

# DEVELOPMENT OF SUPPLY CHAIN FOR WOOD PELLET HEATING APPLICATIONS IN THE CANADIAN NORTHWEST TERRITORIES

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## Land Acknowledgement

Know more than names of the land.

We are past the point of gratitude.

It is time to commit to more than

“live, work, and play.”

**Musqueam**

**Dene**

**Métis**

**Inuvialuit**

KNOW MORE THAN NAME  
SOFTHE LAND WE ARE  
AT THE POINT OF GRAT  
IT IS TIME TO GO  
MIMIT TOMORE THAN  
IVE, WORK AND PLAY.



## Outlines

- ❖ Project Description
- ❖ Regional Overview
- ❖ Evaluation of Existing Heating Systems
- ❖ Case Study: Mackenzie River Communities
- ❖ Wood Pellet Supply Chain Mapping and Optimization
- ❖ Challenges
- ❖ Key Recommendations

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## Project Description

Northwest Territories in Canada relies heavily on fossil fuels for space heating due to its harsh climate and limited access to affordable energy alternatives. This dependence contributes to high greenhouse gas (GHG) emissions, elevated energy costs, and supply chain vulnerabilities in remote areas. Biomass heating, particularly wood pellets, offers a renewable and low-carbon option that can reduce emissions and promote local energy resilience.

- Reduce GHG emissions from diesel-generated electricity by 25%
- Increase the share of renewable energy used for community heating to 40%
- Improve building energy efficiency by 15%



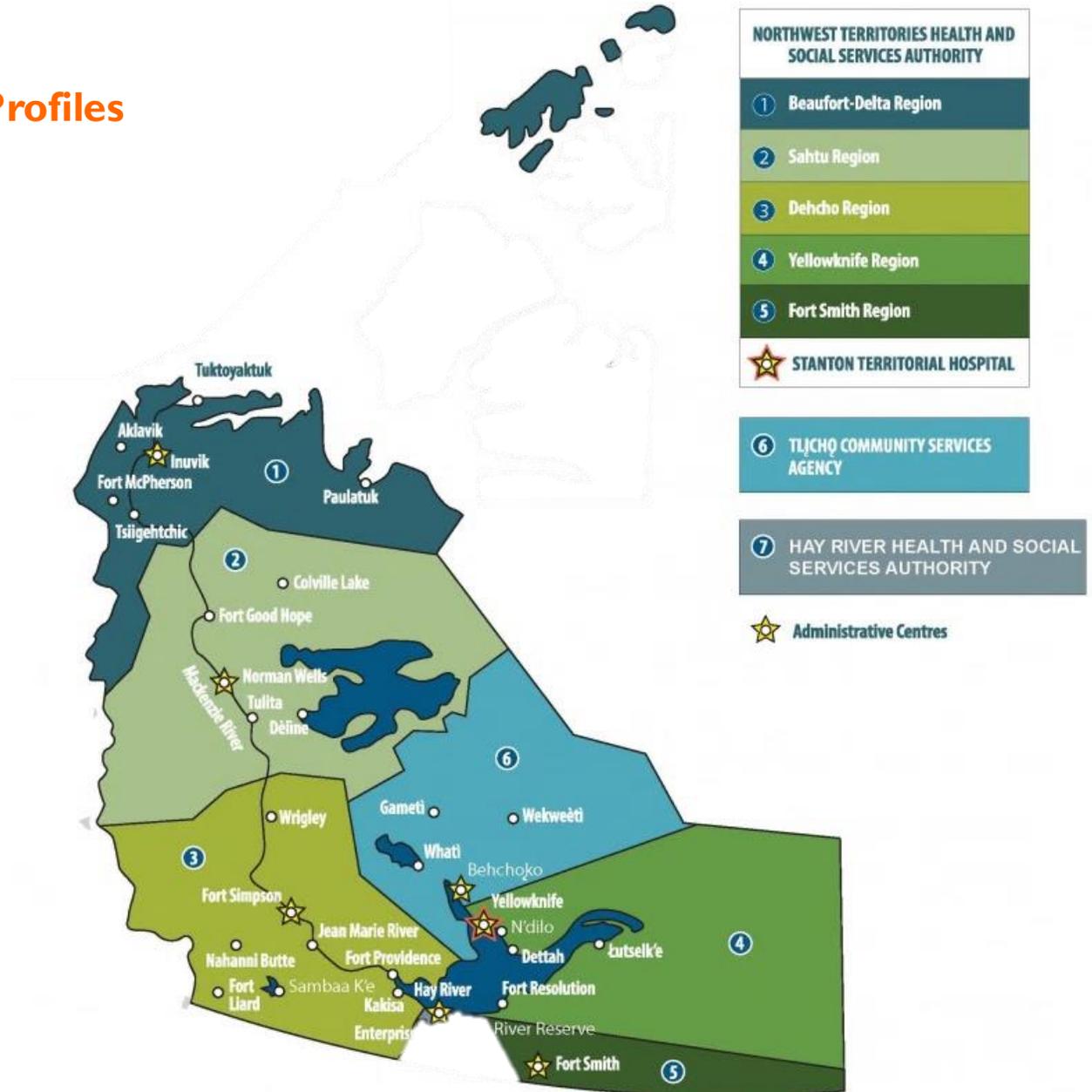
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# Regional Overview

