANIZATION	WEBSITE	CONTACT INFORMATION	SERVICES
Compass Energy Consulting	https://compassenergyconsulting.ca/	Tel.: (647) 812-7320	Renewable energy consulting, risk assessment.
Indigenous Clean Energy (ICE)	https://indigenouscleanenergy.com/	Tel.: (613) 416-9300 ext. 700 Email: info@indigenouscleanenergy.com	Clean energy capacity-building and funding programs.
Minogi	https://minogi.ca/	Tel.: (905) 985-3337 ext. 700 Or 1-800-647-8454 ext. 700	Clean energy consulting, infrastructure development.
Oshkaabewis Engineering and Consulting	https://www.oshkaabewis.ca/	Tel.: (249) 225-8088 Email: info@oshkaabewis.ca	Energy modeling, renewable energy systems design, feasibility studies.
Rise Consulting	https://riseconsultingltd.ca/	info@riseconsultingltd.ca or contact through their webform at: https://riseconsultingltd.ca/contact-us/	• Sustainability and ESG strategy development • Guidance on UN initiatives such as UNDRIP, SDGs, and PRI, with a focus on Indigenous inclusion in ESG strategies • Expertise in governance, risk management, regulatory compliance,

			workplace safety, and climate change policy
Tatâga Inc.	https://www.tataga.ca/	Contact through their webform at: https://www.tataga.ca/contact	ESG advisory, economic development, anti-oppression training.

6.2 Engineering and infrastructure

ORGANIZATION	WEBSITE	CONTACT INFORMATION	SERVICES
Crozier Consulting Engineers	https://www.cfcrozier.ca/our-markets/first-nations/	Tel.: (416) 477-3392	Infrastructure engineering, construction management.
First Nations Engineering Services Ltd. (FNESL)	http://www.fnesl.ca/	Tel.: (519) 445-0040	Water systems, wastewater systems, land development.
Neegan Burnside Ltd.	https://www.neeganburnside.com/	Tel.: 1-800-595-9149 Email: info@neeganburnside.com	Feasibility studies, energy audits, community energy plans.
Saulteaux Consulting & Engineering	https://sceinc.ca/	Tel.: 807 274 7114 Email: jmattson@sceinc.ca	Renewable energy integration, project coordination, contract administration.
SOAR Professional Services	https://www.soarps.ca/	Tel.: 416.229.4646 Email: itoso@dillon.ca info@soarps.com	Planning, engineering, environmental science, management consulting.
Nibi Bamijkewin	https://nibibamijkewin.ca/	Tel.: (807) 863-0101 Email: inquiries@nibibamijkewin.ca	Expertise in permitting, water treatment optimization, and forestry-related services

6.3 Clean energy partnerships

ORGANIZATION	WEBSITE	CONTACT INFORMATION	SERVICES
Ontario Power Generation (OPG)	https://www.opg.com/about-us/our-commitments/indigenous-relations/	Tel.: (416) 592-2555	Renewable energy development, hydroelectric projects.
Wataynikaneyap Power	https://www.wataypower.ca/	Tel.: (807) 577-5955 ext. 117 Email: watayinquiries@wataypower.ca Community members of the Project's 24 First Nation owner communities are also invited to call (807)-577-5955 ext. 117 for questions or concerns.	Transmission and distribution systems, renewable energy projects.
Noozhoo Nokiiyan Limited Partnership (NNLP)	https://nnlp.ca/about	Tel.: (905) 985-1661	Infrastructure development partnerships.
Social Energy and Infrastructure	https://www.socialenergy.ca/	Contact through their webform at: https://www.socialenergy.ca/contact	• Renewable energy development • Solar energy solutions • Community-focused clean energy initiatives
Creative Fire Consulting	https://creative-fire.com/	Tel.: +1 306-934-3337 Email: hello@creative-fire.com	• Sustainability strategy • ESG materiality assessment • ESG goal setting • ESG reporting
The Firelight Group	https://firelight.ca/	Tel.: (778) 851-0264 Email: info@firelight.ca	• Research services, environmental

			assessments, Indigenous knowledge studies
Coral Rapids Power	https://coralrapidspower.com	Tel.: (705) 272-1148 Email: info@coralrapidspower.com	• First Nations-led hydroelectric development, renewable energy projects, infrastructure partnerships

6.4 Advocacy and policy support

ORGANIZATION	WEBSITE	CONTACT INFORMATION	SERVICES
Ontario Sustainable Energy Association (OSEA)	https://ontario-sea.org/	Tel.: (416) 493-9232 Email: info@ontario-sea.org	Advocacy for community energy, development of sustainable energy projects.
Miikana Consulting	https://miikana.ca/	Tel.: 1-833-497-8423	Indigenous strategy, governance consulting, leadership development.
CREE8ive Advisory	https://cree8iveadvisory.com/	Email: admin@cree8iveadvisory.com Or contact through their webform at https://cree8iveadvisory.com/contact-us	Strategic planning, capacity building, communication consulting.
Williams Consulting and Management services	https://williamsconsulting.ca/	**Work:** 905 485 1800 **Toll-Free:** (855) 728-4367 **Cell:** (587) 284-4029 **Fax:** (587) 317-7338 Email: andrea@williamsconsulting.ca	Policy reviews, community development, and environmental scanning services

CHIEFS OF ONTARIO

FIRST NATIONS ENERGY TOOLKIT

Toolkit 3: Case studies and best practices for First Nations energy projects

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https://chiefs-of-ontario.org/

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Toolkit 3: Case studies and best practices for First Nations energy projects

Purpose and overview

Toolkit 3 is designed to inspire and guide First Nations communities by showcasing real-world examples of successful energy projects. It highlights case studies, proven strategies, and best practices that combine environmental stewardship, energy independence, and economic resilience. This toolkit empowers communities to replicate or adapt innovative energy solutions while addressing their unique cultural, geographic, and energy needs.

Key insights

- **Proven pathways to success**: Case studies of impactful projects, such as the Oneida Energy Storage Facility and Wataynikaneyap Power Project, demonstrating solutions to challenges like energy sovereignty, economic development, and emissions reduction.
- **Practical applications**: Examples of how communities have implemented solar, wind, and bioenergy projects, showcasing actionable steps and lessons learned.
- **Knowledge transfer and decision-making**: Insights into overcoming barriers, building partnerships, and enhancing community-driven energy initiatives.
- **Community engagement**: Strategies to foster collaboration, inspire action, and build leadership capacity.

