CASES

# ENERGY PROFILE: FORT MCPHERSON

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University of Saskatchewan

# FORT MCPHERSON

*Figure 1 Fort McPherson, NWT from the air (Northwest Territories Tourism, 2019)*

March 2020

## Energy Profile

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# Fort McPherson

**ENERGY PROFILE**

## REGULATION AND GOVERNANCE

### Ownership Structure

This section describes the current energy ownership structure for generation and distribution, including any private, public, cooperative, players, roles, responsibilities, and authorities.

The eight communities of the Beaufort Delta region have no existing or nearby transmission infrastructure to connect to. This includes the community of Fort McPherson (Figure 2). The nearest transmission infrastructure is the Snare and Taltson grids to the distant south. As a result, the comparatively small community loads and large distances between communities preclude interconnecting any transmission infrastructure between communities or to neighboring regions.


*Figure 2 Map of Canada with Fort McPherson, NWT location*

The current Fort McPherson renewable and non-renewable energy generation structure is owned by the Northwest Territories Power Corporation (NTPC). NPTC controls the diesel generators and the Biomass Boiler Plant at the Health Centre (Government of Northwest Territories, 2018). The community also have a residual heat recovery system which uses the heat from the NTPC diesel plant to heat buildings in the community (Northwest Territories Power Corporation, n.d.). This system is owned by Aadrii Limited, a joint-venture district heating system owned equally by the Gwich'in Development Corporation (GDC) and NWT Power Corporation (NWT Public Utilities Board, n.d.). GDC is corporation 100% owned by the Gwich'in Tribal Council (Gwich'in Development Corporation, n.d.), and the NTPC along with Northwest Territories Energy (NTEnergy) are owned by NT Hydro (Figure 3), which in turn is 100 percent owned by the Government of the Northwest Territories. (Northwest Territories Power Corporation, n.d.).

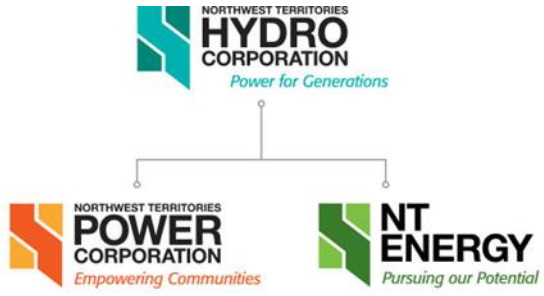


*Figure 3 Energy Ownership Structure in NWT*

## Institutional Arrangements

This section describes the current rules, regulations, or standards that enable or constrain energy transition. This includes options or restrictions on community ownership of generation and/or distribution; targets or restrictions on renewables integration; rate structures; etc.

### Territorial Level

The Government of Northwest Territories (GNWT) publicly lists all its Acts and Regulations on its official website (Legislation of the Northwest Territories). The Acts are the laws approved by the Legislative Assembly, and the Regulations are laws that are authorized by an act and issued by the administering departments or public bodies. The Regulations are the rules used to carry out the Acts, providing the implementation details. Details on how Northwest Territories (NWT) legislation provides or fails to provide support for renewable energy in Fort McPherson are listed below.

**Petroleum Products and Carbon Tax Act and Regulations**

In August 2019, the GNWT introduced changes to the Petroleum Products Tax Act to implement the NWT Carbon Tax (Northwest Territories Gazette, 2019). The Act, which is now called Petroleum Products and Carbon Tax Act and Regulations, charges a carbon tax on all fuel sold in the NWT (Petroleum Products and Carbon Tax Act, 2019). The objective of this law is to discourage the use of fossil fuels in order to reduce greenhouse gas emissions.

The NWT Carbon Tax will charge $20/tonne of greenhouse gas emissions (GHG) for gasoline, motive diesel, non-motive diesel, railway, heating fuel, propane, natural gas and naphtha. The initial rate will increase annually until 2022 when it will reach $50/tonne. Carbon taxes start at a minimum of $0,035/litre, considering the tax for each litre of Butane in 2020, and can reach up to $0,137/litre, considering the litre of Diesel in 2022 (Figure 4). In Fort McPherson, considering data from November 2019, the carbon tax represents 2.95% of the price paid for a litre of gasoline.

| Item \| *N°* | Type of Fuel \| *Type de carburant* | September 1, 2019 – June 30, 2020<br>*Le 1er septembre 2019 et se terminant le 30 juin 2020* | July 1, 2020 and ending June 30, 2021<br>*le 1er juillet 2020 et se terminant le 30 juin 2021* | July 1, 2021 and ending June 30, 2022<br>*le 1er juillet 2021 et se terminant le 30 juin 2022* | July 1, 2022 and thereafter<br>*le 1er juillet 2022 et continuant* |
|---|---|---|---|---|---|
| 1 | Aviation gasoline \| *Essence d'aviation* | exempt \| *exempté* | exempt \| *exempté* | exempt \| *exempté* | exempt \| *exempté* |
| 2 | Aviation jet fuel \| *Carburant pour turbo-* | exempt \| *exempté* | exempt \| *exempté* | exempt \| *exempté* | exempt \| *exempté* |
| 3 | Butane (L) | $0.035 | $0.053 | $0.071 | $0.089 |
| 4 | Diesel (L) | $0.055 | $0.082 | $0.109 | $0.137 |
| 5 | Gasoline \| *Essence* (L) | $0.047 | $0.070 | $0.094 | $0.117 |
| 6 | Naphtha \| *Naphthe* (L) | $0.051 | $0.077 | $0.102 | $0.128 |
| 7 | Natural gas \| *Gaz naturel* ($m^3$) | $0.038 | $0.058 | $0.077 | $0.096 |
| 8 | Propane (L) | $0.031 | $0.046 | $0.062 | $0.077 |

*Figure 4 Northwest Territories Carbon Tax Rate Schedule (2019)*

The act also offers **tax rebates and tax-free benefit** to help offset the cost of the territorial carbon. Consumers will receive a full rebate on the carbon tax paid for heating fuel and utility companies will receive a full rebate on the carbon tax paid for fuel used for electrical generation. The NWT Cost of Living Offset (COLO) is the tax-free benefit paid to individuals and families living in the NWT to help offset the cost of the territorial carbon. In 2020, a Fort McPherson family will receive $104 per adult and $120 per child under the ag e of 18.

The Carbon Tax Regulations also provide a **Grant for Emissions Reduction Projects**, a grant focused in large emitters which are developing projects that will contribute to the reduction of greenhouse gas emissions in the NWT. The Regulations consider as large emitters the companies: Diavik Diamond Mines Inc., De Beers Canada Inc., Dominion Diamond Ekati Corporation, and Imperial Oil Resources NWT Limited. In the current regulations there is no grant that is not focused on these large emitters, independent producers do not have direct support from the regulations for the development of renewable energy projects. According to the GNWT, the NWT Carbon Tax will generate an estimated $16.3 million in 2019 and 2020, which $3.8 million will be invested in initiatives that will reduce GHG emissions (Implementing the NWT Carbon Tax, 2019).