## Geography, Demographics, and Community Profiles

- Area: ~1.4 million square kilometers
- 33 communities
- 45,000 residents
  - Yellowknife ~ 20,000
  - Hay River ~ 3,500
  - Inuvik ~ 3,200
  - Fort Smith ~ 2,400
  - Fort Simpson ~ 1,200
- Dene, Métis, and Inuvialuit



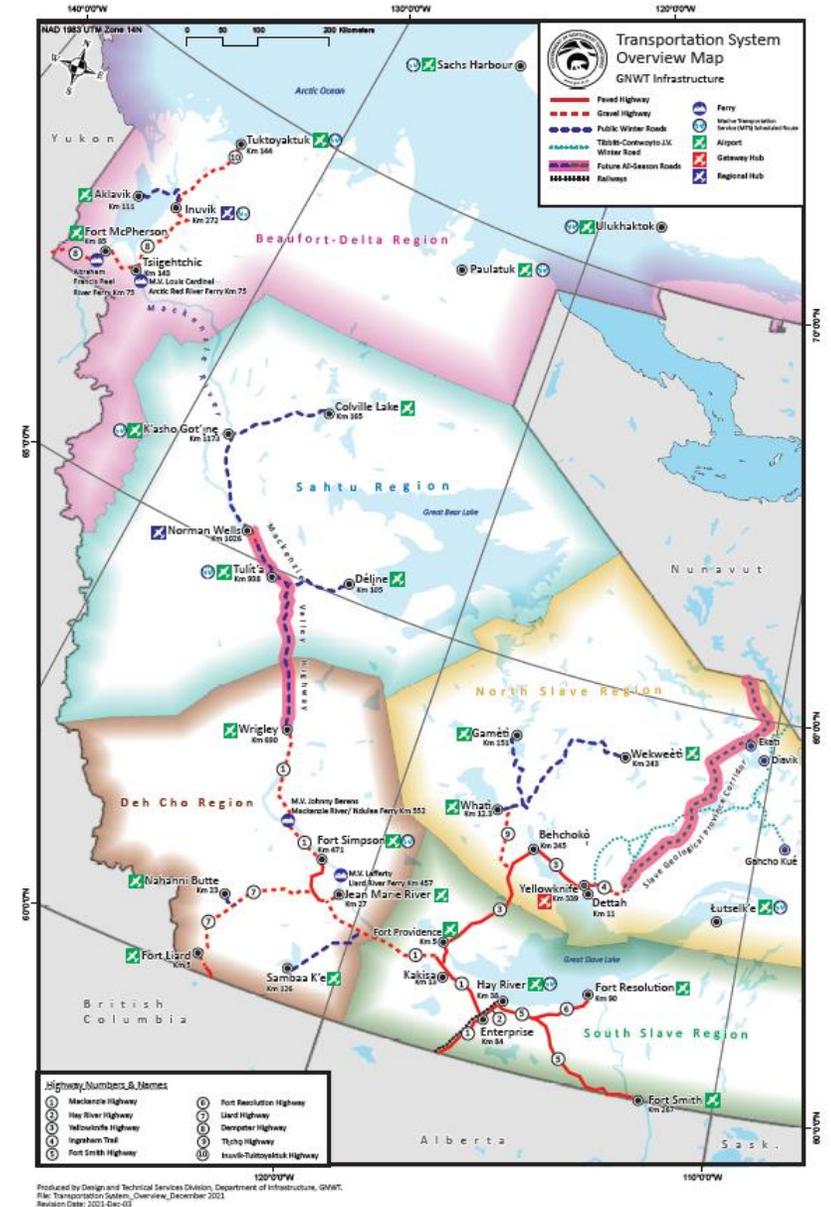
\* <https://www.practicenwt.ca/en/map-nwt>

