Pacific NorthWest Economic Region

2015 ECONOMIC LEADERSHIP FORUM

Energy Opportunities and Challenges in the Northwest Territories

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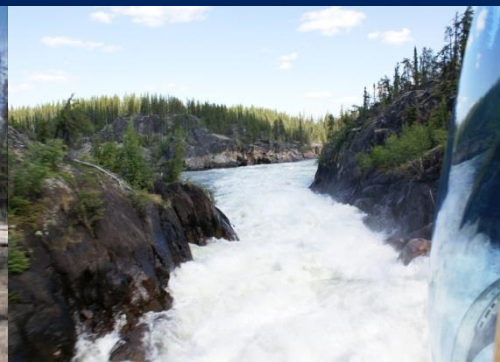
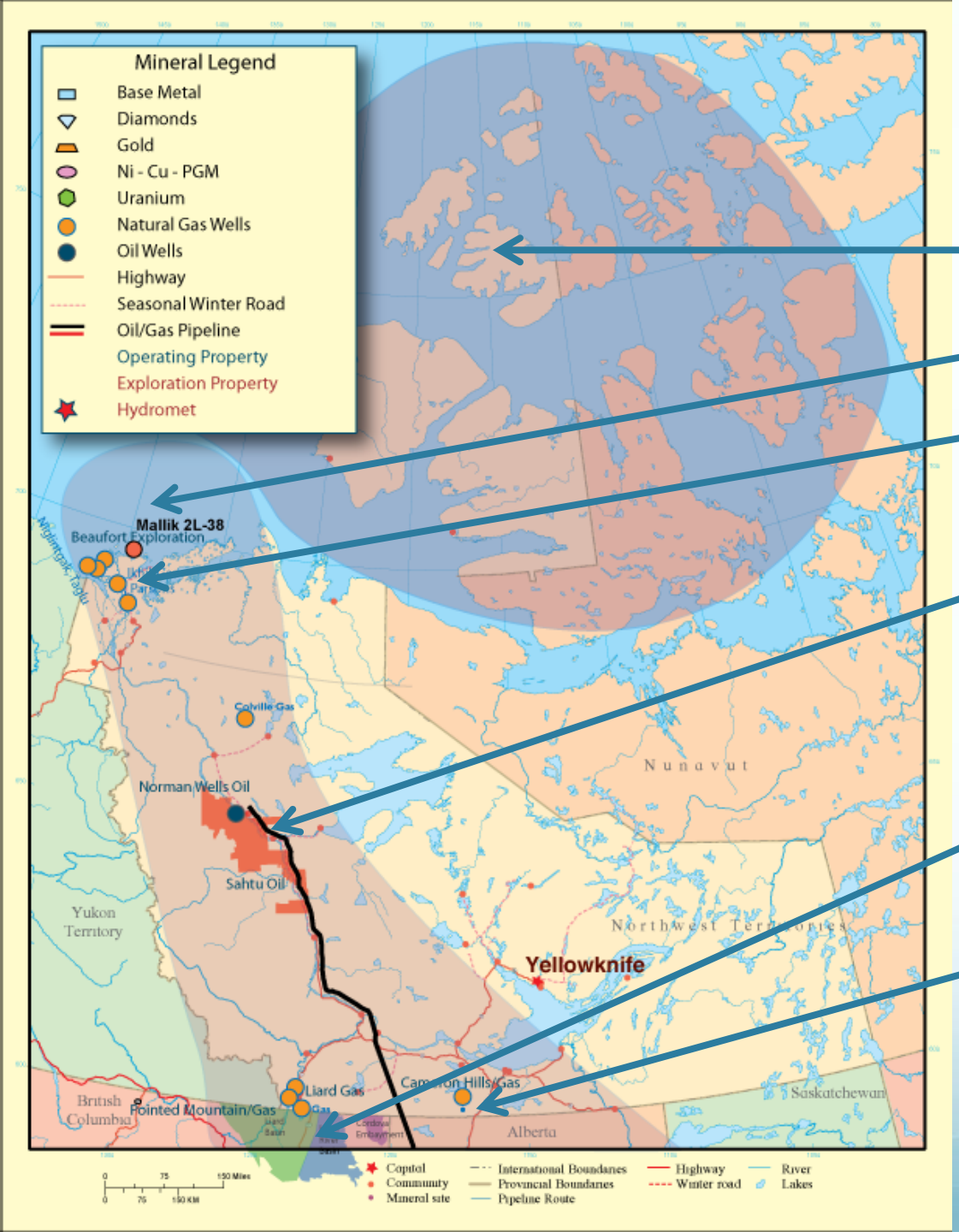


Introduction

- Energy in the NWT
- Response:
  - Energy Conservation and Efficiency
  - Integrating Renewable and Alternative Energy Sources
- Low Water in the North Slave Region
- Opportunities Going Forward