### Natural Resources Conservation Trust Act

The Natural Resources Conservation Trust Act establishes **The Natural Resources Conservation Trust Fund**. The purpose of this fund is to promote through education, research and demonstration, the wise use of renewable resources; awareness, enhancement and protection of the environment; and use of the most

efficient and most effective methods of trapping wildlife (Government of Northwest Territories, 2016). As defined under section 13, the Natural Resources Conservation Trust Fund Board of Trustees shall provide an annual report to the Legislative Assembly. That includes (c) the recipient and amount of each payment made from the Fund; (d) a description of the purpose for which each payment was made from the Fund. However, little information is made available as to which projects are receiving resources from this fund.

**Community Planning and Development Act and Regulations**

This Act defines the guidelines to community planning, and by extension, may provide a framework to support energy planning within a community. However, the act does not define as mandatory the description of future use, practices and possible areas of development related to energy (Government of Northwest Territories, 2013). As the Act does not provide specifications for the community energy sector, the Regulations, therefore, do not support the development of community energy planning (Government of Northwest Territories, 2013). The government of the Hamlet of Fort McPherson, however, has developed an integrated community sustainability which includes a community energy plan (Hamlet of Fort McPherson, 2010).

## Federal Level

Details on how federal legislation provides or fails to provide support for renewable energy in Fort McPherson are listed below.

**Northwest Territories Devolution Act**

This agreement transferred responsibility for public land, water and resource management in the NWT from the federal department of Aboriginal Affairs and Northern Development Canada (AANDC) to the GNWT on April 1, 2014 (Parliament of Canada, 2014). This Act provides the territorial government more control over public lands and resource development. This is important as it provides GNWT with the authority to create their own energy future (Heerema & Lovekin, 2019).

**Canadian Energy Regulator Act**

This Act regulates certain energy matters within Parliament's jurisdiction and defines rules for the development of pipelines, power lines, and oil and gas exploration, regulates trade in energy products, and ensures transparent and efficient public participation (Government of Canada, 2019). In particular, this Act reinforces Indigenous participation in the evaluation of energy projects, ensuring funding to build capacity and enhance Indigenous participation (Government of Canada, 2019).

**Energy Efficiency Act and Regulations**

The Energy Efficiency Act provides for the making and enforcement of regulations concerning minimum energy performance levels for energy-using products, as well as the labelling of energy-using products and the collection of data on energy use. The Energy Efficiency Regulations establish energy efficiency standards for a wide range of energy-using products, with the objective of eliminating the least energy-efficient products from the Canadian market (Government of Canada, 2017). Unlike provinces such as, British Columbia, Manitoba, Ontario, Quebec, New Brunswick and Nova Scotia, the GNWT does not have an Acts or

Regulations supporting energy efficiency at a territorial level. However, it does have alternative programs that support energy efficiency locally. These programmes are known as "Efficiency Rebates" and are developed in partnership with the Artic Energy Alliance.

## Gaps in Institutional Arrangements

This section describes the gaps in the current rules, regulations, or standards that enable or constrain energy transition.

### Independent Power Producer (IPP) Regulations

Independent Power Production allows communities to generate renewable energy and feed the local electrical grid. According to data from the Government of Yukon, one of the Canadian territories that has IPP regulations, IPP regulations provide support for utilities and independent power producer, while ensuring that rates remain stable for consumers. IPP supports affordable, reliable, flexible and clean electrical energy (Government of Yukon, 2019). Nevertheless, there is no documented IPP policy, and consequently, no IPP regulation in place in the Northwest Territories. Heerema and Lovekin (2019), states that IPP project proposals are subject to a negotiation with the government and utility. The author also states that while the 2030 Energy Strategy provides some direction for IPP projects, it does not provide adequate support for community-led energy projects. The lack of IPP regulations, therefore, limits the development of community owned renewable energy projects.

## Policy Environment

This section describes overarching policies and plans (e.g. climate policies, energy policies, existing energy plans) that provide specific direction, encouragement (or lack thereof) for energy transition, security, or sovereignty. Key conflicts or synergies between energy transition needs/goals and other sectors or land uses that enable or constrain transition are presented.

### 2030 Energy Strategy

The Northwest Territories 2030 Energy Strategy (Government of Northwest Territories, 2019) is a long-term strategy focused on the development of the energy future in NWT. The strategic objectives include community engagement, targets for the reduction of GHG emission, an increase in the share of renewable energies and an increase in buildings' energy efficiency. The policy aims to "guide the development of affordable, and sustainable energy for transportation, heat, and electricity, support energy efficiency and conservation, and promote renewable and alternative energy solutions for the NWT". **The Energy Action Plan 2018 – 2021** (Government of Northwest Territories) sets the ongoing and yearly new Actions and Initiatives needed for the GNWT and its partners to achieve the Strategic Objectives set out in the 2030 Strategy.

The 2030 Energy Strategy introduces two participation models for Indigenous communities that includes mid-scale and larger-scale projects, not only considering developments up to 15 kilowatts. The 2030 Energt Strategy design funding for the mid-scale and larger projects. This strategy provides two types of grants for projects that aim to reduce GHG emissions: **The GHG Grant Program for Buildings and Industry Program**

**and the GHG Grant Program for Government** (Government of Northwest Territories, 2019). The Government focused program is designed to support greenhouse gas (GHG) emissions reduction projects and initiatives for NWT community governments, municipalities, GNWT departments, and Indigenous governments. This grant program may support renewable energy projects in Fort McPherson, as the focus of this grant is on reducing GHG emissions, and it has a strong focus on Indigenous communities.

This strategy also provides an alternative to the gap of IPP policies. The mid-scale participation model considers developments of more than 15 kilowatts, which are community owned and have the potential to receive government grants. As stated in the Strategy, the proposed approach is not the conventional independent power producer model, but it is a solution made specifically for the NWT scenario, where the community receives payments based on the value of diesel fuel displaced by the renewable energy.

**2030 NWT Climate Change Strategic Framework**

The 2030 NWT Climate Change Strategic Framework outlines how the territory plans to respond to challenges and opportunities associated with a changing climate. The three goals of this framework are related to the reduction of fossil fuel consumption, and consequent reduction of GHG emissions, the dissemination of climate change impacts and the process of building resilience and adapting to this change (Government of Northwest Territories, 2019). The first goal, related to the annual decrease of GHG emissions, is directly related to the energy transition objectives of the **2030 Energy Strategy.** The GNWT (2018) states that the main path to achieve the first goal is through the reduction of fossil fuel use, in particular by reducing diesel consumption for electricity generation. **The 2030 NWT Climate Change Strategic Framework 2019-2023 Action Plan** is also connected and supports the Energy Action Plan 2018 – 2021. This action plan design actions to support the NWT's transition to a lower carbon economy (Government of Northwest Territories, 2018).

**NWT Petroleum Resources Strategy**

"Alongside the Northwest Territories 2030 Energy Strategy and the NWT Climate Change Strategic Framework, it sets the foundation for how the GNWT will improve energy security, stabilize the cost of living and address the impacts of climate change with clear and positive actions." (Government of Northwest Territories, 2018). The NWT Petroleum Resources Strategy, opposed to the energy transition proposed by 2030 Energy Strategy, aims to improve the petroleum infrastructure and regulatory framework in NWT, along with greater investment in NWT petroleum resources. The purpose is to invest in natural gas, as it is a source that emits less GHG than diesel fuel.