## Transportation

- 2,200 km of all-weather highways
- 1,425 km of seasonal winter roads
- 27 public airports
- 4 public ferries
- Seasonal marine barge along Mackenzie

## Energy System Context and Regional Variation

- North Slave ( Yellowknife)
- South Slave (Fort Smith, Hay River)
- Beaufort Delta
- Dehcho
- Sahtu



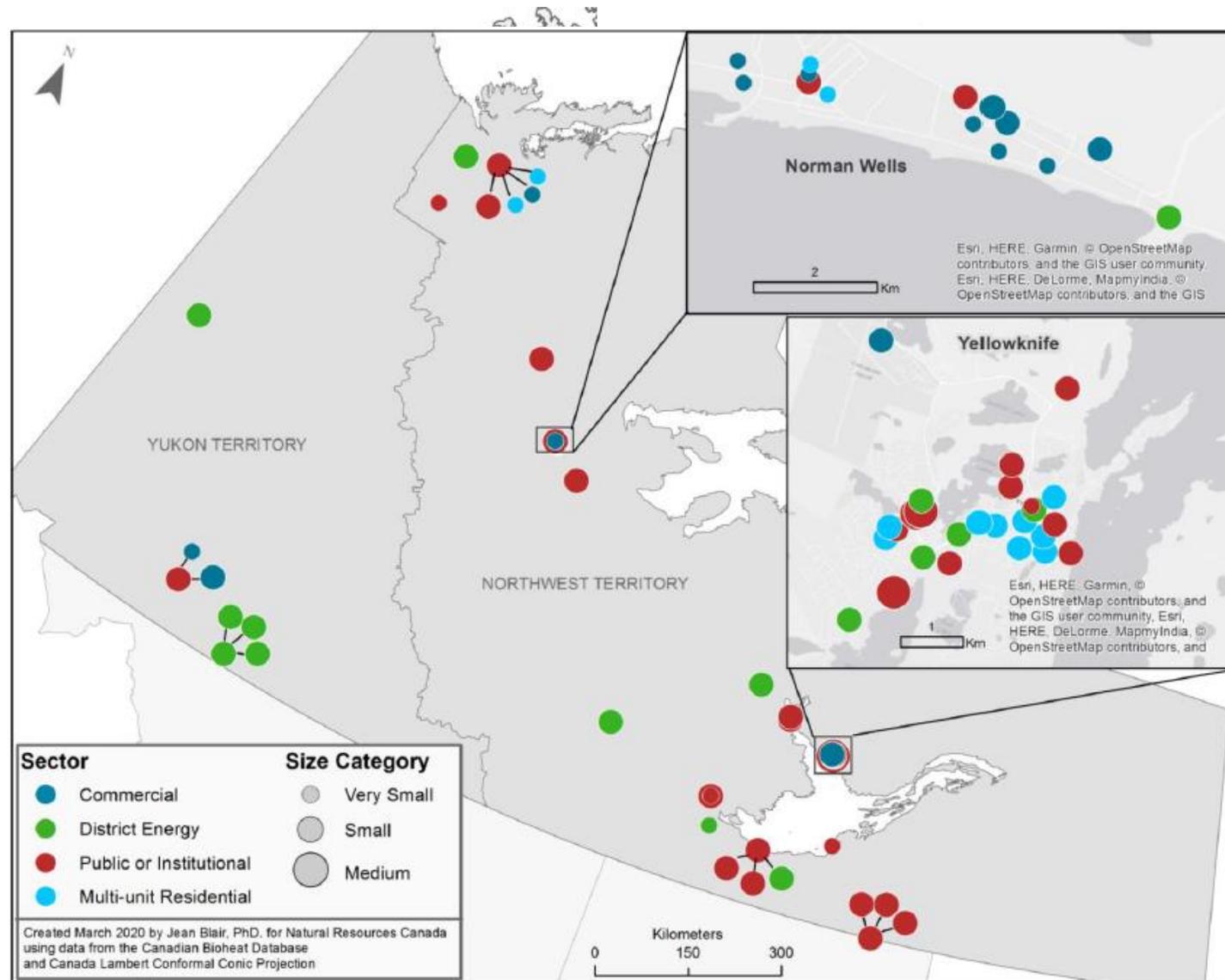
\* *Transportation System Overview* (Revision date: December 3, 2021). Government of the Northwest Territories, Yellowknife, NT, Canada