How to use this toolkit

Toolkit 3 is a resource for community leaders, energy champions, and decision-makers to:

1. **Explore regional context**: Explore regional energy opportunities and challenges in **Northern and Southern Ontario**, considering geographic, economic, and social factors to inform your approach.
2. **Examine case studies**: Learn from detailed examples of First Nations-led renewable energy projects. Each case study highlights successes, challenges, and solutions, offering actionable insights.
3. **Apply best practices**: Use lessons from other communities to overcome barriers like funding or infrastructure limitations, engage stakeholders effectively, and build leadership and capacity within your community.
4. **Integrate with other toolkits**: *Toolkit 1*: Foundational energy knowledge and advocacy skills and *Toolkit 2*: Practical community-based energy solutions.

1. Why case studies and best practices matter for First Nations

First Nations in Canada are at the forefront of adopting renewable energy solutions that align with their cultural values, economic aspirations, and commitment to environmental stewardship. These communities exemplify how innovative energy approaches can harmonize sustainability with local economic development, driving transformative change at the community level[1]. Examining case studies allows First Nations to gain insights into how others have successfully turned ambitious energy goals into practical, impactful outcomes. These success stories provide inspiration and actionable blueprints for addressing common challenges and maximizing the potential of renewable energy projects.

Importance of case studies and best practices for First Nations

Case studies and best practices are crucial for First Nations, particularly in the context of renewable energy projects. They provide valuable insights into successful governance models and community engagement strategies. For instance, the case studies of the Ojibway Pic River First Nation and the NaiKun Offshore Wind Project highlight the importance of participatory governance and community control in renewable energy projects. These examples demonstrate how inclusive planning and community ownership can lead to sustainable energy futures that align with the long-term visions of First Nations[2]. Additionally, the case study of Poplar Hill First Nation illustrates the complexities of energy transitions in remote communities, emphasizing the need for community engagement and understanding of local contexts to achieve self-sufficiency and sustainable development[3].

Importance of case studies and best practices for energy planning

In the realm of energy planning, case studies and best practices serve as essential tools for understanding the diverse challenges and opportunities associated with transitioning to renewable energy systems. For example, the National Renewable Energy Laboratory (NREL) has identified best practices for community energy planning, which include data-driven approaches and equitable planning processes. These practices are informed by extensive experience and literature reviews, providing a framework for communities to effectively manage their energy transitions[4]. Furthermore, the analysis of local energy initiatives in Saerbeck, Germany, and Lochem, the Netherlands, underscores the significance of strategic leadership and community involvement in successful energy transitions. These best

[1] Government of Canada. (2023). Indigenous energy projects and initiatives. Retrieved from https://www.canada.ca/en/natural-resources-canada/news/2023/11/government-of-canada-announces-10-indigenous-communities-advancing-clean-energy-solutions.html

[2] Krupa, J., Galbraith, L., & Burch, S. (2015). Participatory and multi-level governance: applications to Aboriginal renewable energy projects. Local Environment, 20, 101 - 81. https://doi.org/10.1080/13549839.2013.818956

[3] Rakshit, R., Shahi, C., Smith, M., & Cornwell, A. (2019). Energy transition complexities in rural and remote Indigenous communities: a case study of Poplar Hill First Nation in northern Ontario*. Local Environment, 24, 809 - 824. https://doi.org/10.1080/13549839.2019.1648400

[4] Ross, L., & Day, M. (2022). Community Energy Planning: Best Practices and Lessons Learned in NREL's Work with Communities. https://doi.org/10.2172/1883201

practices highlight the importance of building networks, managing expectations, and facilitating learning to support local energy initiatives[5].

2. Regional energy context

The energy landscapes of Northern and Southern Ontario not only present distinct opportunities and challenges for First Nations but also align closely with Canada's broader energy strategy. Projects like the Wataynikaneyap Power Project, Oneida Energy Storage, and the Henvey Inlet Wind Farm exemplify how First Nations leadership is driving progress toward achieving the objectives of Canada's 2030 Emissions Reduction Plan, the Clean Energy for Indigenous Communities Program, and the National Net-Zero Emissions by 2050 Commitment.

These projects support federal and provincial energy policies by:

- ✓ Reducing reliance on diesel and fossil fuels, contributing to significant greenhouse gas emissions reductions.
- ✓ Strengthening Indigenous participation in renewable energy, advancing reconciliation and self-determination.
- ✓ Creating local jobs and fostering green economic development in both remote and urban settings.

By emphasizing cultural preservation, environmental stewardship, and economic resilience, these First Nations-led initiatives are not only transforming local energy systems but also setting benchmarks for meeting Canada's clean energy and net-zero goals.

2.1 Northern Ontario: Advancing energy sovereignty in remote communities

Northern Ontario is characterized by vast, sparsely populated territories and remote First Nations. These geographic realities create significant energy generation and distribution challenges, such as reliance on costly and environmentally harmful diesel generators. Despite these obstacles, Northern Ontario offers opportunities for transformative renewable energy projects that reduce emissions, enhance energy reliability, and strengthen local governance.

[5] Hoppe, T., Graf, A., Warbroek, B., Lammers, I., & Lepping, I. (2015). Local Governments Supporting Local Energy Initiatives: Lessons from the Best Practices of Saerbeck (Germany) and Lochem (The Netherlands). Sustainability, 7, 1900-1931. https://doi.org/10.3390/SU7021900

KEY CHALLENGES

1. **Reliance on diesel generators**: Many remote First Nations depend on diesel for electricity, incurring high costs and environmental impacts. For instance, Fort Severn First Nation spent a significant portion of its annual budget on diesel transportation before transitioning to solar energy[6]. Diesel reliance also increases greenhouse gas emissions, making energy alternatives critical[7].
2. **Geographical isolation**: Seasonal transportation routes, like ice roads and airstrips, limit the delivery of materials and technical expertise. The Fort Severn Solar Project overcame logistical challenges by strategically transporting solar components during accessible seasons[8]. Geographic barriers further exacerbate energy access issues, particularly in northern and remote Ontario communities.
3. **Infrastructure gaps**: Limited access to Ontario's main electricity grid has driven the adoption of localized energy solutions, such as the Wataynikaneyap Power Project, which connects remote communities to reliable energy sources[9]. Infrastructure gaps are further highlighted in reports by the Ontario Energy Board[10] and the IESO's Indigenous Energy Support Program[11].

