Community-Wide District Heating

Lessons from New Glasgow, NS

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Jean Blair, PhD
Director of Planning and Outreach
TorchLight Bioresources
mjblair@tlbio.com

Biomass District Heating

- Network of insulated hot water pipes connecting buildings to a central bioenergy plant, heat exchangers in buildings
  - Central biomass plant can be heat only or combined heat and power (CHP)
  - Can heat a small cluster of buildings to an entire town or city
- Several examples in Canada, mostly institutional, some in rural/remote communities (e.g., Yellowknife cluster)
- District heat common in Nordic Countries, provides 55% - 75% of building heat, (~1% in Canada)

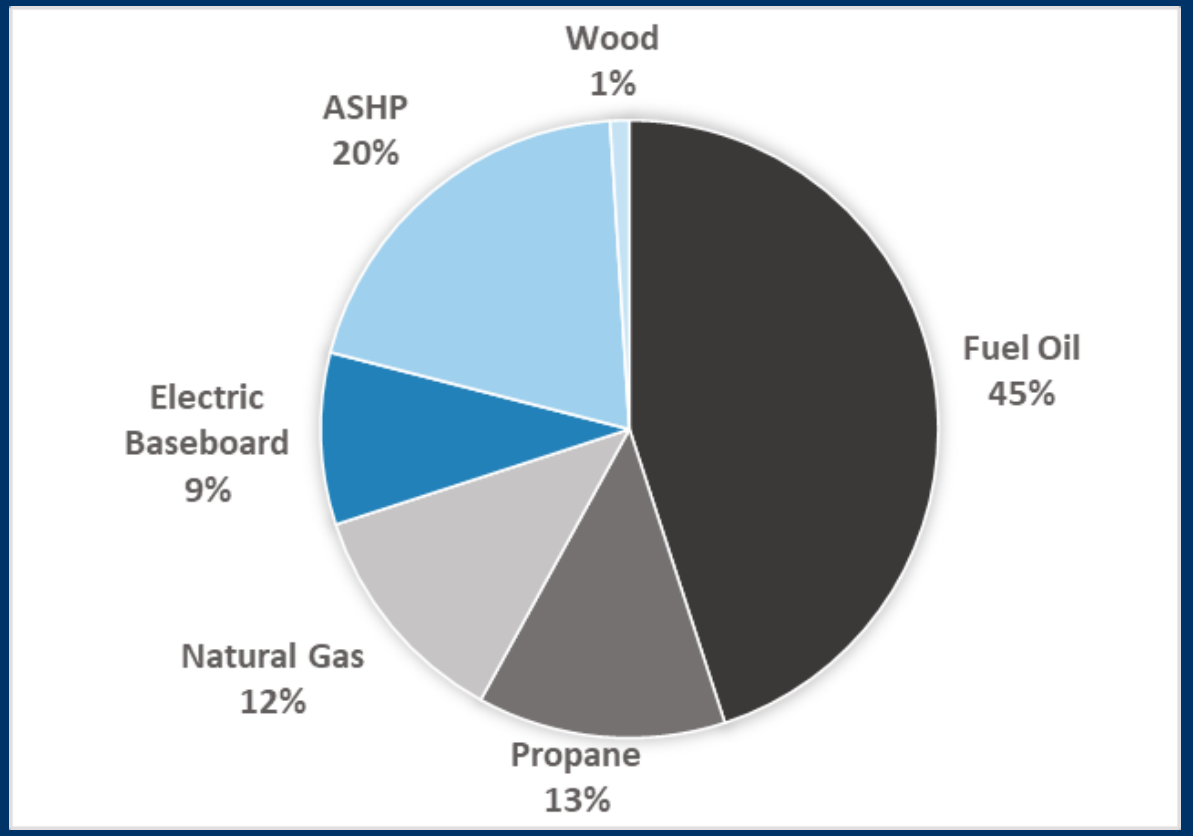
Can Community-Wide Biomass District Heating be Economically Feasible in Canada?