## Biomass and Pellet Heating System in the NWT

- 70 bioheat projects
- 786 kW of bioheat capacity per 1000 residents
- Biomass share for GNWT buildings heating:
  - Sahtu ~ 50 %
  - Beaufort Delta ~ 16 %
  - Dehcho ~ 15 %
- Mostly Wood Pellets

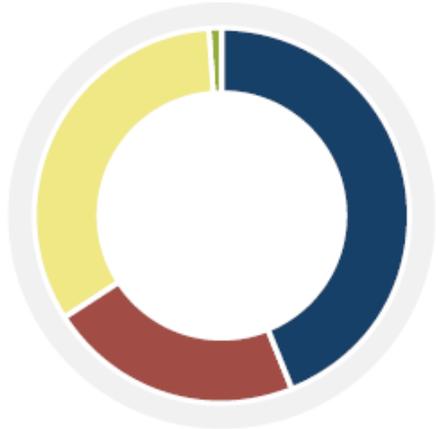
## Wood Pellet Resources

- La Crete Sawmill Ltd. - Alberta
- Historically, from Premium Pellet - BC



\* Blair, M. J. (2020). Updating of the Canadian Bioheat Database: Final Report. Prepared for Natural Resources Canada. March 31, 2020.

# Evaluation of Existing Heating Fuels



- **44%** | Heating Oil
- **22%** | Propane/Natural Gas
- **33%** | Wood Pellet
- **1%** | Electricity/Residual Heat