OPPORTUNITIES AND FIRST NATIONS-LED SOLUTIONS

1. **Solar microgrids**: First Nations are demonstrating leadership in adopting solar microgrids to reduce diesel reliance and enhance energy sovereignty. Projects like the **Gull Bay Microgrid** have achieved a 25% reduction in diesel use, lowered greenhouse gas emissions, and provided consistent energy access, serving as a replicable model for other communities[12][13].

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[6] International Energy Agency. (2023). *Clean Energy for Rural and Remote Communities Program*. Retrieved from https://www.iea.org/policies/17863-canadas-clean-energy-for-rural-and-remote-communities

[7] Hedgehog Technologies. *Fort Severn Solar Project*. Retrieved from https://www.canadianconsultingengineer.com/awards/pdfs/2020/G-04_Hedgehog_FortSevernSolarProject_Entry.pdf

[8] Hedgehog Technologies. *Fort Severn Solar Project*. Retrieved from https://www.canadianconsultingengineer.com/awards/pdfs/2020/G-04_Hedgehog_FortSevernSolarProject_Entry.pdf

[9] Wataynikaneyap Power. (2024). *Wataynikaneyap Power Completes Construction of "the Line that Brings Light".* Retrieved from https://www.wataypower.ca/updates/wataynikaneyap-power-completes-construction-of-the-line-that-brings-light

[10] Ontario Energy Board. (2022). *Electricity Grid Access for Remote Communities*. Retrieved from https://www.bing.com/ck/a?!&&p=e063722a6bb14e7fbfb42494f362ed13148f37f77481330c2e092a5c39445240JmltdHM9MTczNTM0NDAwMA&ptn=3&ver=2&hsh=4&fclid=00f8b1e7-447f-6c6e-076a-a52a45d56d3d&psq=Ontario+Energy+Board.+(2022).+Electricity+Grid+Access+for+Remote+Communities&u=a1aHR0cHM6Ly93d3cucmRzLm9lYi5jYS9DTVdlYkRyYXdlci9SZWNvcmQvNzQzOTU0L0ZpbGUvZG9jdW1lbnQ&ntb=1

[11] Independent Electricity System Operator (IESO). (2023). *Indigenous Energy Support Program*. Retrieved from https://www.ieso.ca/en/Get-Involved/Indigenous-Relations/Indigenous-Energy-Support-Program/IESP-Overview

[12] International Brotherhood of Electrical Workers. (2019). *First remote energy storage microgrid in Gull Bay Indigenous community*. Retrieved from https://ibewcco.org/news/first-remote-energy-storage-micro-grid-gull-bay-indigenous-community/

[13] Government of Canada. (2019). Government of Canada supports renewable energy alternatives in Indigenous and northern communities. Retrieved from https://www.canada.ca/en/crown-indigenous-relations-northern-affairs/news/2019/05/government-of-canada-supports-renewable-energy-alternatives-in-indigenous-and-northern-communities.html

2. **Hydropower projects**: First Nations-led hydropower projects showcase the potential of renewable energy to create long-term economic and environmental benefits:
    - **The Wataynikaneyap Power Project**: 51% owned by First Nations, connects 24 communities to Ontario's power grid, reducing diesel use by 6.6 million liters annually and creating economic opportunities through equity stakes and employment[14][15].
    - **The Smoky Falls Generating Station Redevelopment**: Modernized aging infrastructure, increasing capacity to 267.9 MW while ensuring revenue-sharing and employment opportunities for the Moose Cree First Nation[16].
3. **Community governance and ownership**: First Nations are setting national benchmarks for self-determination in energy planning through equity ownership and decision-making roles. Projects like **Wataynikaneyap Power** not only provide long-term revenue but also strengthen Indigenous governance, ensuring that energy development aligns with traditional land and economic priorities[17][18].
4. **Emerging technologies**:
    - **Small Modular Reactors (SMRs)**: Highlighted in Canada's SMR Action Plan, SMRs offer a low-carbon energy solution for remote communities. First Nations involvement is critical in shaping the future of this technology to ensure it aligns with community needs and values[19][20].
    - **Hydrogen energy**: Hydrogen is emerging as a sustainable energy carrier with the potential to complement renewable systems like solar and hydropower. Pilot projects in Northern Ontario are showcasing its feasibility for remote communities[21].

2.2 Southern Ontario: Innovation for urban and semi-urban contexts

Southern Ontario, with its dense population centers and developed energy infrastructure, presents a unique opportunity for scaling renewable energy initiatives led by First Nations. These projects not only address high urban energy demands but also serve as examples of how renewable energy systems can be integrated into existing urban and semi-urban contexts. Leveraging cutting-edge technologies,

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[14] Wataynikaneyap Power. (2022). *Wataynikaneyap Power Reaches Major Milestone!*. Retrieved from https://www.wataypower.ca/updates/wataynikaneyap-power-reaches-major-milestone

[15] The Narwhal. (2022). *How Indigenous-led Wataynikaneyap Power is bringing renewable energy to remote Ontario communities*. Retrieved from https://thenarwhal.ca/ontario-indigenous-energy-watay-power/

[16] Ontario Power Generation. (2015). *Lower Mattagami Project Complete*. Retrieved from https://archive.opg.com/pdf_archive/Media%20Releases/H150_20150119LowerMattagamiProjectComplete.pdf

[17] Wataynikaneyap Power. (2024). *The Partnership*. Retrieved from https://www.wataypower.ca/ownership/partnership

[18] Independent Electricity System Operator. (2023). *Indigenous Energy Support Programs Funding Increase and 2023 Recipients Announced*. Retrieved from https://www.ieso.ca/en/Sector-Participants/IESO-News/2023/11/Indigenous-Energy-Support-Programs-Funding-Increase-and-2023-Recipients-Announced

[19] Natural Resources Canada. (2021). *Canada's Small Modular Reactor Action Plan*. Retrieved from https://smractionplan.ca/

[20] First Nations Power Authority. (2021). *FNPA on Canada's SMR Action Plan*. Retrieved from https://fnpa.ca/2021/12/09/national-smr-forum-with-indigenous-communities-2/

[21] Ontario Ministry of Energy. (2023). Ontario Investing in Hydrogen to Fuel Province's Growing Economy. Retrieved from https://news.ontario.ca/en/release/1003639/ontario-investing-in-hydrogen-to-fuel-provinces-growing-economy

strategic partnerships, and innovative approaches, these initiatives balance economic development, cultural preservation, and environmental sustainability.