Onshore Oil and Gas Properties



Arctic Islands Oil and Gas

Beaufort oil and gas

Mackenzie Gas

Norman Wells Conventional Oil and Gas Field and Canol Shale Oil

Horn River Shale Gas

Cameron Hill Oil and Gas

Legacy Hydro 1940's / 1960's

Snare River Hydro

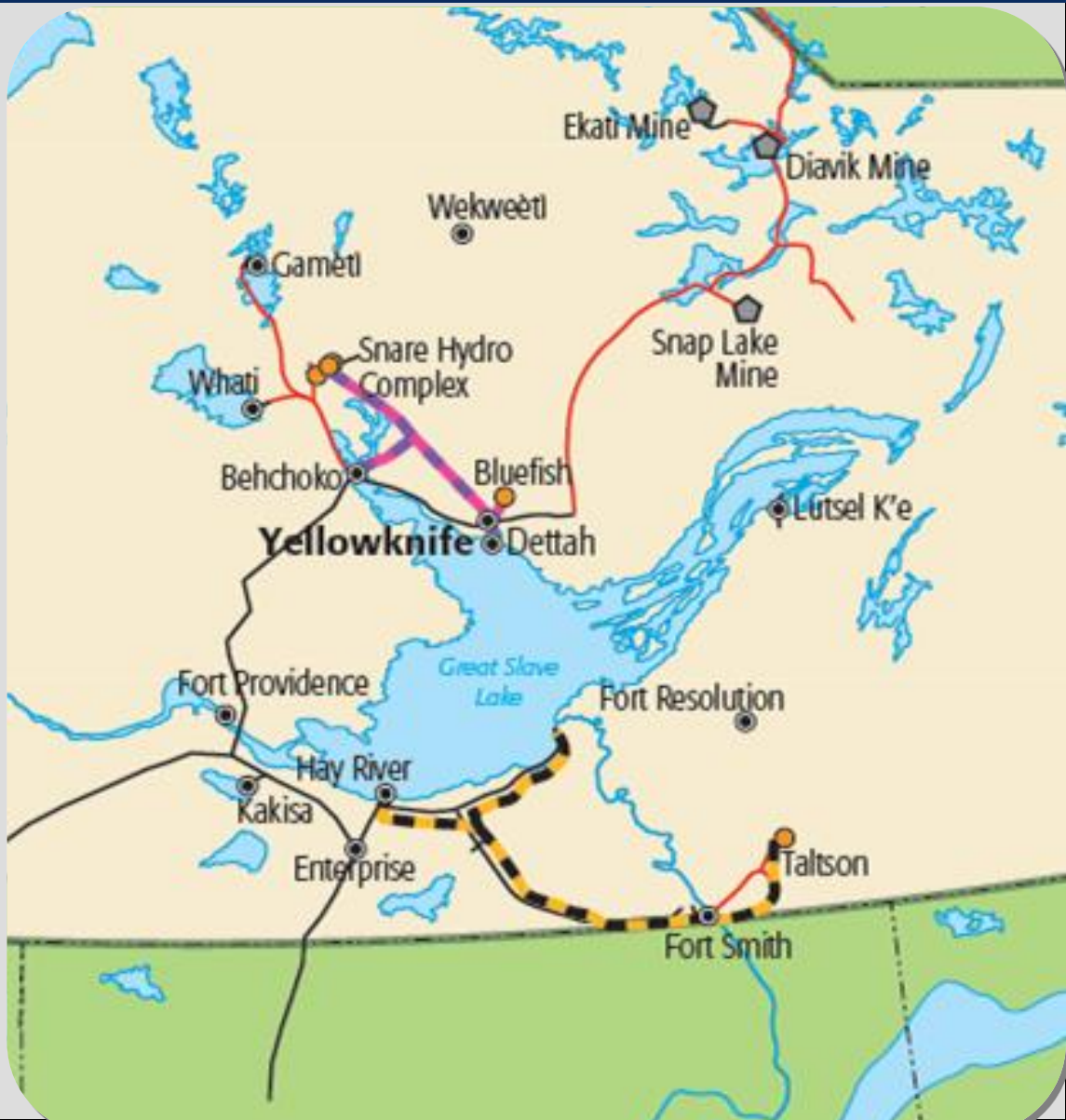
- Snare Rapids – 8.5 MW
- Snare Falls – 7.4 MW
- Snare Cascades – 4.3 MW
- Snare Forks – 10 MW
- 150km transmission

Yellowknife River

- Bluefish Dam – 7.5 MW

Taltson River

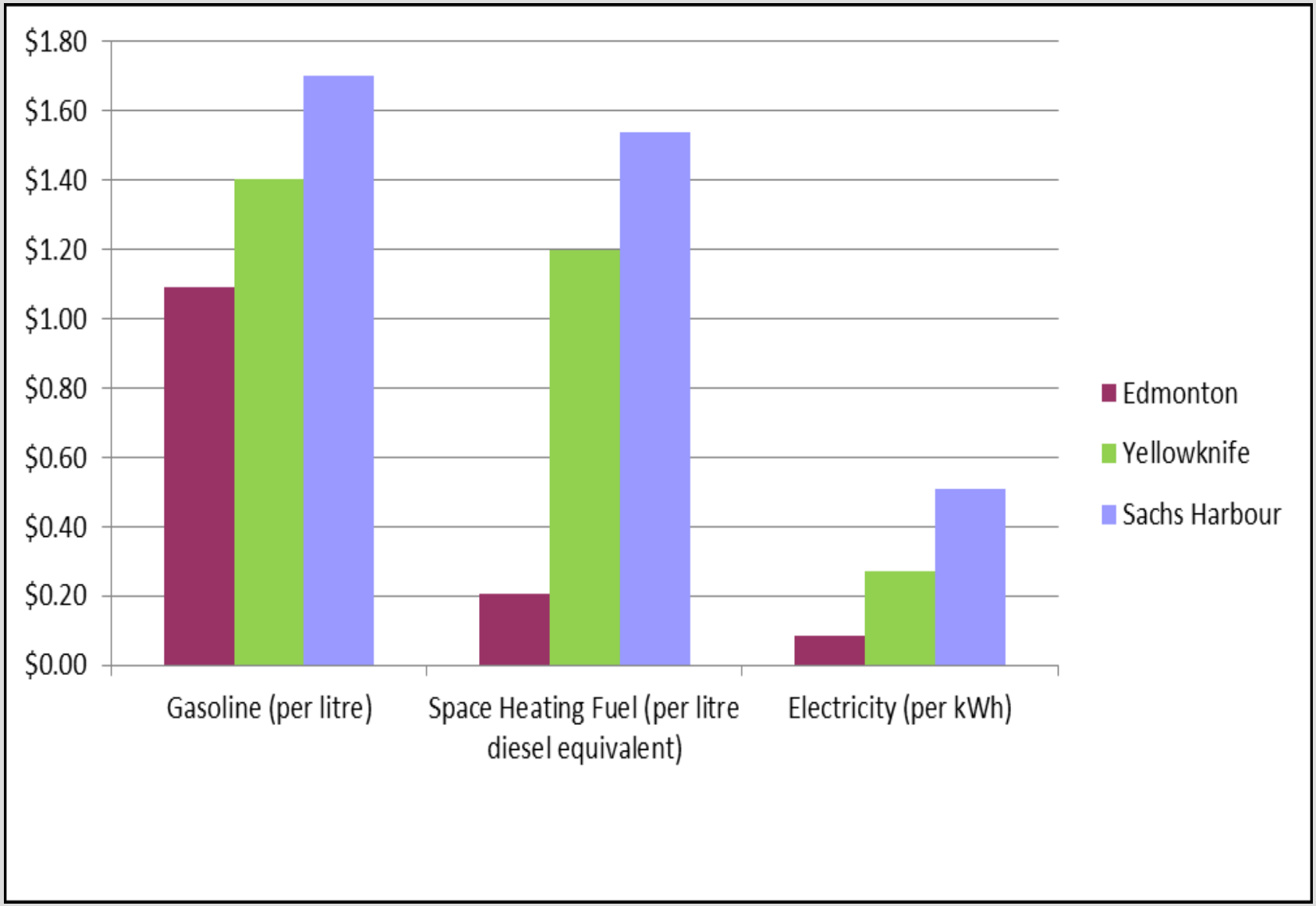
- Twin Gorges – 18 MW
- 200km transmission