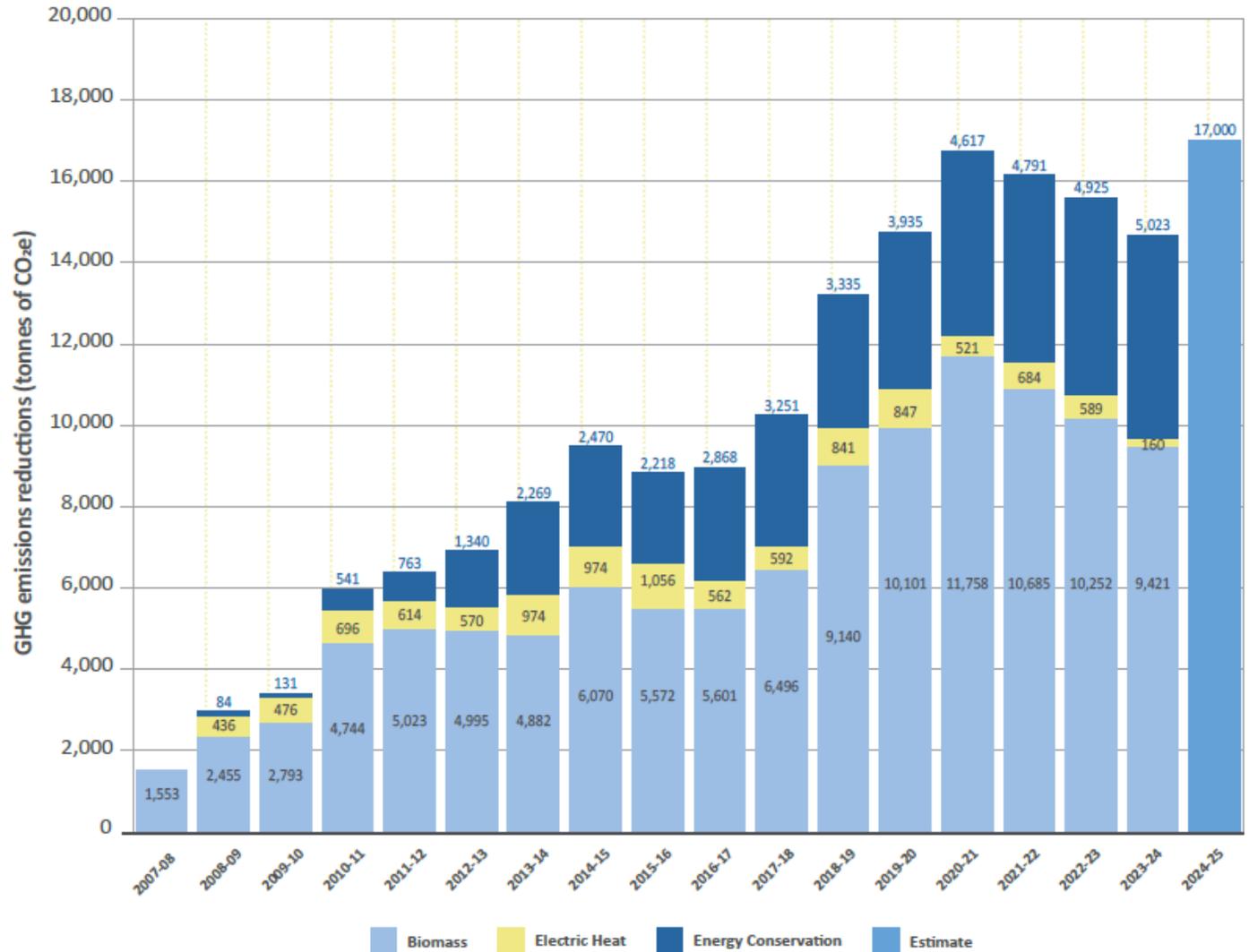
**Annual Biomass Use:**  
**~25,000** tonnes wood pellets