New Glasgow Feasibility Study

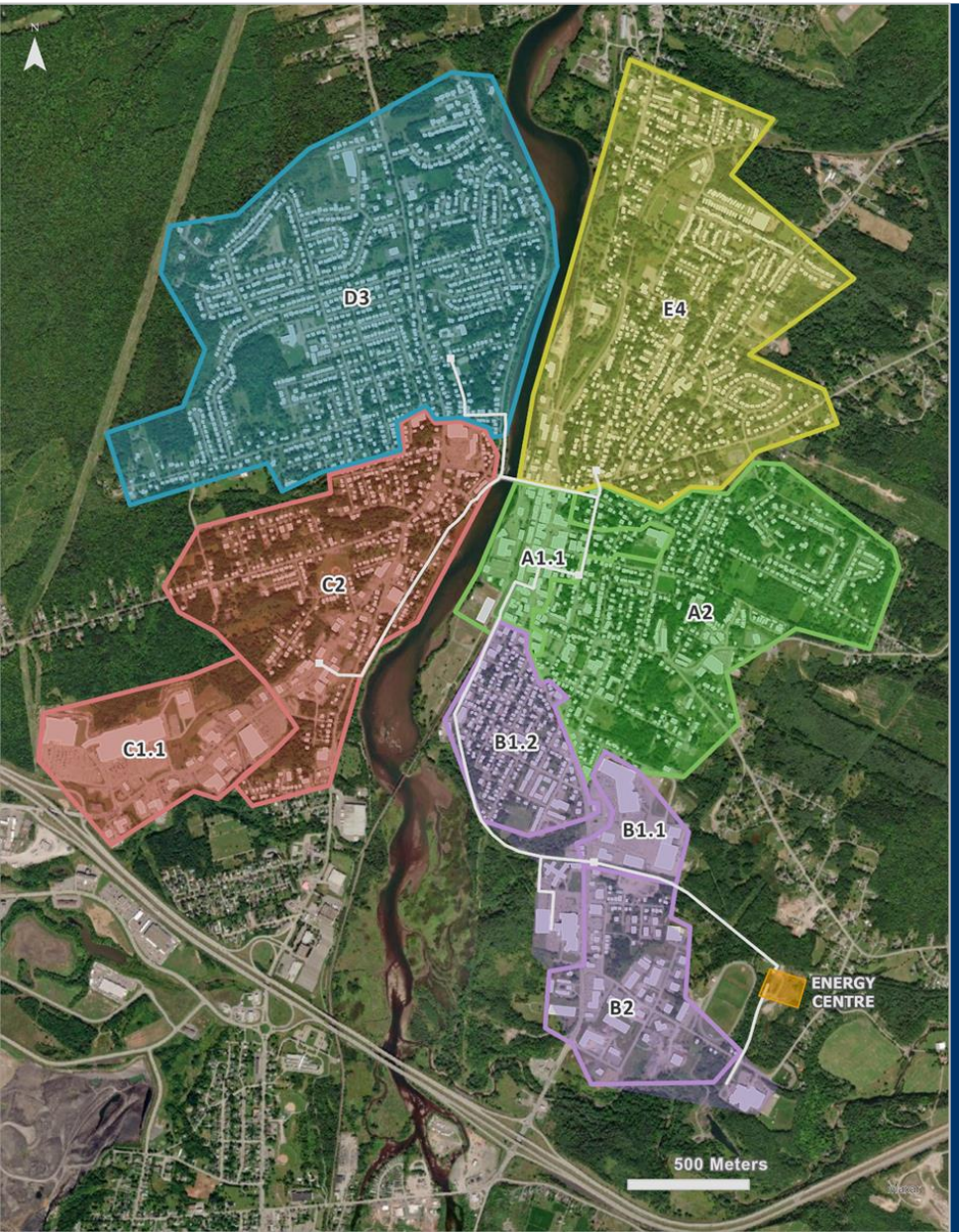
- FEL-1 Feasibility Study funded by Natural Resources Canada, Smart Renewables and Electrification Program
- In partnership with Town of New Glasgow
- Primary driver for Town is reducing energy poverty, local economic development
- Heating costs are high, primarily heating oil
- Developed Masterplan to connect 3,400 buildings to biomass district heating network, including single family homes