Hydro Potential

NWT River	Developed (MW)	Potential (MW)	Proposed (MW)
Bear	0	568	0
La Martre	0	27	13
Lockhart	0	269	0
Mackenzie	0	10,450	0
Snare	30	33	0
Snowdrift	0	1	1
Taltson	18	200	56
Yellowknife	7	0	0
Petitot	0	35	0
Mountain	0	30	0
Redstone	0	260	0
TOTAL	55	11,873	70

High Cost of Energy in the NWT



Some Electricity Figures

33 Communities

25 Thermal Zone, 8 Hydro Zone Communities

31 cents / kWhr in Yellowknife, similar range in other hydro communities

61 cents / kWhr in the Thermal Zone

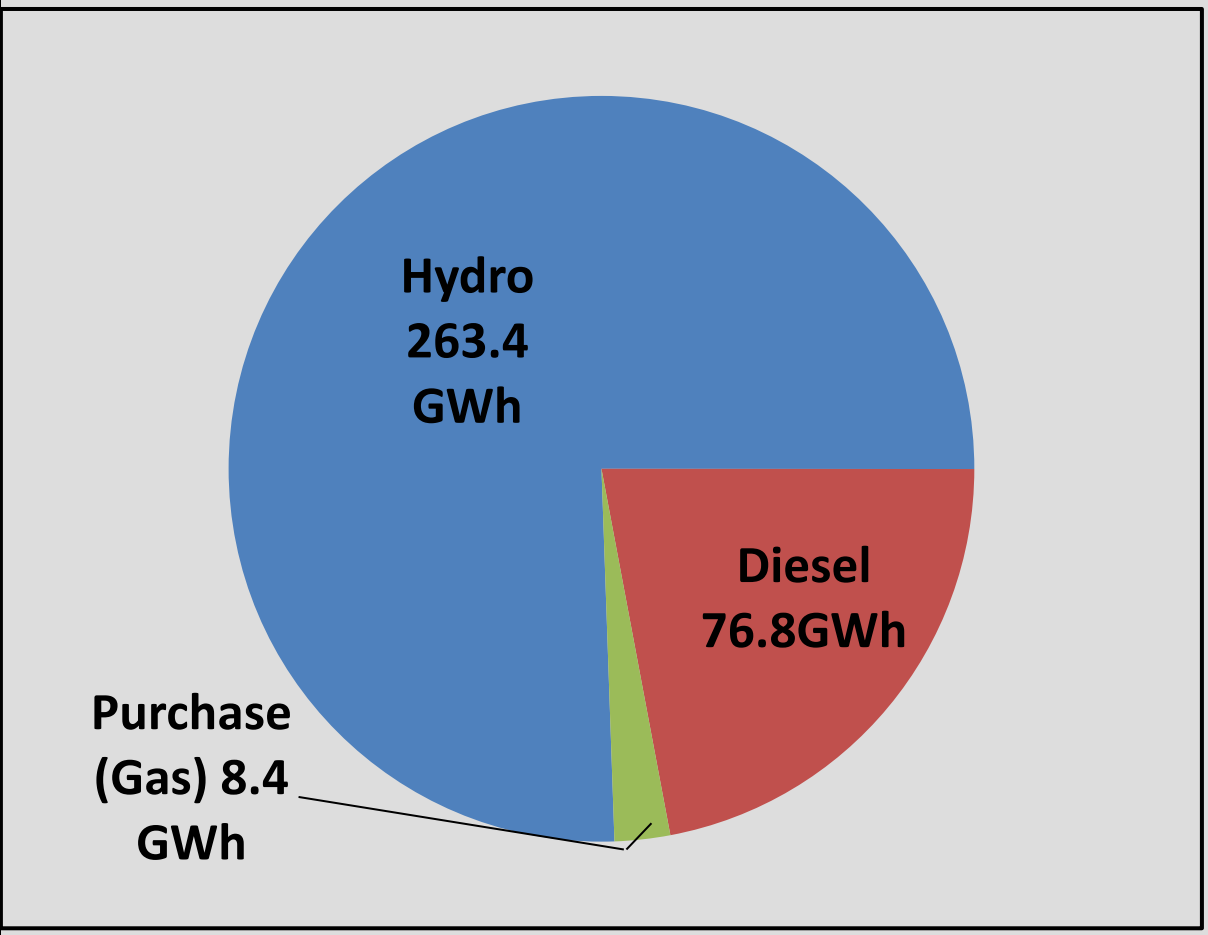
Residential Power Subsidy: YK rates for 600 kWhrs in summer, 1,000 kWhrs in Winter

Cost of Diesel: ~ 32 cents per kWhr


Sachs Harbour
Banks Island
Victoria Island
Ulukhaktok
Tuktoyaktuk
Paulatuk
Aklavik
Inuvik
Fort McPherson
Tsiigehtchic
Inuvialuit Settlement Region
Gwich'in Settlement Area
Colville Lake
Fort Good Hope
Great Bear Lake
Norman Wells
Deline
Tulita
Sahtu Settlement Area
Yukon Territory
Wrigley
Deh Cho Region
Fort Simpson
Jean Marie River
Nahanni Butte
Fort Liard
Trout Lake
Kakisa
Enterprise
Hay River
Fort Providence
Great Slave Lake
Fort Resolution
Taltson Grid
Fort Smith
Snare Grid
Whati
Behchoko
Ndilo
Yellowknife
Dettah
Lutsel K'e
Gamètì
Wekweètì
North Slave Region
South Slave Region
Nunavut
British Columbia
Alberta
Saskatchewan
Hydroelectric Generation
Natural Gas Generation
Diesel Generation
Solar Generation
Established Mining
Established Oil & Gas
Transmission Lines
N
0
200 Miles
0
200 KM