KEY CHALLENGES

1. **Urban energy demand:** Cities in Southern Ontario consume significant electricity, necessitating scalable renewable energy solutions to meet long-term urban needs. The Henvey Inlet Wind Project exemplifies how large-scale wind energy can supply power to approximately 100,000 homes annually while reducing fossil fuel dependency[22].
2. **Transitioning from fossil fuels:** Many First Nations face challenges in converting legacy fossil fuel infrastructure into renewable energy systems. For example, the Nanticoke Solar Facility was built on the site of North America's largest coal-fired power plant, transforming it into a 44 MW solar hub, significantly reducing greenhouse gas emissions[23].
3. **Equitable partnerships:** Ensuring fair revenue-sharing agreements and collaborative decision-making processes in partnerships with non-Indigenous entities remains a priority. The Oneida Energy Storage Project, for instance, demonstrates how public-private partnerships can align economic benefits with First Nations ownership and decision-making[24].
4. **Integration of emerging technologies:** Incorporating emerging energy technologies, such as Small Modular Reactors (SMRs) and hydrogen energy, requires substantial investment and technical expertise. SMRs offer reliable and low-carbon energy solutions, while hydrogen energy is increasingly viewed as a clean alternative for energy storage and transportation[25].

OPPORTUNITIES AND FIRST NATIONS-LED SOLUTIONS

1. **Large-scale wind energy:** The Henvey Inlet Wind Project is Canada's largest First Nations-owned wind energy initiative, featuring 87 Vestas turbines that generate 300 MW of clean electricity annually. This project exemplifies First Nations leadership in large-scale renewable energy, providing significant revenue and employment opportunities while addressing urban electricity needs[26].
2. **Repurposing infrastructure:** The Nanticoke Solar Facility, developed collaboratively by the Six Nations of the Grand River Development Corporation and the Mississaugas of the Credit First Nation, produces 44 MW of solar energy. This capacity powers

[22] Pattern Energy. (2023). *Henvey Inlet Wind Project Overview*. Retrieved from https://patternenergy.com/projects/henvey-inlet-wind/
[23] Ontario Power Generation. (2019). *Nanticoke Solar Now Generating Renewable Power for Ontario*. Retrieved from https://www.opg.com/stories/nanticoke-solar-now-generating-renewable-power-for-ontario/
[24] NRStor. (2023). *Oneida Energy Storage Project Overview*. Retrieved from https://nrstore.ca/projects/oneida-energy-storage-project/
[25] Natural Resources Canada. (2024). *Canada's Small Modular Reactor Action Plan*. Retrieved from https://smractionplan.ca/
[26] Pattern Energy. (2023). *Henvey Inlet Wind Project Overview*. Retrieved from https://patternenergy.com/projects/henvey-inlet-wind/

approximately 13,000 homes annually and significantly reduces greenhouse gas emissions. The project demonstrates the feasibility of transforming outdated fossil fuel infrastructure into renewable energy hubs[27].

3. **Energy storage solutions:** The Oneida Energy Storage Project is one of North America's largest battery storage initiatives, with a capacity of 250 MW. It plays a critical role in reducing greenhouse gas emissions by an estimated 2.2 to 4.1 million tonnes over its lifespan, equivalent to taking up to 40,000 cars off the road annually. Additionally, it enhances grid stability and creates sustainable economic benefits for the Six Nations of the Grand River[28].
4. **Community-scale solar projects:** The Aamjiwnaang First Nation has been involved in various renewable energy projects, including partnerships in wind energy initiatives like the Grand Bend Wind Project. These projects integrate renewable energy into community facilities, providing clean electricity and reducing reliance on non-renewable energy sources. They also offer training opportunities for local members in renewable energy technologies, empowering communities with technical expertise[29].

[27] Ontario Power Generation. (2019). *Nanticoke Solar Now Generating Renewable Power for Ontario*. Retrieved from https://www.opg.com/stories/nanticoke-solar-now-generating-renewable-power-for-ontario/

[28] Todo Canada. (2023). *Largest Electricity Battery Storage Project in Canada Coming to Ontario*. Retrieved from https://www.todocanada.ca/largest-electricity-battery-storage-project-in-canada-capable-of-meeting-peak-demand-in-oshawa-sized-city-coming-to-ontario/

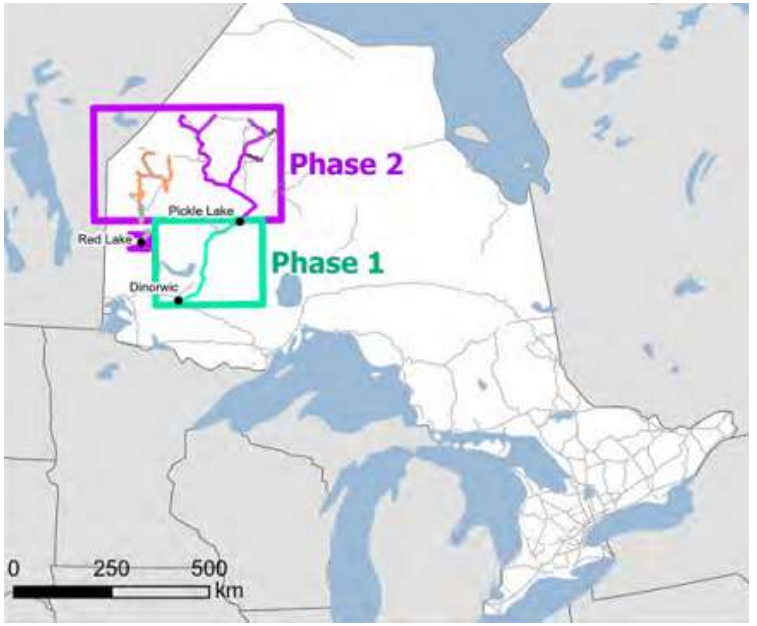
[29] Anishinabek News. (2015). *Giiwedin Noodin and Northland Power Inc. Close Funding Deal for Grand Bend Wind Project*. Retrieved from https://anishinabeknews.ca/2015/04/15/giiwedin-noodin-northland-power-inc-close-funding-deal-for-grand-bend-wind-project/