Existing Heating Systems

- Online survey of residential heating systems in New Glasgow
- In-Building Assessments of Commercial and Institutional (C/I) Buildings
- Natural gas is only used in a small number of large C/I Buildings
- Electricity used for heat is mostly coal-generated



Heat New Glasgow - Masterplan



- Used Comsof Heat to rapidly model heat network for entire town
- Biomass CHP built first with heat network constructed over time
- Phased connection to **3,444** buildings in five zones, transmission pipe to each zone
- **~70 MW** heat demand met with **35 MW_{th}** (11 MW_e) biomass CHP + 'peaking' boilers
- **~100,000 bdt/y** of biomass

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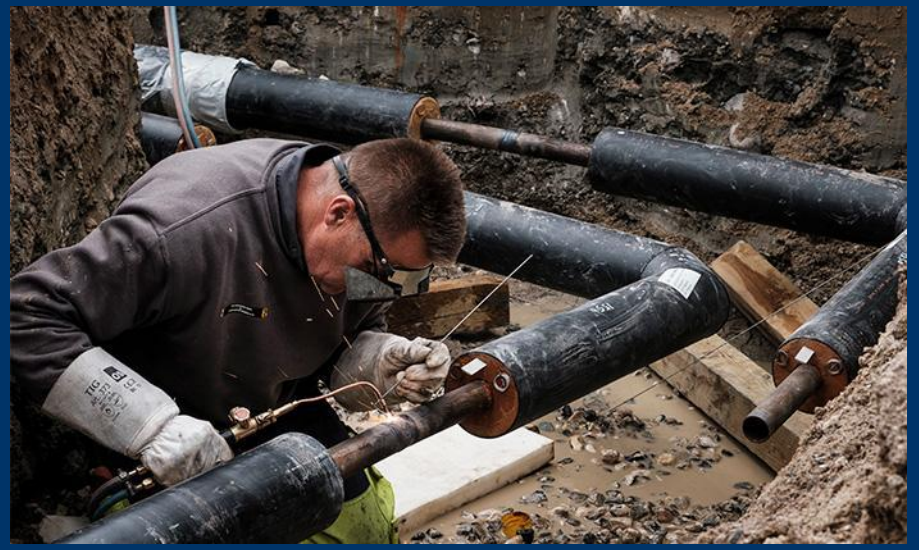
Heat Transmission Pipes

Single Family Home Connections

- Not common in NA, looked to EU experience and technology

- How to minimize connection costs for homes?
  - Modular, wall mounted heat transfer unit for both space heat and domestic hot water (likely utility-owned)
  - Service connections use steel flex pipes, through lawns