Nunavut
Colville Lake
Fort Good Hope
Great Bear Lake
Norman Wells
Deline
Tulita
Northwest Territories
Wekweètì
Gamètì
Whati
Wrigley
Behchoko
Ndilo
Yellowknife
Dettah
Lutsel K'e
Fort Simpson
Jean Marie River
Fort Providence
Great Slave Lake
Nahanni Butte
Hay River
Fort Resolution
Kakisa
Fort Liard
Trout Lake
Enterprise
Fort Smith
British Columbia
Alberta
Saskatchewan

Community Electrical Generation

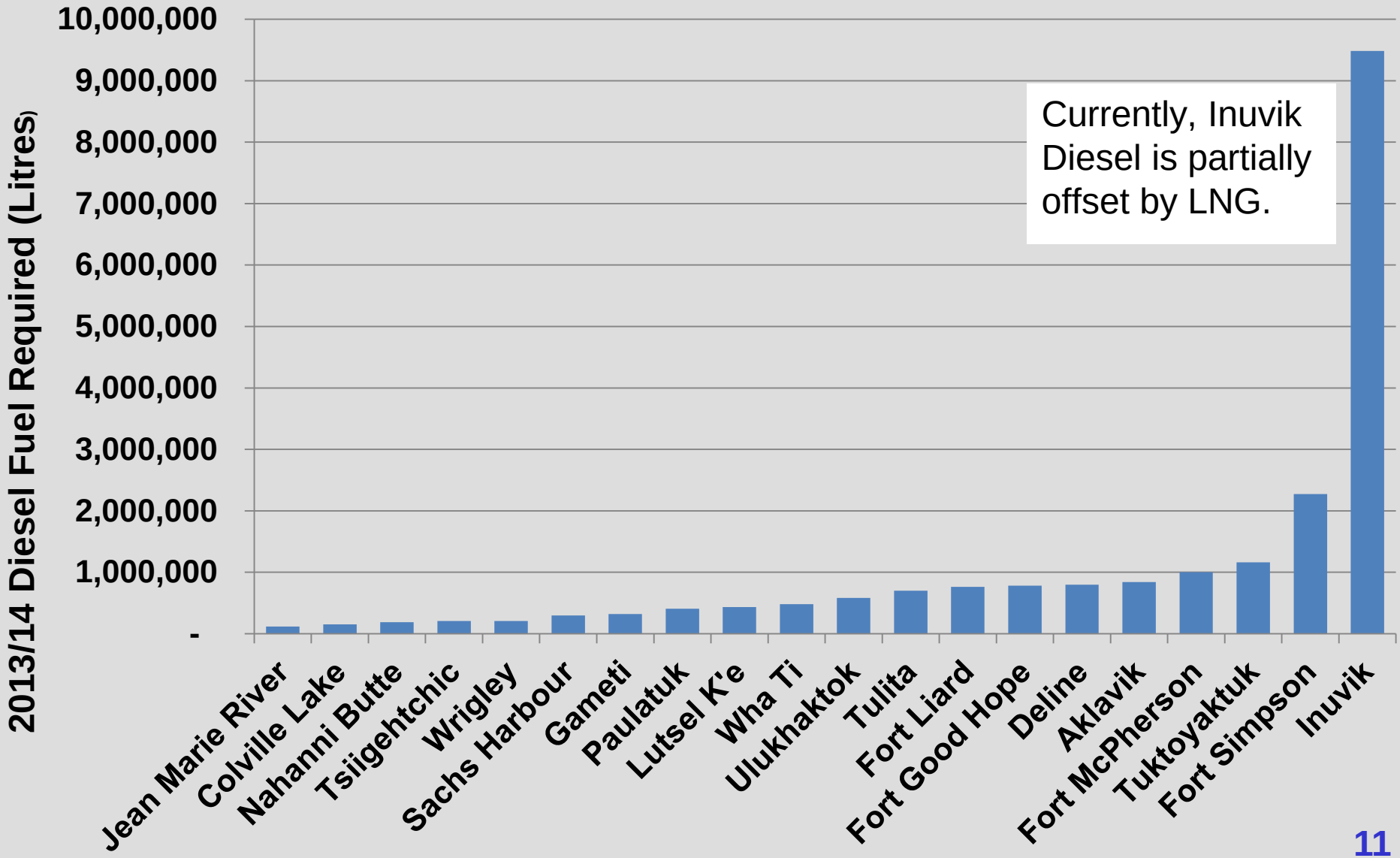


"One of the most complicated 64 MW systems I've seen"

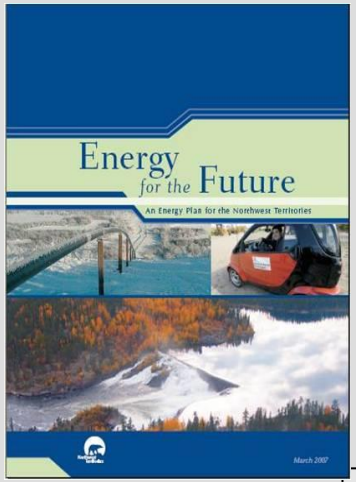
Dr. Marlo Raynolds, 2014 Energy Charrette

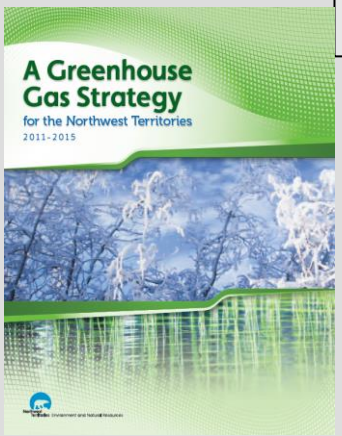
Estimated Diesel Consumption, NWT Diamond Mines:
200 million litres