**NWT Economic Opportunities Strategy**

The last economic strategy was launched by the GNWT in 2013, and it considers both renewable and non-renewable resources as an economic opportunity (Government of Northwest Territories, 2013). One of the objectives of this Strategy is attract major projects and investment to the NWT, it argues that obtaining an oil and gas strategy is crucial to achieve this goal. Despite mentioning renewable energy as an economic opportunity, the strategy fails to provide details on economic strategies for the energy transition.

## Historic Shifts and Embeddedness

| | |
|---|---|
| **1948** | Establishment of Northwest Territories Power Commission, a federal crown corporation |
| **1956** | The federal corporation is renamed to Northern Canada Power Commission (NCPC) |
| **1988** | Government of the Northwest Territories acquires NCPC from federal government |
| **1989** | The Commission is renamed the Northwest Territories Power Corporation (NTPC) |
| | NWT Public Utilities Board commences partial regulation of the Corporation. |
| **1992** | Full regulation of the Corporation by the NWT Public Utilities Board. |
| **1997** | Community-based rates established. |
| **2007** | The GNWT creates the Northwest Territories Hydro Corporation (NT Hydro). The new corporate structure includes NTPC as one of three NT Hydro subsidiaries. |
| | Energy for the Future, an Energy Plan for the NWT |
| **2008** | Establishment of the Energy Priorities Framework for NWT |
| **2009** | Creating a brighter future: a review of electricity regulation, rates and subsidy programs in the NWT |
| **2013** | NWT Energy Action Plan 2013 - 2016 |
| **2014** | Devolution occurs; NWT gains more powers over its land, waters and natural resources |
| **2018** | 2030 Energy Strategy |
| | 2018 - 2021 Energy Action Plan |

## Relationships

Grassroots information on communications between energy utilities and community leadership in energy planning, policy setting, and decision making could not be found in the Government documents and papers. It is recommended that this information be acquired in interviews with members of the community and local utility, i.e. NTPC.

### LOCAL CAPACITY AND INNOVATION

Local capacity and innovation are vital to a successful long-term approach to support secure, affordable and sustainable energy supply and use in the NWT. The GNWT and its partners—including utilities, governments, communities, residents, business, industry and nongovernment organizations—must work together, be innovative, and develop strategies while building capacity to achieve set goals and objectives. The components of local capacity and innovation discussed are the community energy plan, energy champion, human capital, community investments, energy programs and incentives, community energy source potential, and priorities.

## Community Energy Plan

This section describes the nature and scope of Fort McPherson's community Integrated Sustainability Plan, including community goals or objectives, key gaps, date established and most recent update. The plan was completed in partnership with Northwest Territories Association of Communications and Northwest Territories Municipal and Community Affairs in 2010 (Hamlet of Fort McPherson, 2010). Fort McPherson also completed a climate change plan, with the title of Tetl'it Zheh Climate Change Adaptation Planning Project. The project was funded by Indian and Northern Affairs Canada's Adaptation and Impacts Research Division. It was completed in partnership with Ecology North in 2011. The components of the climate change plan that relate to energy are also included within this section (Ecology North, 2011).


*Figure 5 Integrated Community Sustainability Plan for the Hamlet of Fort McPherson* (Hamlet of Fort McPherson, 2010)

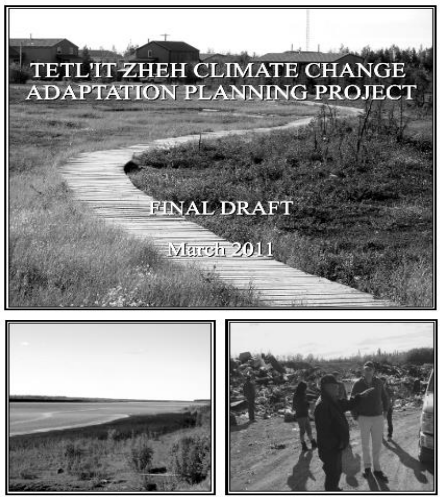


*Figure 6 Tetl'it Zheh Climate Change Adaptation Planning Project* (Ecology North, 2011)

**Climate Change Adaptation Plan: Vision for Fort McPherson in 2050**

The Local Advisory Committee of this project also developed a vision for how they see the community in 2050 (Ecology North, 2011). It was:

"Our community of Fort McPherson will be a resilient, self-sufficient community which celebrates and practices its culture and promotes renewable economic development within our traditional lands."

**Community Energy Goals**

The hamlet Fort McPherson developed an Integrated Community Sustainability Plan (ICSP) through a community-based process that was focused on having as much public input as possible. It was noted that people are eager for change in the community, and that it is believed that a committed leadership focused on sustainability is required (Hamlet of Fort McPherson, 2010). The community members outlined that a sustainable community needs to be built on the following foundations:

- Social and physical well-being
- Pride and participation in Gwich'in culture
- Environmental responsibility
- Strong and stable employment
- Informed citizens involved with their local government
- Well-managed Hamlet staff and services

Said principles were expanded upon to create the following community energy goals. There were also 46 strategies recognized to implement these goals. The majority were recognized as being not focused on spending money, but on improving communications and sharing vision among local governments and organizations. It was considered that many of the strategies were focused on ensuring the fundamentals of a well-managed Hamlet government are put in place. Each strategy also included an intended timeframe, activities involved, target percentage of completion within the time frame, a plan for sustaining the strategy, a community involvement plan, a partnering opportunity plan, and a capital budget and an operating budget (Hamlet of Fort McPherson, 2010).

**Goal A:** Develop a governance structure for the Hamlet of Fort McPherson that provides for effective decision making, openness and transparency, public engagement and accountability.

*The community government will provide the foundation for a safe, sustainable and healthy community by ensuring the council and administration are committed to good governance.*

- **Strategy A.1**: On-going training for Council and Senior Staff on critical governance issues.
- **Strategy A.2:** Election training for prospective councilors.
- **Strategy A.3:** Ensure proper management systems are in place.
- **Strategy A.4:** Implement organizational and compensation review.
- **Strategy A.5:** Improve citizen involvement in Council decisions.
- **Strategy A.6:** Strengthen communications with residents and local organizations.

- **Strategy A.7:** Build strong working relationships with Tetlit Gwich'in Council and other organizations in the community.

**Goal B:** To provide and sustain public infrastructure that supports effective delivery of programs and services.

*The community government is committed to adopting effective planning practices in all areas of operations to ensure sustainable public infrastructure development*

- **Strategy B.1:** Update and implement five-year Capital Plan.
- **Strategy B.2**: Report on impacts of permafrost degradation on both existing and future public infrastructure.
- **Strategy B.3:** Ensure there are sufficient levels of residential lands for future development.
- **Strategy B.4:** Develop maintenance and project management expertise.
- **Strategy B.5:** Consolidate garage and maintenance buildings for the Hamlet and build one central garage.

**Goal C:** Implement an and Energy Plan to reduce energy usage and greenhouse gas emissions by 10 percent over three years, and the community's overall impact on the environment.

*The community government will actively pursue the goal of reduced energy usage and greenhouse gas emissions and develop progressive strategies to reach this goal*.