3. Case Studies: First Nations renewable energy projects

3.1 Northern Ontario

3.1.1 WATAYNIKANEYAP POWER PROJECT

Energy type	Hydroelectric and other renewable sources via grid connection
First Nation	24 First Nations, including those under Treaty 9, Treaty 3, and Treaty 5
Location	Northwestern Ontario
Project purpose	To connect 24 remote First Nations communities across Ontario to the provincial power grid. This initiative aims to reduce reliance on diesel generators, which are costly and environmentally harmful, while providing clean, reliable, and sustainable energy to underserved areas.
Capacity	1,800 km of transmission lines connecting 24 communities
Partners	Wataynikaneyap Power LP, Ontario Power Authority, Government of Canada
Key features	-Largest Indigenous-led infrastructure project in Canada with 51% First Nations ownership. -Eliminates reliance on diesel generators, significantly reducing greenhouse gas emissions. -Designed to withstand rugged terrain and extreme weather conditions.
Challenges	-Geographical remoteness of the communities and the difficult terrain, which required innovative engineering solutions -High costs and stringent environmental protection requirements added complexity to the development process
Solutions	-Federal and provincial funding were crucial in financing the project, which included environmental assessments and community consultations to respect the environment and First Nations cultural priorities.
Economic impact	-More than 5000 workers contributed to the transmission project, including nearly a thousand individuals from First Nation communities across the north. The project also ensures long-term employment opportunities in the operation and maintenance of the energy infrastructure
Environmental benefits	-By eliminating the reliance on diesel generators, the project reduces diesel consumption by 6.6 million liters annually. This translates to a greenhouse gas emissions reduction equivalent to removing approximately 14,000 cars from the road each year
Social benefits	-Access to reliable electricity has enabled significant improvements in healthcare, education, and local businesses. Communities now benefit from uninterrupted power supporting the operation of schools, clinics, and essential services
First Nation involvement	51% ownership by 24 First Nations communities ensures long-term revenue sharing.
Completion year	2021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3.1.2 GULL BAY FIRST NATION MICROGRID

Energy type	Solar power with battery storage
First Nation	Kiashke Zaaging Anishinaabek (Treaty 3)
Location	Northwestern Ontario
Project purpose	To reduce reliance on diesel by creating a sustainable and environmentally friendly microgrid solution, while improving energy security and reliability for the community
Capacity	300 kW of solar energy combined with a 2.2 MWh lithium-ion battery system capable of storing and managing excess energy
Partners	Hydro One Remotes, Government of Canada
Key features	-Canada's first fully integrated solar-battery microgrid -Reduces diesel use by 25% annually, serving as a National model for clean energy in remote First Nations communities
Challenges	-High initial costs of microgrid infrastructure implementation -Technical challenges in seamlessly integrating the solar-battery system with existing diesel generators
Solutions	-Collaborated with industry experts to design and implement the microgrid -Developed community training programs to empower local members to operate and maintain the system independently
Economic impact	-Created local jobs during construction and ongoing maintenance, including roles such as solar technicians and battery system operators -Diesel cost savings reinvested into community infrastructure and programs
Environmental benefits	-Offset approximately 130,000 liters of diesel annually, reducing CO2 emissions by 345 tons per year -Improved air quality and reduced noise pollution by minimizing diesel generator use
Social benefits	-Enhanced energy reliability supports schools, health clinics, housing developments, and community facilities -Fostered community pride and recognition as a leader in renewable energy innovation
First Nation involvement	-Local training programs developed community expertise in solar and battery system management, empowering residents to maintain and operate the microgrid independently -Community leadership guided the project to ensure alignment with local values and priorities
Completion year	2019


hydro one


remote renewable
energy-storage
micro grid
BUILD ON
THE NORTH

3.1.3 FORT SEVERN SOLAR PROJECT

Energy type	Solar power
First Nation	Fort Severn First Nation (Treaty 9)
Location	Northern Ontario
Project purpose	To reduce diesel reliance and promote environmental sustainability through the adoption of solar energy. The project aimed to address the high financial and environmental costs of diesel generators, which had long been the community's primary energy source.
Capacity	A 300 kW solar power system was installed, providing a substantial renewable energy source to supplement existing diesel generation.
Partners	The project was supported by the Independent Electricity System Operator (IESO) and the Government of Canada.
Key features	-Offset diesel consumption by 25% -Designed for operation in extreme weather conditions, including cold climates and low sunlight periods
Challenges	-Harsh weather conditions, including heavy snowfall and limited daylight hours. -Transportation challenges in accessing the remote community, relying on ice roads and seasonal air travel.
Solutions	-Utilized durable solar technology specifically designed for extreme cold weather. -Scheduled strategic delivery of materials during accessible seasons, leveraging community knowledge for efficient transportation.
Economic impact	-Created local jobs during installation and maintenance phases. -Training programs for youth developed technical expertise in renewable energy systems, fostering long-term employment opportunities.
Environmental benefits	-Reduced diesel consumption by 100,000 liters annually. -Prevented 250 tons of CO2 emissions per year, significantly lowering the community’s carbon footprint.
Social benefits	-Reliable electricity improved access to essential services such as healthcare, education, and housing. -Enhanced community self-sufficiency and resilience against energy disruptions.
First Nation involvement	-Community members played a key role in material transportation and installation -Leadership worked with partners to ensure cultural, economic, and environmental priorities were respected -Training programs empowered residents to manage and maintain the solar system, fostering a sense of ownership
Completion year	2018