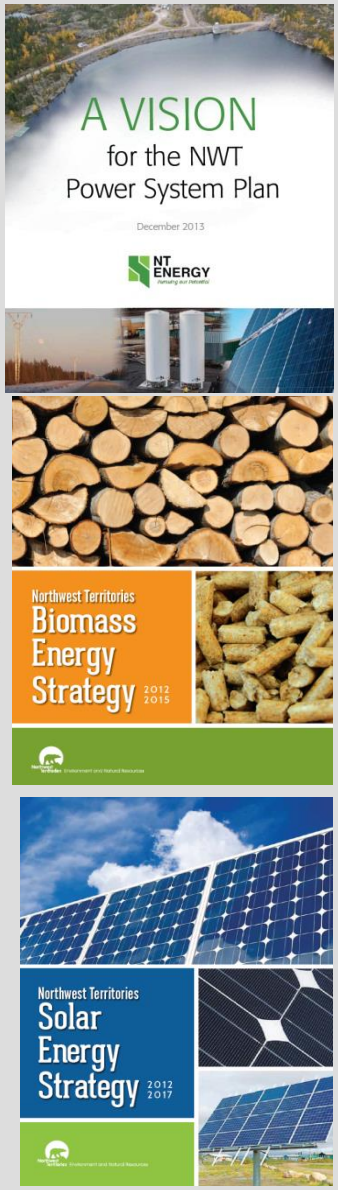
NWT Diesel Use: 22 million litres
Add ~27 million litres in Yellowknife for 2015-16

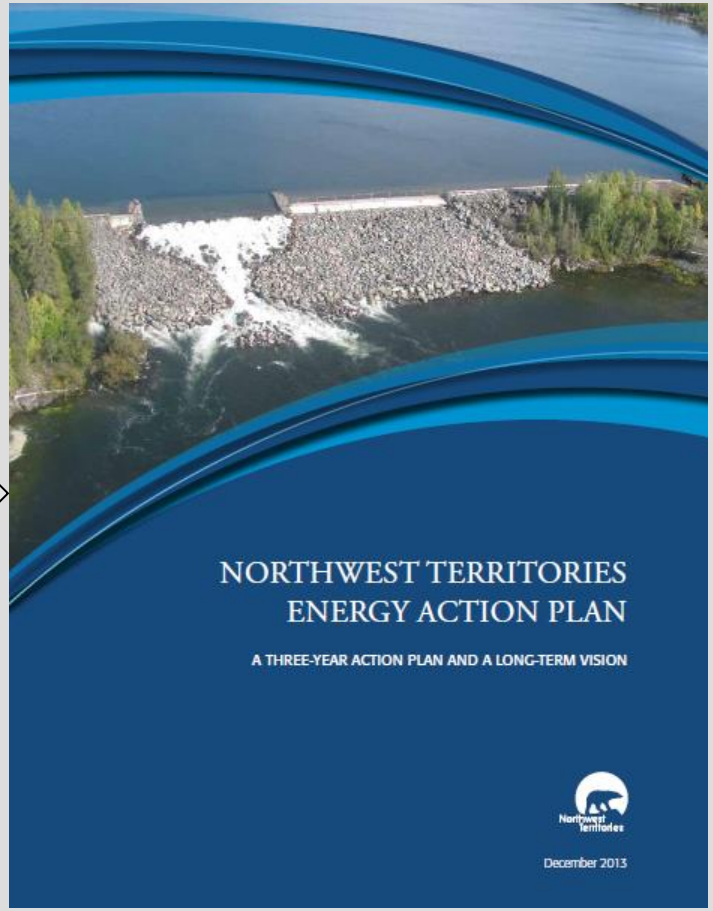


GNWT Energy Policy









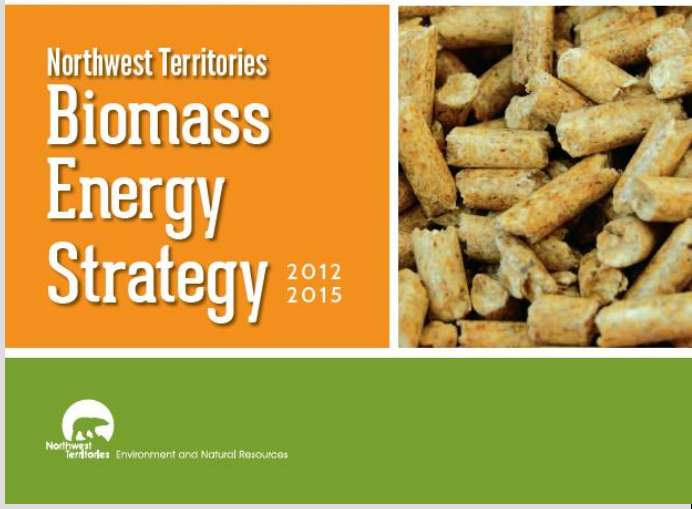
Arctic Energy Alliance

- The GNWT contributes over $3 million to the AEA per year.
- The GNWT has funded the establishment of regional offices in Hay River, Inuvik, Norman Wells, Whatì and Fort Simpson.