- **Strategy C.1:** Organize the Fort McPherson Energy & Environment Committee.
- **Strategy C.2:** Maintain buildings and vehicles to minimize fuel used to heat buildings and run vehicles.
- **Strategy C.3:** Review existing Hamlet buildings to maximize insulation and reduce heating costs.
- **Strategy C.4:** Ensure any new Hamlet buildings exceed the minimum NWT requirements for energy efficiency.
- **Strategy C.5:** Rationalize current vehicle fleet.
- **Strategy C.6:** Report on building a community heating plant, in conjunction with upgraded and expanded utilidor.

**Goal D:** To improve the level of service and program delivery in areas of emergency services, recreation and roads.

*The community government is committed to improved program and service delivery in the areas of emergency services, recreation and wellness and roads. All program and service improvements support being a safe, healthy, and active community.*

- **Strategy D.1:** Create, and update yearly, a Hamlet Recreation Plan.
- **Strategy D.2:** Chip seal remainder of major roads and improve dust control on remainder.
- **Strategy D.3:** Improve drainage on main roadways.
- **Strategy D.4:** Repair existing sidewalks and extend them along the main road to improve safety of pedestrians.
- **Strategy D.5:** Report on infrastructure required to facilitate active transportation (i.e. walking, biking, running, skiing, trails).
- **Strategy D.6:** Renovate Arena Complex and bring up to Fire and Public Health codes, and improve heating in the spectator area.

- **Strategy D.7:** Renovate and reopen Curling Rink.
- **Strategy D.8:** Build a new community swimming pool.
- **Strategy D.9:** Report on what outdoor facilities youth require to become more active (i.e. soccer pitch, skateboard park) and include priorities in five-year Capital Plan.
- **Strategy D.10:** Form working group with Tetlit Gwich'in Council to explore establishing a Cultural and Tourism Centre.
- **Strategy D.11:** Report on providing enhanced emergency services, including ambulance and vehicle extrication.

**Goal E:** Increase awareness of, and participation in, Gwich'in language, traditional values and cultural practices as a community.

*Traditional values and culture are the foundation for a sustainable community and the community government will influence and support initiatives that bring traditional values and culture to the forefront.*

- **Strategy E.1:** Include heritage and cultural activities in recreation and leisure services activities.
- **Strategy E.2:** Continue to support existing traditional healing and social events.
- **Strategy E.3:** Encourage Councillors and Staff to participate in cultural and heritage activities within the community

**Goal F:** The Hamlet government is fully staffed with local citizens and staff are performing to the requirements of their positions.

*Staff and council will have the required skills and knowledge to achieve the goals and meet the objectives of the community government.*

- **Strategy F.1:** Refine and implement Human Resource Plan.
- **Strategy F.2:** Provide Council training focused on leadership.
- **Strategy F.3:** Support mentorship of local staff.
- **Strategy F.4:** Support activities that develop the capacity of Hamlet staff and residents, and promote lifelong learning.
- **Strategy F.5:** Update Employee Policy to incorporate requirements for continuous learning.

**Goal G:** Develop a strong and stable local economy.

*Economic development and local job development is a priority for the community government.*

- **Strategy G.1:** Create a Council Economic Development portfolio and assign it to a Councillor.
- **Strategy G.2:** Report on creating an Economic Development Advisory Committee.
- **Strategy G.3:** Organize small business workshops for local people.
- **Strategy G.4:** Make establishing a business in the Hamlet as easy as possible.
- **Strategy G.5:** Create a local environment that nurtures local new businesses.
- **Strategy G.6:** Market Fort McPherson to tourists.
- **Strategy G.7:** Market Fort McPherson to outside businesses looking to expand or relocate.

**Goal H:** Address poverty, homelessness, violence, alcohol and drug abuse and gambling addictions.

*The community government will take a leadership role in working with local agencies, governments and organizations in making the Hamlet a more socially healthy community.*

- **Strategy H.1:** Support local initiatives addressing these issues with appropriate bylaws, policies, meeting/office space, grants, staff time.
- **Strategy H.2:** Council's Lottery Committee to investigate various methods of managing local bingos.

**Key Gaps**

Through the creation of the Integrated Community Sustainability Plan, a Strengths Weaknesses Opportunities Threats (SWOT) Analysis was performed. Factors were categorized as either internal and helpful or harmful, or external and helpful or harmful (Hamlet of Fort McPherson, 2010). The results are displayed below:

Internal and Helpful:

- Large youth population
- Traditional lifestyle still valued
- Small town
- Gwich'in heritage/culture
- Natural environment
- Isolation
- On a road
- Residents want change
- Strong sports (hockey) culture

Internal and Harmful:

- Lack of cooperation among local governments
- Lack of capacity
- Small town
- Lack of jobs
- Lack of housing
- Isolation
- Alcohol, drugs, gambling addictions
- High school education
- Lack of eldercare in town

External and Helpful:

- Partnership opportunities with local organizations
- Infrastructure funding (Gas Tax $, etc.)
- Willingness to try to improve
- Improved communication among residents with Hamlet
- Natural environment could be used to create jobs (enviro-tourism)

- Cultural environment could be used to create jobs (cultural tourism)
- New training opportunities
- High(er) speed internet access opens distance education, better health care, reduced telecommunication costs (VoIP), improved access to business opportunities, entertainment

External and Harmful:

- Lack of communication among local organizations (rivalry?)
- Out -migration of youth and adults
- Community not fully engaging in programs and services
- Problems facing community may seem overwhelming to some
- Inuvik/Whitehorse seen to have more opportunities
- Discrepancy between government population numbers and local government population numbers

The community also created a list of recommended adaptations through the creation of the Climate Change Adaptation Planning Project. Said adaptations were categorized by the anticipated difficulty of the implementation of the respective adaptations and placed in specific themes (Ecology North, 2011). Below are those which related to energy:

- **Theme: Climate Change**
    - Adaptation: Investigate the potential for using willows as biomass to heat community buildings

Included in the recommended adaptations were those which related to the reduction of fossil fuel use. It was noted that there was community interest in mitigating climate change by reducing the community's dependence on fossil fuels that may lead to the reduction of the cost of living (Ecology North, 2011). Several recommended adaptations related to energy and climate change include:

- Develop closer ties with Arctic Energy Alliance.
- Investigate the use of wood chips or pellets to incorporate and expand the residual heat distribution system in the core of town.
- Develop an anti-idling campaign to reduce unnecessary fuel use.
- Promote the use of woodstoves and wood pellet stoves in residences in Fort McPherson.

**Recent Updates**

The Integrated Community Sustainability Plan for the Hamlet of Fort McPherson was established in March of 2010, and it has not been updated (Hamlet of Fort McPherson, 2010). Additionally, the Climate Change Adaptation Planning Project was established in March of 2011, and it has not been updated (Ecology North, 2011).

## Energy Champion

**Clean Energy Advisor, Inuvialuit Regional Corporation**

Leigh Ann Williams-Jones, Clean Energy Coordinator

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Bag Service #21

Inuvik, NT X0E 0T0

- Responsible for supporting community energy priorities and establishing an inclusive approach to clean growth and energy implementation efforts within the Inuvialuit Settlement Region (ISR). The Clean Energy Coordinator works closely with local communities, and the Inuvialuit Corporate Group to ensure a coordinated approach to energy development and management in the ISR.