NORTH WEST REGION
CENTRAL REGION
NORTH EAST REGION
HEADQUARTERS


Keewaytinook

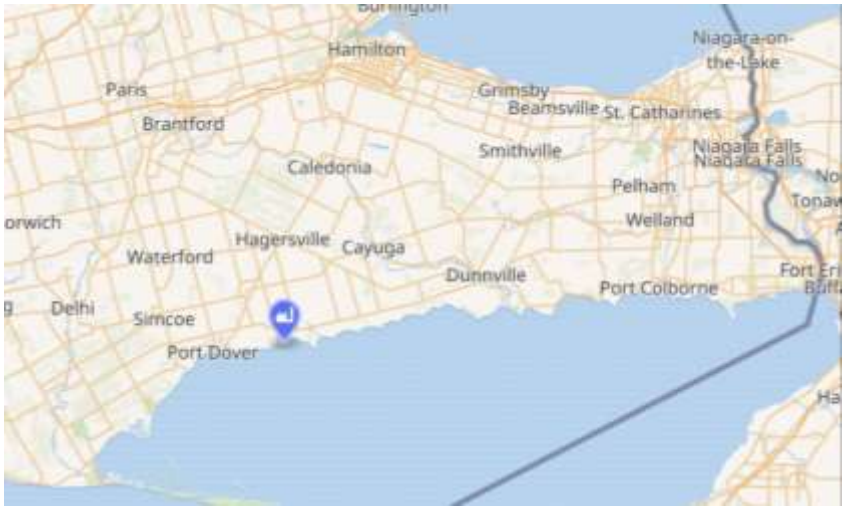
3.1.4 SMOKY FALLS GENERATING STATION REDEVELOPMENT

Energy type	Hydroelectric Power
First Nation	Moose Cree First Nation (Treaty 9)
Location	Approximately 85 km northeast of Kapuskasing, Ontario
Project purpose	To modernize aging infrastructure, increase clean energy capacity, and provide economic and social benefits to the Moose Cree First Nation.
Capacity	Upgraded from 54 MW (commissioned in 1931) to 267.9 MW (redeveloped in 2014)
Partners	Ontario Power Generation (OPG) and Moose Cree First Nation
Key features	-Redeveloped as part of the $2.6 billion Lower Mattagami Project, upgrading four hydro stations on the Mattagami River. -Replaced the original Smoky Falls station with a new three-unit station to significantly enhance capacity.
Challenges	-Addressing environmental impacts of redevelopment in a sensitive ecosystem. -Balancing infrastructure upgrades with preserving cultural and natural heritage.
Solutions	-Conducted comprehensive environmental assessments to mitigate ecological disruption. -Engaged stakeholders to ensure cultural and environmental priorities were addressed.
Economic impact	-Created 1,800 construction jobs at peak, including over 250 First Nation and Métis workers. -Revenue-sharing agreements provided ongoing financial support for community programs, such as education and healthcare initiatives.
Environmental benefits	-Increased clean energy capacity, reducing reliance on fossil fuels and avoiding emissions equivalent to powering 215,000 homes annually. -Habitat restoration efforts ensured minimal long-term ecological disruption.
Social benefits	-Strengthened community capacity through training and employment opportunities in hydroelectric operations. -Empowered the Moose Cree First Nation to take a leadership role in Ontario's renewable energy initiatives.
First Nation involvement	- Holds a 25% equity stake through the Amisk-oo-Skow Comprehensive Agreement, ensuring long-term revenue streams. - Community members received training and employment to develop local expertise in energy operations.
Completion year	2014

3.2 Southern Ontario

3.2.1 NANTICOKE SOLAR FACILITY

Energy type	Solar power
First Nation	Six Nations of the Grand River Development Corporation and the Mississaugas of the Credit First Nation
Location	Shores of Lake Erie, Haldimand County, Southern Ontario
Project purpose	To repurpose the site of the decommissioned Nanticoke Generating Station, formerly North America's largest coal-fired power plant, into a renewable energy source, fostering economic development within the involved First Nations communities.
Capacity	44 MW (approximately 192,431 solar panels)
Partners	Ontario Power Generation (80% ownership), Six Nations of the Grand River Development Corporation (15%), and Mississaugas of the Credit First Nation (5%)
Key features	-Repurposed the former Nanticoke coal plant site into a solar energy facility -Generates clean electricity for approximately 13,000 homes annually
Challenges	-Transitioning from coal-based energy infrastructure to a renewable energy facility Ensuring equitable partnerships and revenue-sharing agreements among stakeholders
Solutions	-Established a collaborative partnership model, ensuring significant equity stakes and decision-making roles for the First Nations partners -Implemented comprehensive community engagement and consultation processes to address concerns and incorporate First Nations knowledge
Economic impact	-Created job opportunities during the construction and operational phases -Provided ongoing revenue streams for the First Nations communities through their equity stakes
Environmental benefits	-Significantly reduced greenhouse gas emissions by replacing coal-fired energy production with clean solar power.
Social benefits	-Strengthened relationships between First Nations communities and industry partners, fostering a model for future cooperative ventures in renewable energy
First Nation involvement	-Active equity partnership (SNGRDC's 15% equity ownership) and revenue-sharing ensured First Nations' long-term economic benefits and decision-making roles in the project
Completion year	2019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Paris
Grimsby
Beamsville
St. Catharines
Brantford
Smithville
Niagara Falls
Caledonia
Pelham
Welland
Hagersville
Cayuga
Waterford
Dunnville
Port Colborne
Delhi
Simcoe
Port Dover

3.2.2 HENVEY INLET WIND PROJECT

Energy type	Wind power
First Nation	Henvey Inlet First Nation
Location	Northeastern shore of Georgian Bay, Southern Ontario
Project purpose	To harness wind energy potential within the Henvey Inlet First Nation's territory, providing clean energy and generating economic benefits for the community.
Capacity	300 MW (87 Vestas wind turbines)
Partners	Nigig Power Corporation (51% owned by Henvey Inlet First Nation) and Pattern Energy (49% ownership)
Key features	-Largest First Nation-owned wind energy project in Canada. -Designed to generate clean electricity to power approximately 100,000 homes annually.
Challenges	-Navigating complex regulatory approvals and environmental assessments. -Ensuring the protection of traditional lands and wildlife habitats during construction and operation.
Solutions	-Conducted thorough environmental assessments and implemented mitigation strategies to minimize ecological impacts. -Engaged in continuous consultation with community members to incorporate First Nations knowledge and address cultural concerns.
Economic impact	-Created significant employment opportunities for community members during construction and operation. -Established a sustainable revenue source for Henvey Inlet First Nation, supporting local infrastructure and social programs.
Environmental benefits	-Generates enough clean electricity to power approximately 100,000 homes annually, significantly reducing reliance on fossil fuels.
Social benefits	-Enhanced community pride and capacity in managing large-scale renewable energy projects.
First Nation involvement	-Henvey Inlet First Nation holds a 51% ownership stake through its subsidiary, Nigig Power Corporation, ensuring long-term economic benefits and decision-making power.
Completion year	2019


KILLARNEY
Henvey
Project Area
GEORGIAN BAY
LAKE HURON
TORONTO
LAKE ONTARIO

3.2.3 AAMJIWNAANG FIRST NATION SOLAR PROJECT

Energy type	Solar power
First Nation	Aamjiwnaang First Nation
Location	Southern Ontario
Project purpose	To develop renewable energy resources within the community, reduce environmental impact, and create economic opportunities for the Aamjiwnaang First Nation.
Capacity	1 MW
Partners	Renewable energy developers, Ontario's Feed-In Tariff (FIT) program
Key features	-Solar panels installed on community buildings and designated lands. -Excess power sold back to the grid under the FIT program.
Challenges	-Securing financing and navigating the FIT application process. -Building technical capacity within the community to manage and maintain solar installations.
Solutions	-Partnered with renewable energy developers to gain expertise and secure funding. -Implemented training programs for community members to develop skills in solar technology installation and maintenance.
Economic impact	-Revenue generated from electricity sales supports community programs and fosters local economic growth. -Created jobs in installation and maintenance of solar panels.
Environmental benefits	-Reduced greenhouse gas emissions by generating clean electricity and decreasing reliance on non-renewable energy sources.
Social benefits	-Increased environmental awareness within the community and empowered members through skill development and participation in sustainable energy projects.
First Nation involvement	-Community leadership ensured alignment with local values and priorities. -Training programs empowered community members to manage and maintain the solar installations.
Completion year	2014