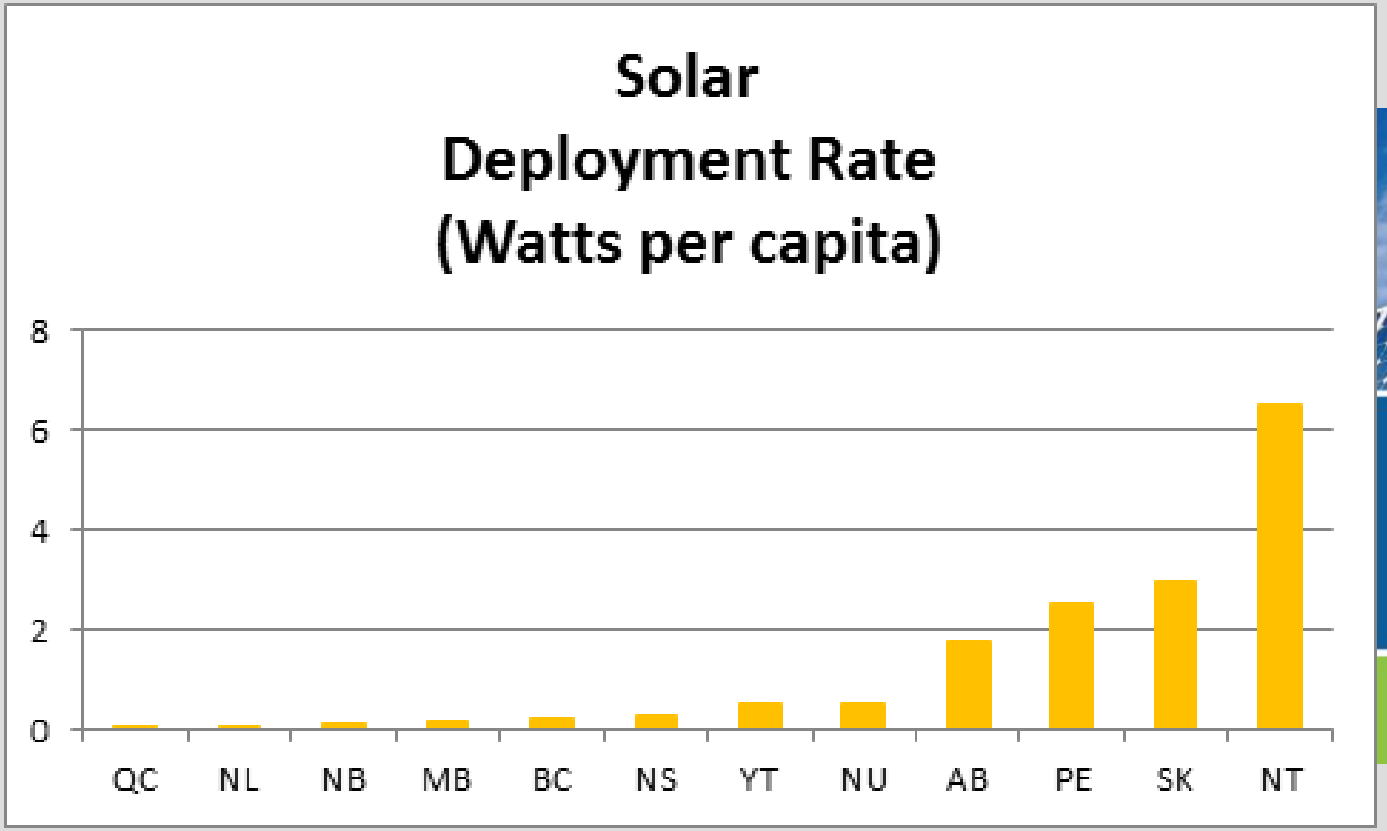
- AEA programs include:
  - Alternative Energy Technologies Program
  - Energy Rating Services Support Program
  - Energy Efficiency Incentive Program
  - Biomass: Promotion, Community Engagement and Project Evaluation
  - Commercial Energy Conservation and Efficiency Program
  - Community Government Energy Retrofit Program
  - Community Renewable Energy Efficiency Program

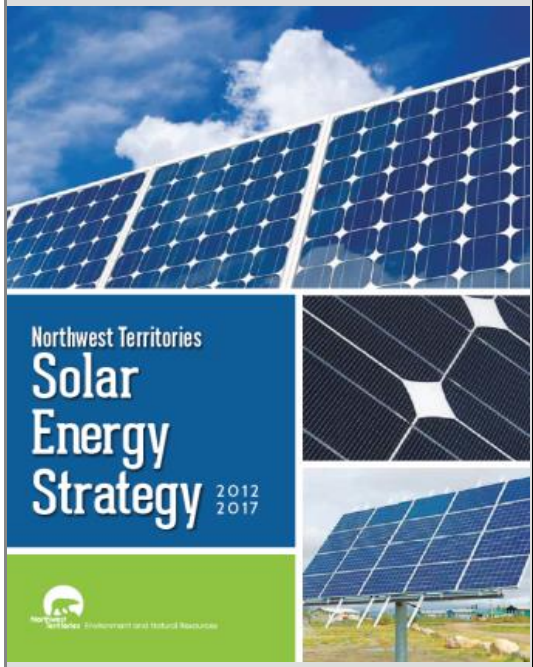
Biomass

- The GNWT has 22 biomass boilers with 6 more to be completed by 2016.
- Cost: ~60 to 70 cents per litre of oil equivalent
- In 2015-2016, pellet boilers will be installed in Tulita and Fort Good Hope schools.
- Local district heating systems will continue to develop as the NWT biomass industry matures.
- Locally produced wood pellets and wood chips is the next step.