Heat Distribution Pipes



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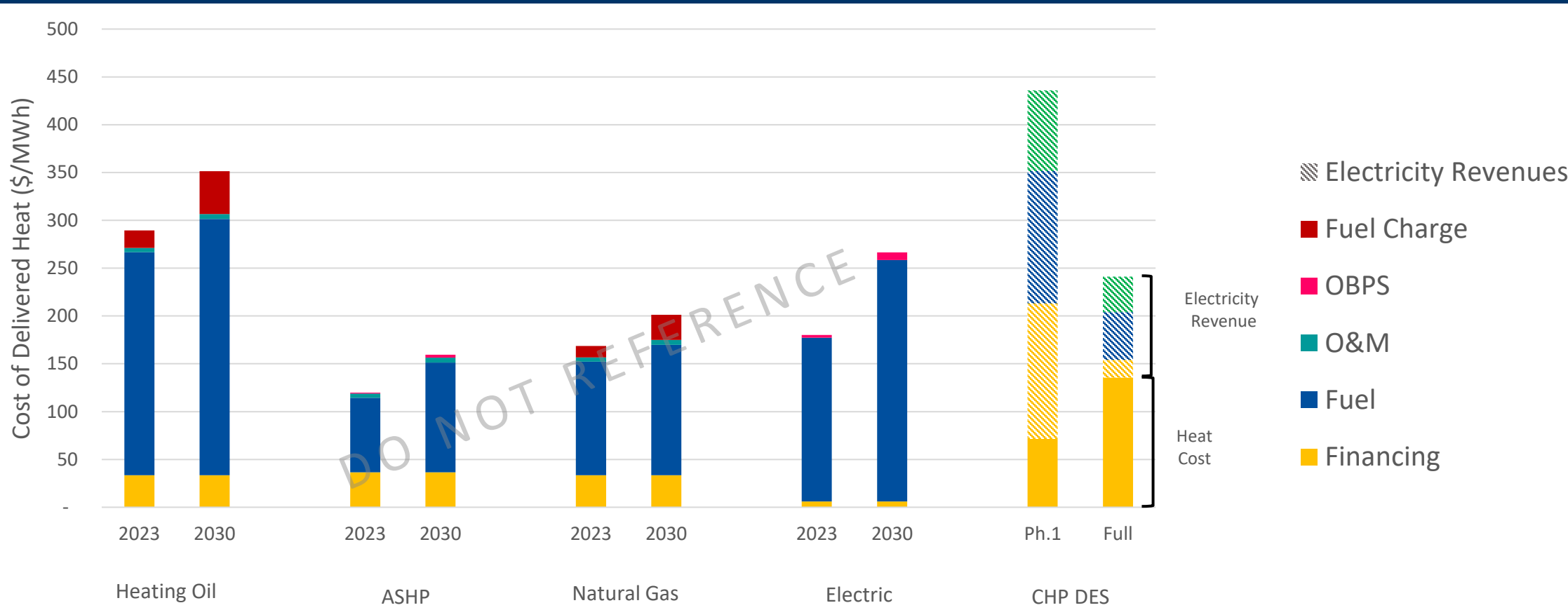
Biomass CHP

About the scale of the conceptualized biomass CHP for New Glasgow

Study Results – Heat Cost



For District Heat Scenarios, revenue from electricity pays for biomass CHP & fuel.

Electricity needs to be appropriately valued to make the economics work.