**Regional Energy Project Coordinator, Arctic Energy Alliance**

Elye Clarkson, Regional Energy Project Coordinator for all of Beaufort-Delta

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Inuvik, NT X0E 0T0

- This role of the full-time regional community energy project coordinator is based out of Inuvik but supports all communities in the Beaufort- Delta region and includes regular travel to Aklavik, Fort McPherson, and Tsiigehtchic.

**Project Coordinator, Arctic Energy Alliance**

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- Participating in events such as the Fort McPherson Community Healthy Living Fair. Where she spoke with residents about reducing their energy use and greenhouse gas emissions and donated a set of LED Christmas lights to the community prize table.
- Promoting a new winter draft door protector that is available for installation by a local company, Fort McPherson Tent and Canvas (FMT&C).
- Visiting the biomass boiler that heats the Tetlit Gwich'in Council and Fort McPherson Health Centre buildings. The boiler can use the fuel sources of pellets, firewood, or wood chips.

**Regional Director, Government of Northwest Territories**

Peter Clarkson, Regional Director for all of Beaufort Delta

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**Energy Planning Committee**

Goal C Strategy 1 of the Integrated Community Sustainability Plan is to organize the Fort McPherson Energy and Environment Committee. The timeframe for this strategy is ongoing from May 2010 (Hamlet of Fort McPherson, 2010). The member names and contacts of these Committee members are not available; however, these can be found once communication with the hamlet of Fort McPherson begins. Through the development of the Gwichya Gwich'in Climate Change Adaptation Planning Project, a community-based Local Advisory Committee was developed, and a Community Coordinator was recognized. The Community Coordinator of the project was Anita Koe. The members of the Local Advisory Committee were Abe Wilson, Abe Koe, Abe Peterson, Ashley Kay, Edwin Koe and Andrew Koe (Ecology North, 2011). The Community Coordinator and Local Advisory Committee's contact information were not available, however, these will be found once communication with the hamlet of Fort McPherson begins. These community members have

shown interest in the wellbeing and sustainability of Fort McPherson, therefore, although they are not a specified energy committee, they will be of great use.

## Human Capital

This section describes the current technical skill sets in the community in the energy sector (e.g. energy stems design, planning, generation and maintenance). Also, it explains the availability of/access to/support for community training and education in the energy sector (e.g. energy systems design, planning, generation and maintenance). The information available in terms of both the current technical skills and the community training and education is lacking. Interviews with the listed Energy Champions, Community Leadership, the Community Coordinator and the Local Advisory Committee of the Climate Change Adaptation Project will help to fill this gap.

**Current Technical Skills**

Biomass Boiler Operator

The biomass boiler in Fort McPherson is used to heat the Tetlit Gwich'in Council building and the Fort McPherson Health Centre building. The biomass boiler can run on multiple fuel sources including pellets, firewood and wood chips. The boiler has a dedicated computer which can be used to change and adapt the boiler to its given fuel source. The operator of the biomass boiler is Johnny Kay (Arctic Energy Alliance, 2014)

. His contact information is not available, but interviews with community leadership will assist in filling this gap.

Fort McPherson Tent and Canvas

Fort McPherson Tent and Canvas has a winter draft door protector product available for the purpose of preventing heat loss. Custom sizes are available as special order. Address: PO Box 58, Fort McPherson NT, X0E 0J0. Phone: (867)952-2179. Fax: (867)952-2718 (Arctic Energy Alliance, 2015b).

**Community Training and Education**

**Aurora College Programs: http://www.auroracollege.nt.ca/_live/pages/wpPages/ProgramsAtoZ.aspx**

- Apprenticeship Electrician
- Apprenticeship Housing Maintainer
- Apprenticeship Oil Heat Systems Technician
- Apprenticeship Plumber/Gasfitter Program
- Environment and Natural Resources Technology Diploma

## Community Investments

This section describes recent community investments in energy technology, renewable energy projects, energy efficiency initiatives, or local energy literacy programs over the last 5 years. The information available

is limited. Interviews with the listed Energy Champions, Community Leadership, the Community Coordinator and the Local Advisory Committee of the Climate Change Adaptation Project will help to fill this gap.

### Wood Stoves

Wood is one of the five fuel sources used within the community in the 2007-08 energy profile. Wood comprised 1% of the total energy and 0.3% of the total energy costs. 100% of the wood used within Fort McPherson is used in residential homes (Arctic Energy Alliance, 2007).

### Waste Heat Recovery

15% of the waste heat from the diesel generator is recovered in the 2007-08 energy profile. 100% of the recovered heat is used to heat community buildings within Fort McPherson (Arctic Energy Alliance, 2007).

### Biomass District Heating Project

Fort McPherson community members Johnny Kay and Richard Wilson attended a conference on biomass heat technology in 2009. Leading to the biomass boiler being installed in November 2013 and beginning operation in December of 2013. It is a containerized KOB Pyromat tri-fuel biomass boiler that is 85 kilowatts in size. It provides heat to the Tetlit Gwich'in Council and the Fort McPherson Health Centre buildings. The biomass boiler can run on multiple fuel sources including pellets, firewood and wood chips made from local willows. The intention of the heating system was to create a local biomass industry, and jobs in the form of harvesting the willow or the heat plant manager. It has employed more than 50 local people with part time work. Several objectives of the project include improving the local economy, enabling a more self-reliant economy, testing the economic feasibility of a local biomass industry, understanding the price of local wood chips versus imported fuel sources, and reducing dependence on imported fuels. An additional objective was to develop skills, knowledge, and capacity within the community. A challenge encountered was the limited local capacity, such as in terms of the accounting, maintenance, and operations. Factors recognized for future success include ongoing focus on new local employment, and continued support from the community and project champions. A way that the local capacity has been improved is through community education and training workshops with Arctic Energy Alliance and GNWT ENR. Also, a training session for maintenance and operation was hosted on May 30, 2014 by Fink Machine, the boiler supplier (Advanced Energy Centre, 2017).

## Energy Programs and Incentives

This section describes availability of energy programs (e.g. loans, grants, incentives, etc.) for renewable energy projects, energy efficiency, training or capacity building.

### GNWT

The GNWT funds programs—delivered by the Arctic Energy Alliance (AEA)—that provide incentives for residents and businesses to use energy-efficient appliances as well as alternative energy sources and technologies.

### Capital Asset Retrofit Fund (CARF)

CARF allows for the upgrading of existing GNWT buildings to improve overall energy efficiency. The program helps to reduce energy consumption, operating costs, and greenhouse gas emissions from the operation of GNWT buildings. The CARF program has been in existence since 2007.

### Alternative Energy Technologies Program (AETP)

AETP provides funding for communities, commercial businesses and NWT residents to use renewable energy sources such as solar, wind, wood pellet heating, biofuel/synthetic gas and ground source heat pumps.

### Energy Efficiency Incentive Program (EEIP)

The EEIP helps homeowners, businesses and nonprofit organizations purchase new, more energy efficient models of everyday products and appliances.

### Commercial Energy Conservation and Efficiency Program (CECEP)

CECEP provides up to $10,000 for eligible projects to help NWT businesses conserve energy and improve their energy efficiency.