AAMJIWNAANG
ENJIMAAJTAANG
"Where Opportunity Begins"
Resource Centre


Aamjiwnaang First Nation
Chicago
Ottawa

3.2.4 ONEIDA ENERGY STORAGE - SIX NATIONS OF THE GRAND RIVER

Energy type	Battery energy storage
First Nation	Six Nations of the Grand River
Location	Southern Ontario
Project purpose	To enhance grid stability and reduce greenhouse gas emissions by storing surplus electricity during off-peak hours and returning it to the grid during peak demand.
Capacity	250 MW
Partners	NRStor Inc., Northland Power, Aecon Group Inc., Six Nations of the Grand River Development Corporation
Key features	-One of the largest battery energy storage projects in North America -Provides up to $760M net savings to ratepayers over 20 years -Reduces CO2 emissions by 4.1 million tonnes over the project's lifespan -Creates over 900,000 hours of local employment
Challenges	-Securing financing for a large-scale energy storage project -Addressing regulatory and grid integration challenges
Solutions	-Established a public-private partnership model to share costs and risks -Worked closely with the Independent Electricity System Operator (IESO) to integrate the project into Ontario's grid system
Economic impact	-Provides not less than $1M annually for the Six Nations community over the 20+ year lifespan of the project. -Created up to 15 full-time employment opportunities during the operations phase -Over 900,000 hours of local employment over the 20-year life of the asset -Established subcontracting and internship opportunities for Six Nations members during construction and operation
Environmental benefits	-Red- Reduces reliance on natural gas peaker plants, significantly cutting greenhouse gas emissions -Prevents 2.2-4.1 million tonnes of CO2 emissions over the project's lifetime
Social benefits	-Strengthened relationships between First Nations and industry partners, fostering future cooperative ventures -Showcases First Nations leadership in adopting cutting-edge renewable energy technology
First Nation involvement	-Six Nations of the Grand River Development Corporation holds equity ownership, ensuring long-term economic benefits and decision-making roles -Community members contribute through subcontracting opportunities and site maintenance
Completion year	2023


Toronto
Kitchener
Hamilton
Brantford
Caledonia
The Haldimand Tract
Six Nations Settlement

4. Best practices and lessons learned

To achieve energy sovereignty and sustainability, First Nations in Ontario can adopt a range of best practices based on successful renewable energy initiatives, strategic partnerships, and government support programs. This section outlines key strategies to overcome barriers, foster community engagement, build partnerships, and strengthen leadership capacity for First Nations renewable energy initiatives. These strategies are informed by real-world case studies and align with national and provincial climate goals.

One exemplary initiative is the Wataynikaneyap Power Project, an Indigenous-led partnership that has successfully connected 17 remote First Nations communities in Northwestern Ontario to the provincial electricity grid. This initiative significantly reduces reliance on diesel-generated electricity, improves energy affordability, and promotes Indigenous leadership in renewable energy planning and operations[30]. The success of this project underscores the importance of Indigenous ownership and governance in addressing critical challenges such as infrastructure gaps, funding barriers, and energy security concerns.

Federal programs such as Canada's Clean Energy for Indigenous Communities Program, which allocates $300 million over five years, play a crucial role in supporting similar initiatives. This program funds clean energy projects in Indigenous, rural, and remote communities, with a target to transition away from diesel power by 2030[31]. Additionally, the federal 2030 Emissions Reduction Plan provides a comprehensive framework for achieving a 40-45% reduction in greenhouse gas emissions by 2030 and achieving net-zero emissions by 2050. This plan prioritizes investments in clean energy infrastructure and promotes Indigenous participation in climate action[32].

Another valuable initiative is the Indigenous Leadership Fund, which offers up to $180 million for community-driven, low-carbon energy projects. This funding empowers First Nations to develop renewable energy projects that align with their cultural and environmental values while addressing local economic priorities[33]. These programs not only provide financial support but also emphasize capacity building, technical training, and collaboration between First Nations, government bodies, and private sector partners.

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[30] Net News Ledger. (2024). Wataynikaneyap Power completes the line that brings light to Northwestern Ontario First Nations. Retrieved from https://www.netnewsledger.com/2024/12/13/wataynikaneyap-power-completes-the-line-that-brings-light-to-northwestern-ontario-first-nations/

[31] Natural Resources Canada. (2022). *Government of Canada investing $300 million in clean energy projects in Indigenous, rural, and remote communities*. Retrieved from https://www.canada.ca/en/natural-resources-canada/news/2022/04/government-of-canada-investing-300-million-in-clean-energy-projects-in-indigenous-rural-and-remote-communities.html

[32] Government of Canada. (2022). *2030 Emissions Reduction Plan*. Retrieved from https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/emissions-reduction-2030.html

[33] Environment and Climate Change Canada. (2023). Indigenous Leadership Fund. Retrieved from https://www.canada.ca/en/environment-climate-change/services/climate-change/low-carbon-economy-fund/indigenous-leadership.html

4.1 Key Insights and pathways forward: Advancing renewable energy sovereignty

The renewable energy projects highlighted in this toolkit underscore the transformative leadership of First Nations in their pursuit of energy sovereignty. These initiatives serve as a blueprint for overcoming persistent challenges, fostering meaningful community engagement, building sustainable partnerships, and leveraging innovative clean energy solutions. By integrating First Nations knowledge with modern energy practices, First Nations are forging a path toward self-determined, resilient, and sustainable energy futures.

The key insights and strategies identified from these case studies can serve as guiding principles for other communities looking to embark on similar clean energy journeys. These insights include:

1. Overcoming barriers

Funding access

Securing initial capital and ensuring operational sustainability are critical challenges. Successful strategies include:

- **Public funding:** Programs like the Clean Energy for Rural and Remote Communities (CERRC) supported the Fort Severn Solar Project, transitioning from diesel dependence to renewable energy and reducing costs[34].
- **Equity sharing models:** Projects such as the Oneida Energy Storage Facility adopted public-private partnerships, with the Six Nations of the Grand River holding a 15% equity stake, ensuring shared risks and long-term economic resilience[35].