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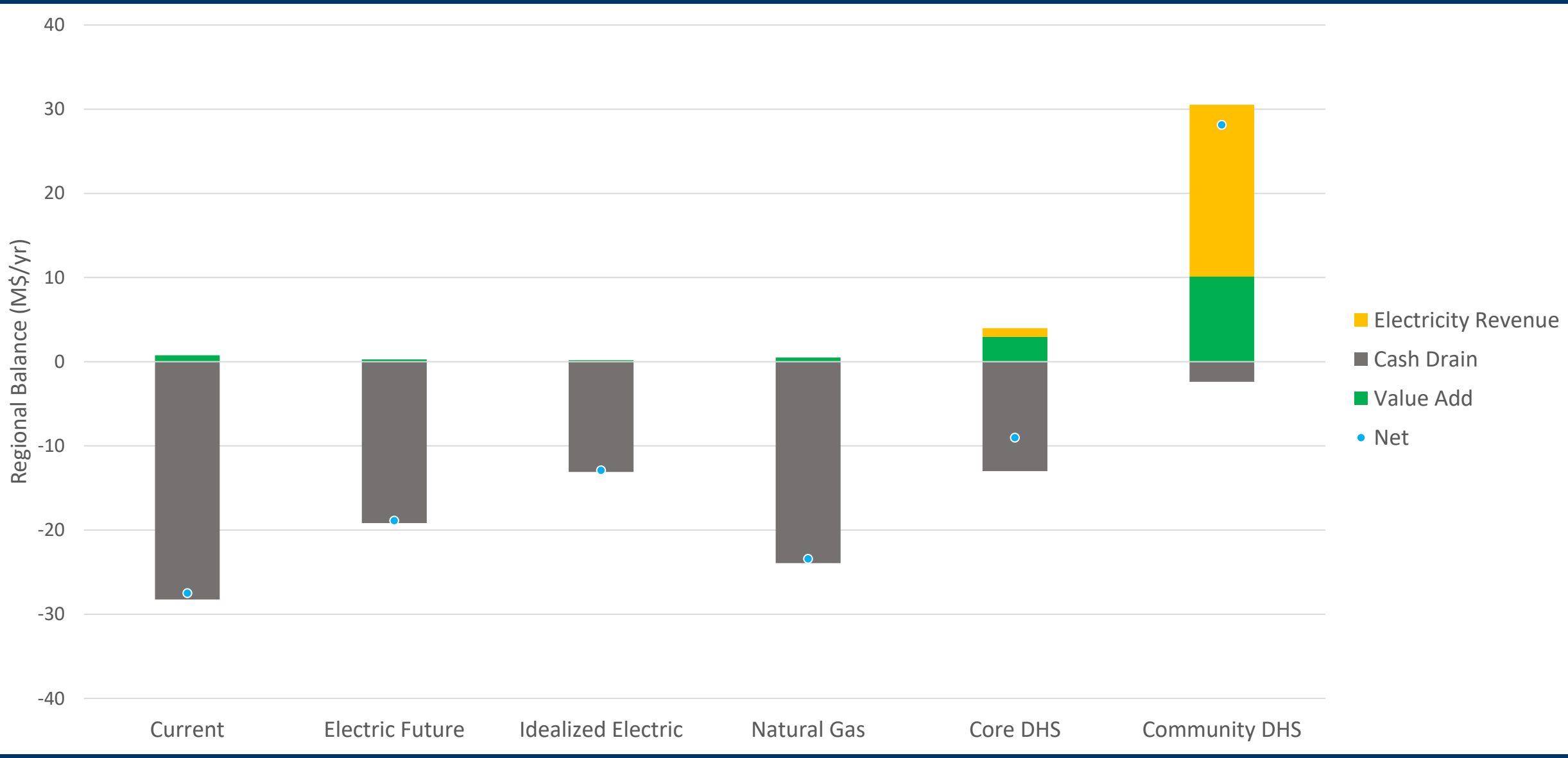