**Annual Emission Reduction:**  
**~9,500** tonnes of CO<sub>2</sub>



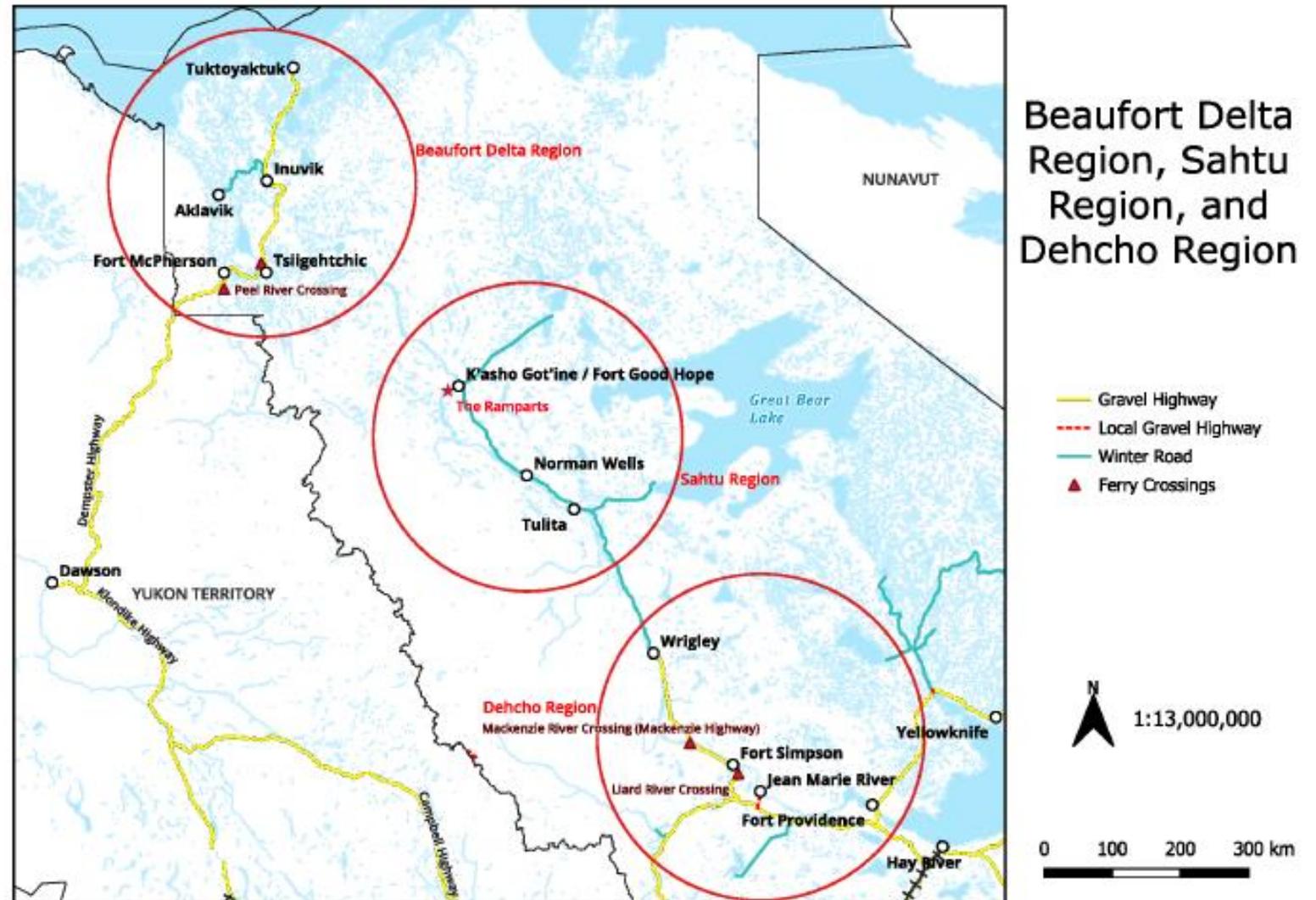
**Annual Cost Savings:**  
**~\$3.2 Million**



\* Energy Initiatives Report 2023–2024 (2024). Department of Infrastructure, Government of the Northwest Territories, Yellowknife, NT, Canada.