Regulatory navigation

Navigating complex regulatory frameworks requires early and transparent engagement.

- The Henvey Inlet Wind Project achieved compliance through early environmental assessments and regular consultations with provincial authorities, balancing ecological and cultural priorities[3637].
- Advocacy for policy reforms has proven impactful, as demonstrated by the Wataynikaneyap Power Project, which benefited from Indigenous-led infrastructure policies[38].

2. Importance of community engagement

Inclusive governance

Engaging communities throughout project development ensures alignment with local values, priorities, and knowledge systems.

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[34] Natural Resources Canada. (2024). *SMR Action Plan and Hydrogen Strategy*. Retrieved from https://natural-resources.canada.ca/reducingdiesel

[35] NRStor. (2023). *Oneida Energy Storage Project Overview*. Retrieved from https://nrstor.com/2023/02/09/nrstor-and-partners-execute-major-agreements-for-1000-mwh-oneida-energy-storage-project/

[36] Nigig Power Corporation. (2023). Henvey Inlet Wind Project Compliance and Environmental Reports. Retrieved from https://aecom.com/en-ca/projects/environmental-assessments-for-henvey-inlet-first-nation-wind-project/

[37] Ontario Ministry of Environment, Conservation and Parks. (2024). Environmental Compliance Approval. Retrieved from https://www.ontario.ca/page/environmental-compliance-approval

[38] Ross, I. (2023). *Indigenous Leaders: Mission accomplished, Wataу Power declares on northwestern Ont. power line project*. Northern Ontario Business. Retrieved from https://www.sudbury.com/local-business/indigenous-leaders-mission-accomplished-wataу-power-declares-on-northwestern-ont-power-line-project-9967771

- The Henvey Inlet Wind Project established advisory groups comprising elders and youth to integrate Aboriginal Traditional Knowledge (ATK) into planning[39].
- The Oneida Energy Storage Facility conducted community-led consultations through town halls, fostering trust and inclusivity[40].

Capacity building

Equipping community members with skills to manage renewable energy infrastructure fosters long-term sustainability.

- The Gull Bay Microgrid incorporated comprehensive training programs, enabling independent operation of solar and battery systems[41].
- Youth workshops, as seen in the Fort Severn Solar Project, encourage interest in renewable energy careers[42].

3. Building sustainable partnerships

Shared ownership

Collaborative models ensure financial benefits and governance opportunities for communities.

- The Nanticoke Solar Facility includes equity stakes held by the Six Nations and Mississaugas of the Credit First Nation, promoting revenue sharing and decision-making[43].
- Partnerships with NRStor and Northland Power in the Oneida Energy Storage Project delivered advanced technology and local job creation[44].

Government and research collaboration

Aligning with federal programs and involving academic institutions enhances project feasibility and funding access.

- Programs such as the Green Infrastructure Fund and Canada Infrastructure Bank provide essential resources.

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[39] Chiefs of Ontario. (2024). *Aboriginal Traditional Knowledge (ATK)*. Retrieved from https://chiefs-of-ontario.org/priorities/environment/

[40] NRStor. (2023). *Oneida Energy Storage Project Overview*. Retrieved from https://nrstor.com/2023/02/09/nrstor-and-partners-execute-major-agreements-for-1000-mwh-oneida-energy-storage-project/

[41] Gull Bay First Nation. (2018). *Mashkawiziiwin Energy - Gull Bay First Nation*. Retrieved from https://www.gullbayfirstnation.com/mashkawiziiwin-energy/

[42] Association of Consulting Engineering Companies (ACEC). (2022). *Fort Severn First Nation Solar Array*. Retrieved from https://www.acec.ca/awards/CCE_awards/2022awards/14.html

[43] Ontario Power Generation. (2019). Nanticoke Solar Now Generating Renewable Power for Ontario. Retrieved from https://www.opg.com/stories/nanticoke-solar-now-generating-renewable-power-for-ontario/

[44] NRStor. (2023). Oneida Energy Storage Project Overview. Retrieved from https://nrstore.ca/projects/oneida-energy-storage-project/

- Feasibility studies, like those conducted for the Henvey Inlet Wind Project, optimize design and efficiency[45].

4. Leveraging data-driven technologies

Innovation in energy literacy and tracking

- Tools like GridWatch provide communities with real-time energy consumption and emissions data to inform decision-making.

5. Planning for longevity

Sustainability mechanisms

Reinvesting project revenues and maintaining adaptability ensures lasting benefits.

- Revenue from projects like the Henvey Inlet Wind Project has been allocated to scholarships and community priorities, fostering leadership and development[46].
- Projects like Wataynikaneyap Power demonstrate the importance of flexibility and ongoing stakeholder engagement to address evolving needs[47].

[45] Pattern Energy. (2024). Henvey Inlet Wind Project. Retrieved from https://patternenergy.com/projects/henvey-inlet-wind/
[46] Pattern Energy. (2024). Henvey Inlet Wind Project. Retrieved from https://patternenergy.com/projects/henvey-inlet-wind/
[47] Wataynikaneyap Power. (2022). *Wataynikaneyap Power Reaches Major Milestone!*. Retrieved from https://www.wataypower.ca/updates/wataynikaneyap-power-reaches-major-milestone

4.2 Pathways forward

To build on these successes, First Nations and stakeholders should consider:

1. **Expanding knowledge sharing**

- ❑ Establish a network for sharing lessons learned and best practices among First Nations involved in renewable energy projects.
- ❑ Include platforms for peer-to-peer mentorship and technical assistance.

2. **Strengthening policy advocacy**

- ❑ Advocate for streamlined regulatory processes and increased funding for First Nations-led energy initiatives through federal and municipal programs like.

3. **Investing in community-centered solutions**

- ❑ Ensure that revenue generated from renewable energy projects is reinvested into local priorities, such as healthcare, education, economic development and infrastructure, fostering holistic community well-being.

4. **Focusing on monitoring and evaluation**

- ❑ Adopt tools like the GridWatch app to track energy consumption, emissions, and project performance, ensuring data-driven decision-making.

By embracing these strategies, First Nations can lead the charge toward a sustainable, culturally aligned energy future, while setting benchmarks for reconciliation and economic resilience.