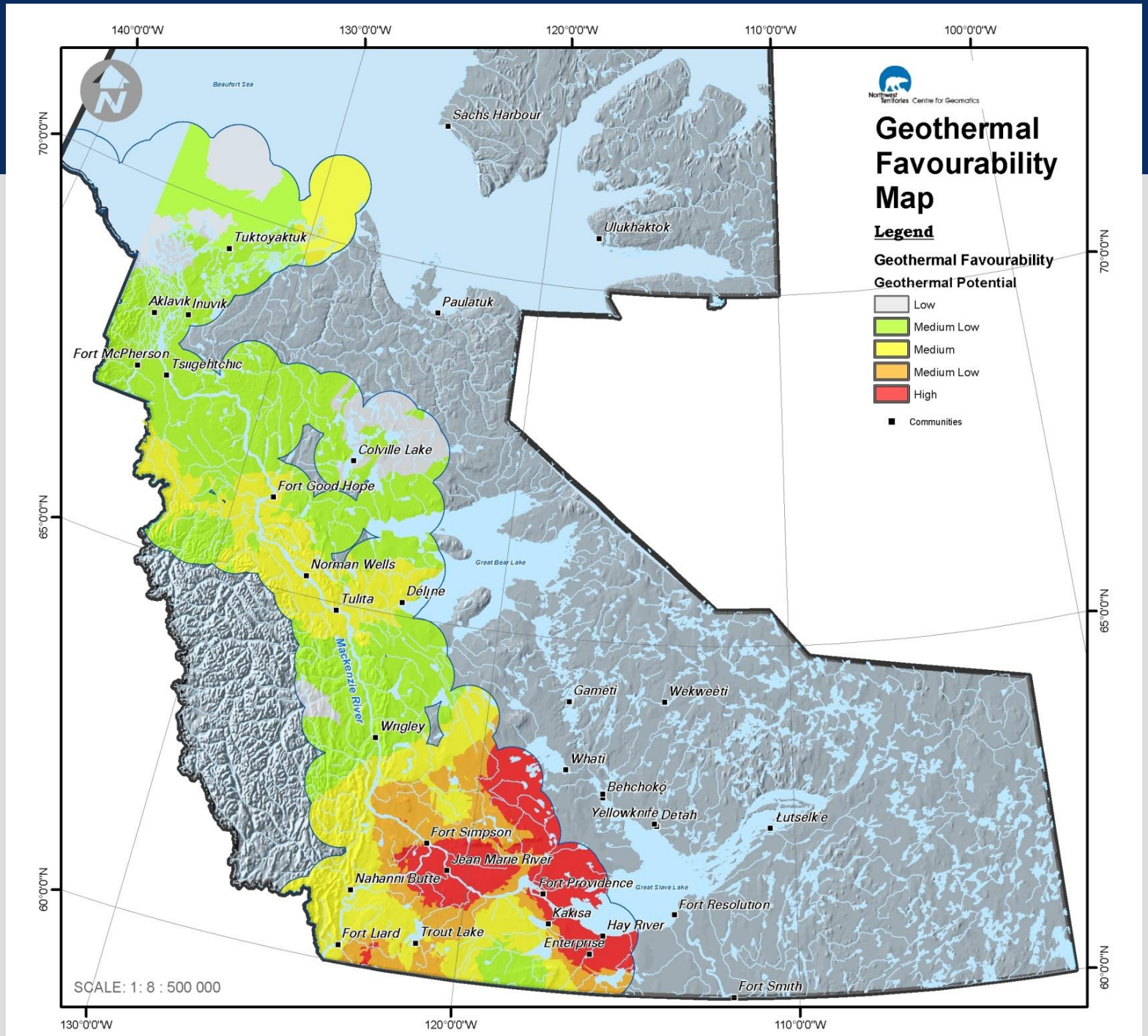


Solar: NWT Ranks 2nd, After Ontario





Natural Gas


Geothermal Favourability Map
Legend
Geothermal Favourability
Geothermal Potential
Low
Medium Low
Medium
Medium Low
High
Communities
Northwest Territories Centre for Geomatics
SCALE: 1: 8 : 500 000
140°0'0"W
130°0'0"W
120°0'0"W
110°0'0"W
100°0'0"W
70°0'0"N
65°0'0"N
60°0'0"N
Beaufort Sea
Sachs Harbour
Ulukhaktok
Tuktoyaktuk
Aklavik
Inuvik
Paulatuk
Fort McPherson
Tsiigehtchic
Colville Lake
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Fort Smith

Net Metering Program

- In April 2015, the GNWT issued rate policy guidelines that directed the PUB to:
  - Ensure costs of net metering are transparent and tracked by utilities.
  - If costs become material, the Board may recommend funding by the GNWT.
  - Government customers, with the exception of municipal governments in thermal communities, should not be eligible for net metering.
  - Limit the size of installations to 15 kw to ensure that the program is accessible to as many residents and businesses as possible.

Engagement

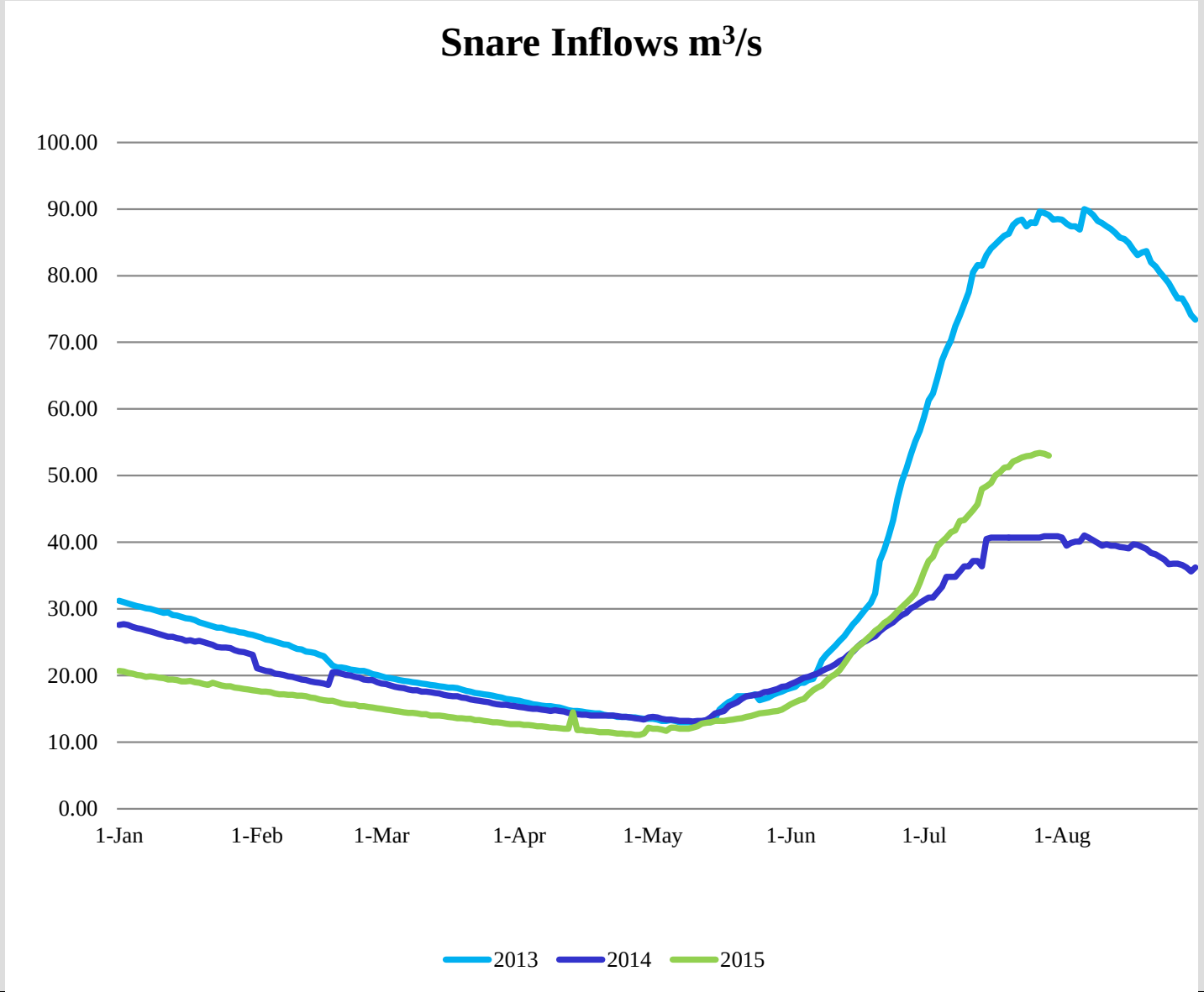
- The GNWT held the first Energy Charrette in 2012.
  - Resulted in Energy Action Plan and the Power System Plan
- Between 2012 and 2014:
  - Electricity rates increased, the 1st year of low water occurred, requiring a $20 million subsidy.
  - Transmission line concept to link the North and South Slave grids with the southern grid proved to be too expensive.