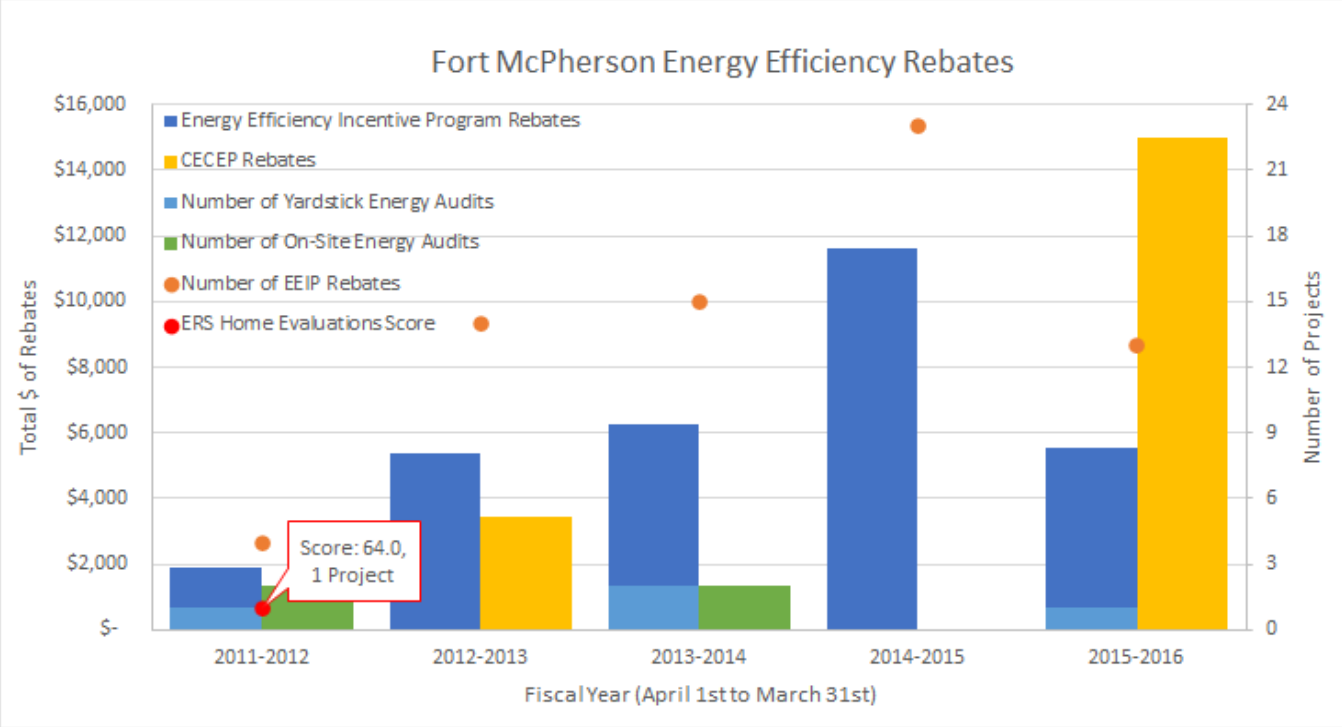


*Figure 7 Distribution of Energy Efficiency Projects in Fort McPherson (Arctic Energy Alliance, 2015a)*

## Community Energy Source Potential

This section describes the physical potential based on solar radiation; hydro resource; geothermal; wind resource; sustainable biomass harvest; coal reserve, etc.

**Climate Change Impacts and Potential Opportunities**

The Climate Change Adaptation Planning Project recognized multiple climate change impacts and potential opportunities as developed by the Local Advisory Committee (Ecology North, 2011). Climate change impacts and subsequent potential opportunities related to energy are listed below.

- Impact: More willows and faster willow growth
    - Opportunity: Potential for biomass harvesting, cutting willows to provide heat energy for community buildings
- Impact: Longer growing season, taller faster growing trees
    - Opportunity: Potential for greater biomass or wood production industry

## Priorities

This section describes key energy priorities over the near-term and long-term (e.g. build service capacity, reduce cost of service, reduce GHGs, renewables transition, induce economic development, energy sovereignty, etc.). Goal C of the Sustainability Plan and its strategies directly relate to energy; these were expanded upon to include a timeframe, activities involved, capital or operating budget, performance measure, target percentage of completion within the time frame, plan to sustain the strategy, community involvement plan, and a partnering opportunity plan (Hamlet of Fort McPherson, 2010). This can be seen below. The five recommended adaptations of the Climate Change Adaptation Planning Project that related to energy, as displayed in the Key Gaps section above, were also included as priorities as shown below (Ecology North, 2011).

**Integrated Community Sustainability Plan**

**Goal C: Implement an and Energy Plan to reduce energy usage and greenhouse gas emissions by 10 percent over three years, and the community's overall impact on the environment.**

*The community government will actively pursue the goal of reduced energy usage and greenhouse gas emissions and develop progressive strategies to reach this goal*.

**Strategy C.1:** Organize the Fort McPherson Energy & Environment Committee.

*This will be headed or co-chaired by a Council member, partnered with Tetlit Gwich'in Council, citizen members (Hamlet of Fort McPherson, 2010).*

- Time Frame: May 2010-ongoing
- Budget Capital:
- Budget Operating: $2,500
- Performance Measure: Have a committee established.
- Target Completion: 100%
- Plan to Sustain: Council to support work of Committee and to adopt its reasonable recommendations.
- Community Involvement:
    - Who: Tetlit Gwich'in Council, Arctic Energy Alliance, Ecology North, public, GNWT, Federal Government
    - How: Public meetings, committee meetings, workshops, research

    - When: 2010
    - Why: Sustainable communities need to reduce greenhouse gas emissions and reduce money spent on non-renewable energy
    - Cost:
- Partnering Opportunity: GNWT, Federal Government, AEA, Ecology North, Tetlit Gwich'in Council, citizens

**Strategy C.2: Maintain buildings and vehicles to minimize fuel used to heat buildings and run vehicles.**

*Create a maintenance schedule, train staff, reduce costs to Hamlet, reduce greenhouse emissions (Hamlet of Fort McPherson, 2010).*

- Time Frame: May 2010-ongoing
- Budget Capital:
- Budget Operating: $5,000
- Performance Measure: Fuel usage decreases.
- Target Completion: 100%
- Plan to Sustain: Council to monitor to ensure fuel usage decreases.
- Community Involvement:
    - Who: Tetlit Gwich'in Council, Arctic Energy Alliance, MACA, GNWT Housing Corporation
    - How: Meetings
    - When: 2010-2011
    - Why: Expertise of AEA shared with TGC.
    - Cost:
- Partnering Opportunity: MACA, GNWT Housing, Tetlit Gwich'in Council, citizens

**Strategy C.3: Review existing Hamlet buildings to maximize insulation and reduce heating costs.**

*Audit and improve buildings (Hamlet of Fort McPherson, 2010).*

- Time Frame: June 2010 - August 2010
- Budget Capital: $50,000
- Budget Operating:
- Performance Measure: All Hamlet buildings audited and recommendations in place
- Target Completion: 100%
- Plan to Sustain: Track audit of buildings and ensure adequate budget in capital improvements
- Community Involvement:
    - Who: MACA,  Arctic Energy Alliance, Tetlit Gwich'in Council
    - How: Meetings
    - When: 2010-2012
    - Why: Hamlet to lead way in reducing greenhouse gas emissions and demonstrating pay back on improved insulation
    - Cost:
- Partnering Opportunity: MACA, AEA, Tetlit Gwich'in Council