## Case Study: Mackenzie River Communities

- 12 remote communities
- 3 administrative regions
  - Beaufort Delta
  - Sahtu
  - Dehcho
- ~11,000 residents
- Uncertainty and reliability of Barging



## Fuel Cost Comparison – Sensitivity Analysis

Regions	Average Heating Oil Consumption 2020-2023 GJ	Average Pellet Consumption 2020-2023 GJ	Total Energy Consumption 2020-2023 GJ
Beaufort Delta	83,131.25	16,387.75	99,519.00
Sahtu	16,910.75	18,386.25	35,297.00
Dehcho	27,617.25	4,675.50	32,292.75

Fuel Type	Price (\$/GJ)		
	Low	Base	High
Heating Oil	45	55	70
Wood Pellet	14	30	40

## 100% Heating Oil vs. 100% Wood Pellets

Regions	100% Heating Oil		
	Low	Base	High
Beaufort Delta	\$ 4,478,355.0	\$ 5,473,545.0	\$ 6,966,330.0
Sahtu	\$ 1,588,365.0	\$ 1,941,335.0	\$ 2,470,790.0
Dehcho	\$ 1,453,173.7	\$ 1,776,101.2	\$ 2,260,492.5

Regions	100% Wood Pellet		
	Low	Base	High
Beaufort Delta	\$ 1,393,266.0	\$ 2,985,570.0	\$ 3,980,760.0
Sahtu	\$ 494,158.0	\$ 1,058,910.0	\$ 1,411,880.0
Dehcho	\$ 452,098.5	\$ 968,782.5	\$ 1,291,710.0

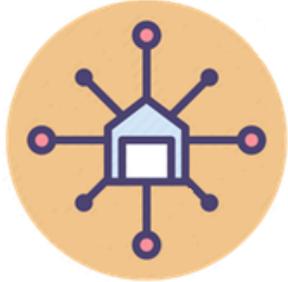
## Actual Consumption

- Beaufort Delta
  - Higher dependence on heating oil
  - Higher energy demand
  - Higher population
- Sahtu
  - More balanced fuel type
- Dehcho
  - High dependence on heating oil
  - Huge potential for heating oil offset

Scenarios	Regions		
	Beaufort Delta	Sahtu	Dehcho
Low-Low	\$ 3,970,334.7	\$ 1,018,391.2	\$ 1,308,233.2
Low-Base	\$ 4,232,538.7	\$ 1,312,571.2	\$ 1,383,041.2
Low-High	\$ 4,396,416.2	\$ 1,496,433.7	\$ 1,429,796.2
Base-Low	\$ 4,801,647.2	\$ 1,187,498.7	\$ 1,584,405.7
Base-Base	\$ 5,063,851.2	\$ 1,481,678.7	\$ 1,659,213.7
Base-High	\$ 5,227,728.7	\$ 1,665,541.2	\$ 1,705,968.7
High-Low	\$ 6,048,616.0	\$ 1,441,160.0	\$ 1,998,664.5
High-Base	\$ 6,310,820.0	\$ 1,735,340.0	\$ 2,073,472.5
High-High	\$ 6,474,697.5	\$ 1,919,202.5	\$ 2,120,227.5
	\$ 2,500,000.0	\$ 900,000.0	\$ 810,000.0

## Regional Supply Chain Performance

### Distribution Hubs



1. Inuvik for Beaufort Delta
2. Norman Wells For Sahtu
3. Yellowknife For North Slave
4. Hay River for South Slave

### Current Supply Chain Structure and Key Routes

- **Dehcho Region** – Direct year-round trucking from La Crête to Fort Simpson and Fort Liard via all-weather roads offers the lowest landed costs.
- **Sahtu Region** – Pellets are trucked to Fort Simpson, then barged up the Mackenzie River to Norman Wells, where Green Energy NWT maintains a 13-silo (≈ 1,300 tonnes) storage hub. From there, hopper trailers deliver to Fort Good Hope and Tulita. Barges run every two–three weeks in summer, with smaller tridem trucks resupplying by winter road.
- **Beaufort Delta Region** – Pellets reach Inuvik and Aklavik mainly by truck along the 3,100 km Dempster Highway. Arctic Restoration Corporation operates about 300 tonnes of silo storage.