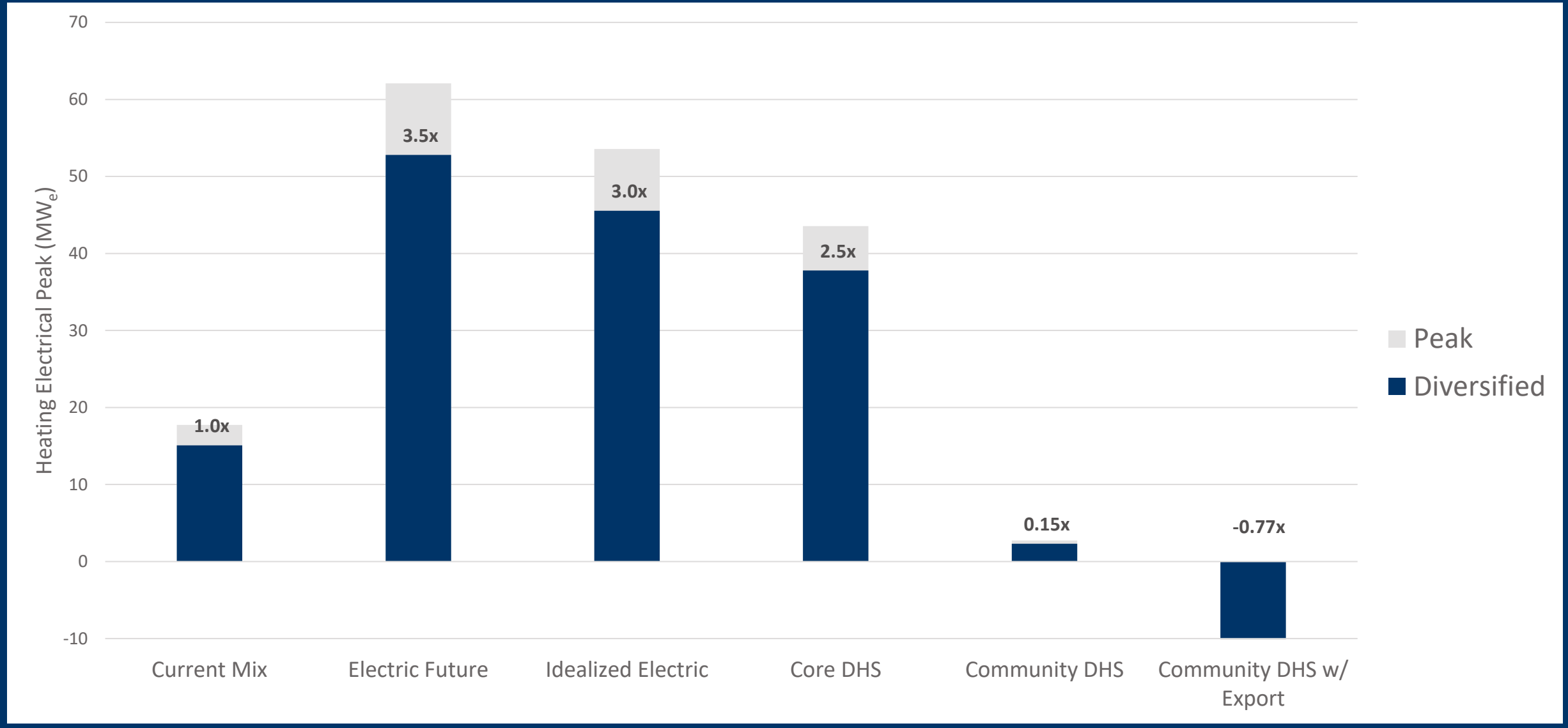
Regional Economic Balance