**Strategy C.4: Ensure any new Hamlet buildings exceed the minimum NWT requirements for energy efficiency.**

*New public infrastructure must be energy efficient (Hamlet of Fort McPherson, 2010).*

- Time Frame: June 2010 - October 2011
- Budget Capital:
- Budget Operating:
- Performance Measure: Council policy created. Standards written into each RFP/RFQ.
- Target Completion: 100%
- Plan to Sustain: Improved maintenance will extend the life of public infrastructure and vehicles, thus saving Hamlet money.
- Community Involvement:
    - Who: MACA, GNWT, Arctic Energy Alliance, Tetlit Gwich'in Council
    - How: Meetings, reports, public comments
    - When: 2010+
    - Why: To meet Hamlet's emissions reduction target and save Hamlet operating costs.
    - Cost:
- Partnering Opportunity: MACA, GNWT, AEA, Tetlit Gwich'in Council, citizens

**Strategy C.5: Rationalize current vehicle fleet.**

*Does the Hamlet need all the pick-up trucks that it has? Can it reduce yearly mileage? (Hamlet of Fort McPherson, 2010).*

- Time Frame: June 2010 - October 2010
- Budget Capital:
- Budget Operating:
- Performance Measure: Report to Council on rational for fleet size with recommendations
- Target Completion: 100%
- Plan to Sustain: Improved maintenance will extend the life of public infrastructure and vehicles, thus saving Hamlet money.
- Community Involvement:
    - Who:
    - How:
    - When:
    - Why:
    - Cost:
- Partnering Opportunity:

**Strategy C.6: Report on building a community heating plant, in conjunction with upgraded and expanded utilidor.**

*Feasibility study required with full costing and payback (Hamlet of Fort McPherson, 2010).*

- Time Frame: June 2010 - ongoing
- Budget Capital:

- Budget Operating: $10,000
- Performance Measure: Study presented to Council for action.
- Target Completion: 100%
- Plan to Sustain: Council to monitor to ensure fuel usage decreases.
- Community Involvement:
    - Who: MACA, GNWT, Arctic Energy Alliance, Tetlit Gwich'in Council, GNWT Housing Corporation
    - How: Public and private meetings
    - When: 2010-2011
    - Why: Reduce greenhouse gas emissions and save organizations money on heating.
    - Cost:
- Partnering Opportunity: MACA, GNWT, GNWT Housing, Tetlit Gwich'in Council, citizens

**Tetl'it Zheh Climate Change Adaptation Planning Project Adaptation**

- Theme: Climate Change Opportunities
    - Adaptation: Investigate the potential for using willows as biomass to heat community buildings
- Theme: Reduce Fossil Fuel Dependence
    - Develop closer ties with Arctic Energy Alliance
- Theme: Reduce Fossil Fuel Dependence
    - Investigate the use of wood chips or pellets to incorporate and expand the residual heat distribution system in the core of town
- Theme: Reduce Fossil Fuel Dependence
    - Develop an anti-idling campaign to reduce unnecessary fuel use
- Theme: Reduce Fossil Fuel Dependence
    - Promote the use of wood stoves and pellet stoves in residences in Fort McPherson (Ecology North, 2011).

## VULNERABILITIES AND SECURITY

The off-grid nature of Fort McPherson combined with the cold climate and geographic remoteness presents unique energy security issues that impact the community. This section outlines what energy security means to the community and describes the vulnerabilities of the community's energy system. The areas of vulnerability discussed are power disruptions, fuel supply, infrastructure, renewables integration and economic vulnerability.

### Energy Security

The document review did not uncover any definition of energy security for the community of Fort McPherson. Neither was any definition of energy security found for the Beaufort Delta region. Academic literature contains definitions of energy security for arctic regions including rural Alaska and northern Russia that experience energy situations similar to the Beaufort Delta region that could be applied to Fort McPherson (Hossain et al., 2016; Kiushkina & Antonenkov, 2019), but it is still necessary to obtain a community-specific definition to have a complete understanding of the vulnerabilities that need to be addressed in building a

community energy plan. The definitions applied in rural Alaska and northern Russia respectively are, "A situation in which people have reliable access to socially acceptable energy generation or provisioning services, at a level sufficient to conducting a sustainable life," (Hossain et al., 2016) and, "This is the state of protection of service areas against external and internal threats caused by territory isolation and remoteness from centralized power supply sources, which enables ensuring fuel-and-energy sector diversification and favourable conditions for operation and energy self-sustainability of local power industry facilities meeting modern requirements to power quality with account for harsh climatic conditions and preventing emergencies in case of power supply interruptions" (Kiushkina & Antonenkov, 2019).

A community-specific definition for Fort McPherson can be developed through interviews with community residents, community leaders, the GNWT Fuel Services Division who provide fuel to the community and NTPC staff.

## Power Disruptions

This section describes the timing, duration, frequency of, and reasons for power outages, changes in power disruptions trends over the past 10 years and outage implications for the community of Fort McPherson.

### Outages and Power Disruption Trends

The sole electrical utility for the Beaufort Delta region is the crown corporation NTPC. NTPC classifies outages into eight categories by their cause (Northwest Territories Power Corporation, 2010):

- Loss of production caused by equipment failures or breakdowns,
- Loss of supply due to problems with the transmission or distribution system,
- Scheduled outages due to disconnection for construction, maintenance or repair,
- Lightning strikes to transmission or distribution systems,
- Adverse weather such as rain, ice storms, snow, winds, extreme temperatures, freezing fog or frost,
- Human elements such as incorrect use of equipment, settings or installation maintenance; switching errors or sabotage,
- External interference such as birds, animals or foreign objects, and
- Unknown where there is no apparent cause.

In its annual reports, NTPC provides leading causes of outages for the year along with reliability indices such as the System Average Interruption Frequency Index (SAIFI) and System Average Interruption Duration Index (SAIDI) for its entire customer base, but the information is not available on a community level (Northwest Territories Power Corporation, 2019a). While the majority of North American utilities are required to report reliability information - including electrical outages - to the North American Electric Reliability Corporation (NERC), because NWT is not connected to the rest of the North American electrical grid, NTPC does not have this requirement. Instead, reliability performance is regulated by the NWT Public Utilities Board (PUB) (Natural Resources Canada, 2016). However, reliability performance information collected by the NWT PUB is not publicly available.

Another possible source of reliability performance data is the Canadian Electricity Association (CEA). The CEA collects reliability performance data from participating member organizations across the country including NTPC, and provides pooled data to the public in an annual report available for a fee (Canadian Electricity Association, n.d.). However, it is unknown if the data NTPC provides to the CEA is detailed at the community level and even if it is, the unpooled data for NTPC is not publicly available.

### Outage Implications for Fort McPherson

Little information is available regarding how power outages affect Fort McPherson residents. It is unknown whether the community relies upon electricity for heat, but heating oil (diesel fuel used for heating) is available to the community that can be used in the event of a power outage.

### Gaps in Data Availability

Data that still needs to be collected surrounding power disruptions are:

1. Current power outage data for Fort McPherson,
2. Trends of power outages in Fort McPherson over the past 10 years, and
3. Outage implications for the community.