\* <https://spectacularnwt.com/about-nwt/geography-and-geology/>

## Logistical Bottlenecks and Challenges

### Infrastructure Risks

- Limited storage and redundancy in regional fuel infrastructure.
- Lack of region-specific data on cost, logistics, and environmental benefits.

### Climate & Geography Risks

- Supply-chain vulnerability due to transportation disruptions.
  - Hydrological variability
  - Climate and terrain impacts - Permafrost degradation and landslides

### Market & Workforce Risks

- High dependence on imported fossil fuels
- Limited community engagement and awareness of biomass potential.
- Labor and trucking constraints
  - Driver shortage
  - Limited suitable truck
- Single-supplier risk

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## Optimization Opportunities

1. **Expand Inuvik Bulk Storage** by at least 900 tonnes. **Beaufort Delta**
2. **Establishment of Fort Simpson** 300 tonnes bulk storage and a dedicated delivery truck as a central hub. **Dehcho**
3. **Development of Behchokò** 300 tonnes bulk storage and dedicated delivery truck as central hub. **North Slave Lake**
4. **Infrastructure Upgrades:** Improve docking facilities and winter storage capability in the **Beaufort Delta**
5. **Optimize Barge Operations:** Alternative northern loading points, flexible shipment methods, and precise scheduling
6. **Diversify Pellet Sources:** Slave Lake, High Level, and Dawson Creek to reduce reliance on the La Crête plant.
7. **Long-Term Supply Agreements**



## Key Recommendations

1. Prioritize Pellet Expansion in High-Feasibility Communities
2. Expand Territorial Storage Infrastructure
3. Optimize Barge, Winter Road, and Multi-Route Logistics
4. Accelerate Conversions in GNWT, Commercial, and Institutional Buildings
5. Enable Moderate Residential Adoption in Road-Connected Communities
6. Support Indigenous-Led Supply Chains and Workforce Capacity
7. Pellet Quality Monitoring
8. Pellet Supply Diversification and Long-Term Supply Agreements
9. Establish a Centralized Biomass Monitoring and Knowledge-Sharing System
10. Promote Continuous Knowledge Exchange

# THANKS



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# APPENDIX

## Local Wood Pellet Plant Feasibility

We have lots of trees in NWT, why not turn them into local pellets?



### Limited Raw Material Supply

Unlike southern projects that use **low-cost forestry waste**, NWT lacks sufficient **waste wood by-products**.

Without adequate wood waste, pellet production **require harvesting trees**, which is **not a sustainable solution**.



### Labor-Intensive Operations

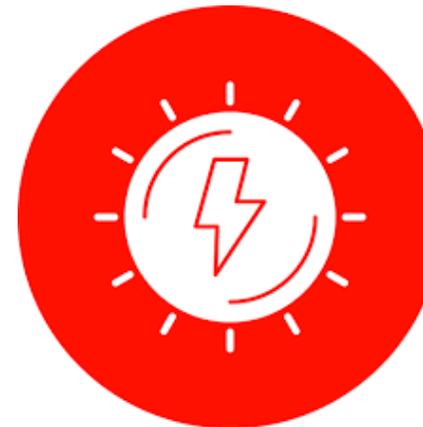
The **Fort Simpson study** found that local pellet production would be **highly labor-intensive**



### High Capital Costs

A **30,000 tpy** facility could offer a **20% ROI**, but the **current market (12,000 tpy)** is too small to sustain profitability.

The **smallest viable plant (10,000 tpy)** would yield only a **9% ROI**, making it **financing difficult**.



### Fuel-Intensive Operations

Producing pellets from harvested trees requires **chopping, drying, and processing**, all of which demand significant energy.