Impact on Peak Electricity Demand



Community-wide district heating is economically viable with co-production of electricity and appropriate power price.

How to Reduce Power Price?

- Power Purchase Agreement (PPA) with Government of Nova Scotia is a sticking point
- Increase scale to reduce power price – 22 MWe
- Expand heat network to neighbouring municipalities – total population ~19,000
  - Multi-municipality ownership?
- Provide heat / power to industrial consumer

Next Steps

- Ownership model
- Biomass supply commitments
- Detailed CHP design
- Final investment decision and financing

Ownership

- Possible models
  - **Preferred – Municipal Ownership with institutional capital**
  - **Consumers cooperative**, network owned by heat customers, common in Denmark
  - Public Private Partnership (P3)
  - Private
  - Etc.
- Network infrastructure and Biomass CHP can be separate
- Ownership ≠ Financing

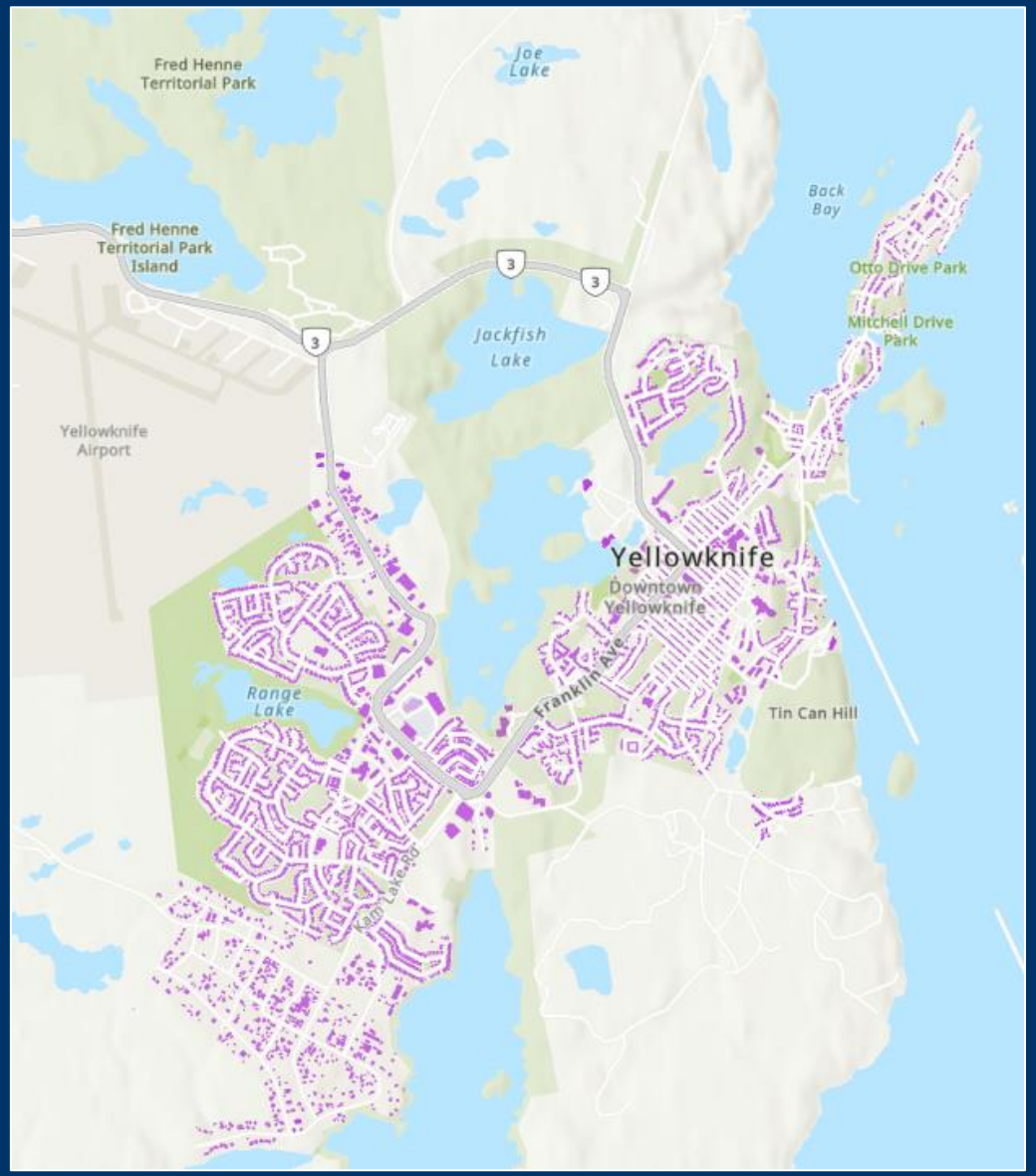
How Does Yellowknife Compare?

	New Glasgow	Yellowknife
Population	19,316	19,673
Population Density	648 /km^2	1,086 /km^2
Number of Buildings	5,950	4,900
Peak Heat Demand	100 - 120 MW	190 - 210 MW
Annual Heat Demand	300 - 330 GWh	550 – 600 GWh
Biomass Fuel Cost	Low – Mid	High (Waste? - Low)
Heat Generated by 22 MWe CHP	80 - 90% of demand	45 – 55% of demand

*Statistics are for Population Centres

22 MWe CHP would produce ~180 GWh/year of electricity, equivalent to about half of all the electricity demand in NWT.

Opportunity to use electricity to supply new demand?



District Heat in the Far North

- **Greenland** - 16 Communities with district heating supplied by crown-owned company that also supplies water and electricity
- Most use waste heat from diesel generators, some use electric boilers where there is excess hydro power
- Waste-to-energy as primary heat source in two largest communities, collect waste from other towns
  - Nuuk, population 19,700 – about the same as Yellowknife
  - Sisimiut, population 5,550 – a bit bigger than Hay River and Inuvik

Waste-to-Energy in Nuuk

Images sourced from: Nunatsiaq News, Jul 8, 2024. Throw it, Burn It, Let it Heat Your Home

Integrated Utilidors in Qaanaaq (Pop. 646)

Image sourced from Google Streetview, captured 2016

Heat loss from district heating pipes in the utilidors helps to keep water and wastewater pipes from freezing

District heating infrastructure enables more efficient energy use, scaling up of biomass heating and waste-to-energy.