Current and historic power outage data can be obtained from NTPC through a formal request. In the event NTPC denies the request, the information may also be obtained from the NWT PUB, though they may not have access to the same wealth of data. Additionally, the CEA could be contacted to determine if they have community-specific data and are willing to share it. Information on outage implications for Fort McPherson can be obtained through interviews with community leaders and residents. Additionally, outage implication data may be obtained from Fort McPherson's emergency response plan. If the community has one, requests can be made to community leaders to view it.

## Fuel Supply

This section describes the access to and reliability of fuel supply for power generation and heating, as well as the reasons for any disruptions in the fuel supply chains.

### Fuel Services Division

Under the Fuel Management Services Agreement, the GNWT Fuel Services Division (FSD) manages the purchase, transport and storage of fuel in 20 off-grid communities on behalf of NTPC until the contract expires on March 31, 2021 (Gwich'in Council International, 2017; Northwest Territories Power Corporation, 2019a). Furthermore, under this agreement, FSD also handles the maintenance of bulk fuel storage tank farms owned by NTPC. Though the actual Fuel Management Services Agreement document could not be located, it is highly likely that Fort McPherson is one of the 20 communities named for servicing. The price of fuel under this agreement depends on the market price, the cost of transport, the GNWT fuel tax rate and the amount of fuel purchased by NTPC in a given year.

While the agreements mentioned above explain who manages the fuel supply logistics for electricity generation, it is unknown whether FSD handles the delivery of fuel to the community that is used for other purposes such as heating.

### Delivery Route

According to the 2010 Report of the NTPC Review Panel, FSD supplies Fort McPherson with fuel from Inuvik by an all season road (Northwest Territories Power Corporation, 2010). Inuvik receives fuel through a combination of marine and winter-road transport. Some products are shipped by rail from Alberta to Hay River, NWT, and then transported by barge along the Beaufort Sea from Hay River to Inuvik (Government of Canada, 2019). The GNWT Marine Transportation Services delivers to Inuvik twice per year during the sailing season. The estimated arrival dates for the 2020 year are June 27 and July 20 (Government of the Northwest Territories, 2020).

### Biomass Source

Wood pellets used to fuel biomass boilers are shipped from various locations in southern Canada (Government of the Northwest Territories, 2017).

### Gaps in Data Availability

1. It needs to be verified whether Fort McPherson is one of the 20 communities serviced by FSD under the Fuel Management Services Agreement,
2. The supply chain for fuels used for purposes other than electricity need to be identified,
3. The exact shipping routes for fuels need to be determined, and
4. Information about fuel supply disruptions needs to be collected.

Item 1 can be confirmed through discussions with FSD staff or NTPC staff. Information on the fuel supply chain, delivery routes and fuel supply disruptions can be obtained through interviews with FSD, local community leaders and local fuel distributors. The local fuel distributors will be identified through interviews with community leaders.

## Infrastructure

This section discusses the condition of energy infrastructure, its current and future capacity, maintenance requirements and major threats to energy infrastructure.

### Age and Condition of Existing Energy Infrastructure

Little information is given on the age and condition of energy infrastructure in Fort McPherson. The only information available is that residual heat is collected from the diesel generating plant and is used to supply heat to buildings in the community such as Chief Julius School through a system of above-ground pipes built by Aadrii Limited, and a biomass boiler was purchased from a third party for the community's health centre in September 2014 (Government of the Northwest Territories, 2018; Northwest Territories Power Corporation, n.d.-b).

### Capacity of Existing Infrastructure to meet Current and Future Energy Needs

NTPC keeps "a reserve margin large enough to compensate for the loss of the largest generating unit during the system peak" (Natural Resources Canada, 2016). This criterion - commonly known as N-1 - means that capacity of backup generation is sized such that the electrical system can sustain the loss of its largest

generating unit without disrupting the electrical supply. More specifically, NTPC backup units are 110% the size of the corresponding primary unit (Northwest Territories Power Corporation, 2010). According to this criterion, Fort McPherson has sufficient back-up power available for when a generator fails, but it provides no information about whether the community is under load restriction. The average annual electrical load is 397 kW and the installed electrical generation capacity is 1835 kW, suggesting that there is sufficient capacity to meet the load (Northwest Territories Power Corporation, n.d.-a, 2019b). However, because the peak annual electrical load is unknown, one cannot conclusively say that existing infrastructure is sufficiently satisfying the community's energy needs. Information around the existing capacity of distribution infrastructure and the capacity of infrastructure to satisfy future energy needs could not be located.

**Access to Maintenance**

NTPC states they do not have technical staff based in every community due to prohibitive costs and that there may be some delays reaching communities in the event of equipment failure (Northwest Territories Power Corporation, 2010). As mentioned in the Fuel Services Division section, if Fort McPherson is one of the 20 communities named in the Fuel Management Services Agreement, then FSD manages the maintenance of the fuel tank farms.

**Major Threats to Infrastructure**

According to NTPC's 2018-19 annual report, adverse weather and foreign interference (external objects such as tree branches, trucks, or animals) are the leading external causes of outages across the territory, but no information is available on the major threats experienced by Fort McPherson's infrastructure specifically (2019a).

**Gaps in Data Availability**

The gaps surrounding Fort McPherson's energy infrastructure are:

1. The age and condition of most of its energy infrastructure are unknown,
2. Little information is available on the capacity of existing infrastructure generation and distribution infrastructure to meet current and future energy needs,
3. Minimal information is known regarding maintenance routines and access to spare parts, and
4. Little information has been found on major threats to Fort McPherson's energy infrastructure.

Most of this information can be gained from NTPC through formal data requests and interviews with staff. Fuel tank farm maintenance procedures can be determined through interviews with FSD staff. Additionally, interviews with community leaders could provide some information on when major energy assets were installed and how well the infrastructure is serving existing energy needs.

## Renewables Integration

This section addresses the ability to integrate renewable energy technologies (RET) into the existing energy system and discusses technical limitations and capital commitments that constrain the ability to transition to or invest in renewables.

### Utility Attitude Toward RET

In phase II of their 2016-19 general rate application, NTPC states that utility owned renewable generation is considered when a diesel power plant is due for replacement, and has introduced a net metering program allowing customer owned solar installations less than 15 kW to be connected to the electrical grid (2017).

### Technical Limitations

RET installations connected to the grid are limited by NTPC to 20% of a community's average annual electrical load. This is done to "protect customers from higher electricity rates and an increased number of outages" that could result from grid instability and inefficient generator cycling associated with high levels of RET penetration (Northwest Territories Power Corporation, 2018). For Fort McPherson, the allowable RET capacity is 79 kW and only 5 kW of RET have been integrated into the grid through the net metering program. This leaves 74 kW of available RET capacity (Northwest Territories Power Corporation, 2019b). While a reason for the renewables penetration cap is given, little explanation is provided regarding why 20% was selected as the maximum rather than a higher or lower value.

### Gaps in Data Availability

No information is available regarding ongoing capital commitments of the community and NTPC that constrain the ability to transition to or invest in RETs. This information can be obtained from interviews with community leaders and NTPC staff.

## Economic Vulnerability

This section discusses the state of key industries and economic sectors in the community and how it is opening or closing opportunities for energy choices. No information on the economic vulnerability of Fort McPherson was found by document review. This information can be obtained through interviews with community leaders to identify Fort McPherson's key economic sectors, and interviews with employers and employees who work in those sectors.

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