2014 Charrette Results: Highlights

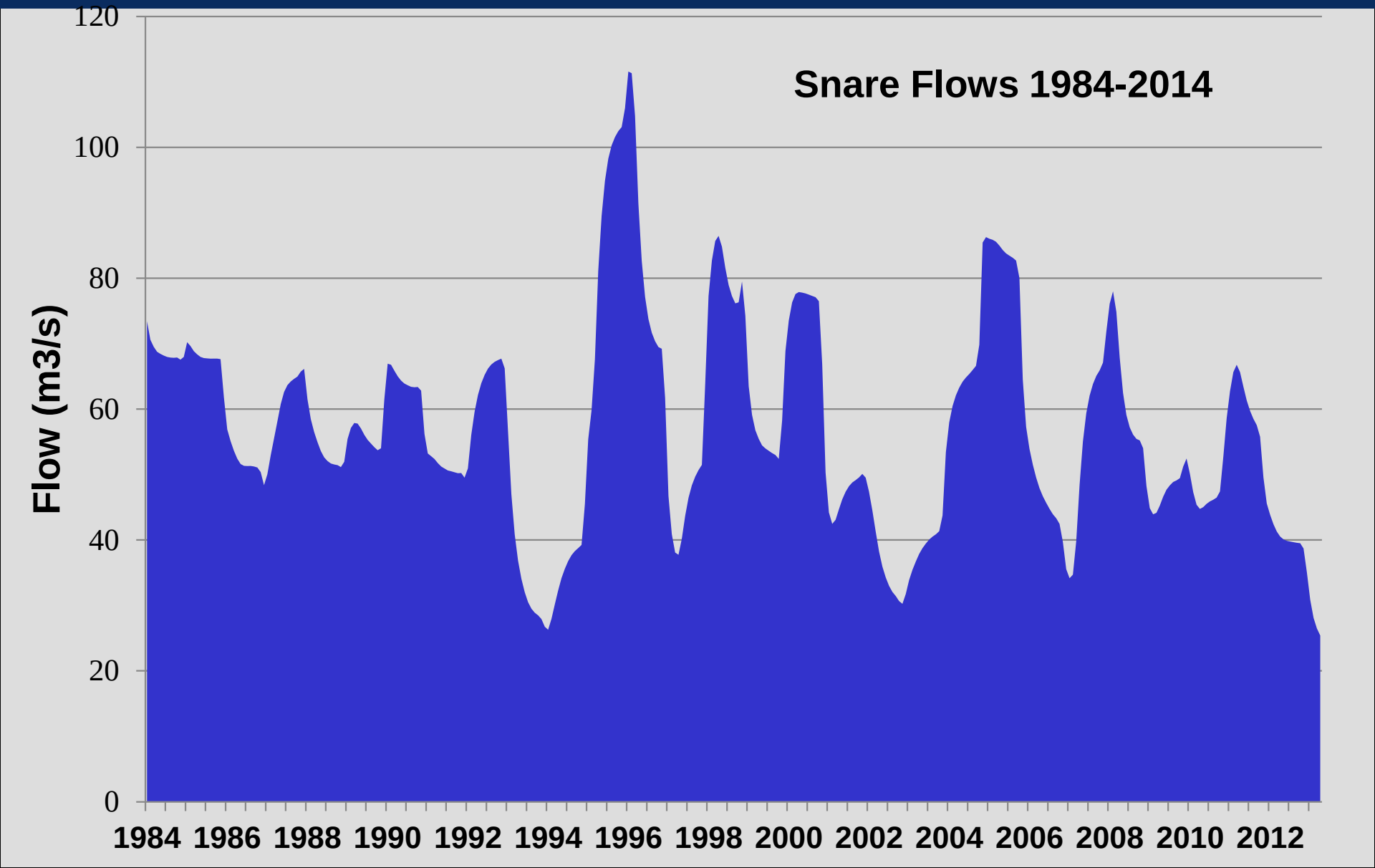
- Be More Aggressive on Energy Efficiency and Conservation
- Place More Focus on Community-level Projects and Plan for Increased Development of Small-scale Renewable Projects
- Continue to Engage Communities! Examine the Potential Benefits of Increased Private Sector / Community Involvement and Investment in Energy
  - Provide improved training opportunities for people in smaller and more isolated communities to service and repair infrastructure
- Overall, “Affordability” was considered the most important objective – “Environment”, “Economy” and “Energy security” were ranked fairly closely together, being second, third and fourth

A Recent Challenge: North Slave Low Water

North Slave Low Water



Historical Water Flows



Response

- Expressions of Interest – private sector proposals?

- North Slave System Resiliency (from the 2014 Charrette)
  - Evaluate a range of options: solar, biomass, wind, hydro enhancement options, batteries
  - Options for enhanced monitoring, hydrological forecasting models
  - Options to avoid rate shock: a low water fund?

- With our high costs and energy supply challenges, the NWT is prepared to look at all options.

Opportunities

- Continue to displace diesel with local, renewable and alternative forms of energy.
- Develop partnerships, expand the grid.
- Federal Liberal Party Platform:
  - Grow the economy by making significant new investments in green infrastructure (nearly $6 billion over the next four years, and almost $20 billion over ten years).
  - Create a New Lower Carbon Economy Trust. The Trust will provide funding to projects that materially reduce carbon emissions under the new pan-Canadian framework. We will endow the Low Carbon Economy Trust with $2 billion.

Opportunities

- Federal Liberal Party Platform:
  - Establish the Canada Infrastructure Bank (CIB) to provide low-cost financing to build new infrastructure projects. The CIB will issue Green Bonds to fund projects like… smart grid technology, clean power storage and transmission lines for renewable energy.
  - Invest $200 million more each year to support innovation and the use of clean technologies in our natural resource sectors, including the forestry, fisheries, mining, energy, and agricultural sectors.
  - Improve energy efficiency standards for consumer and commercial products, and use new financing instruments to encourage investments in energy-saving retrofits.

Summary

- The NWT has a wealth of energy resources but our harsh environment, vast distances, and economies of scale make local energy services very expensive.
- The NWT will require a 'suite of solutions' - energy efficiency, biomass, solar, storage, perhaps wind and geothermal, an expanded grid system where possible.
- Continued emphasis on partnerships with communities and the federal government will increase the renewable energy sources integrated into community energy systems.