Decarbonizing our Buildings

Commoditizing Waste Energy and the Impact of Infrastructure for Social Good

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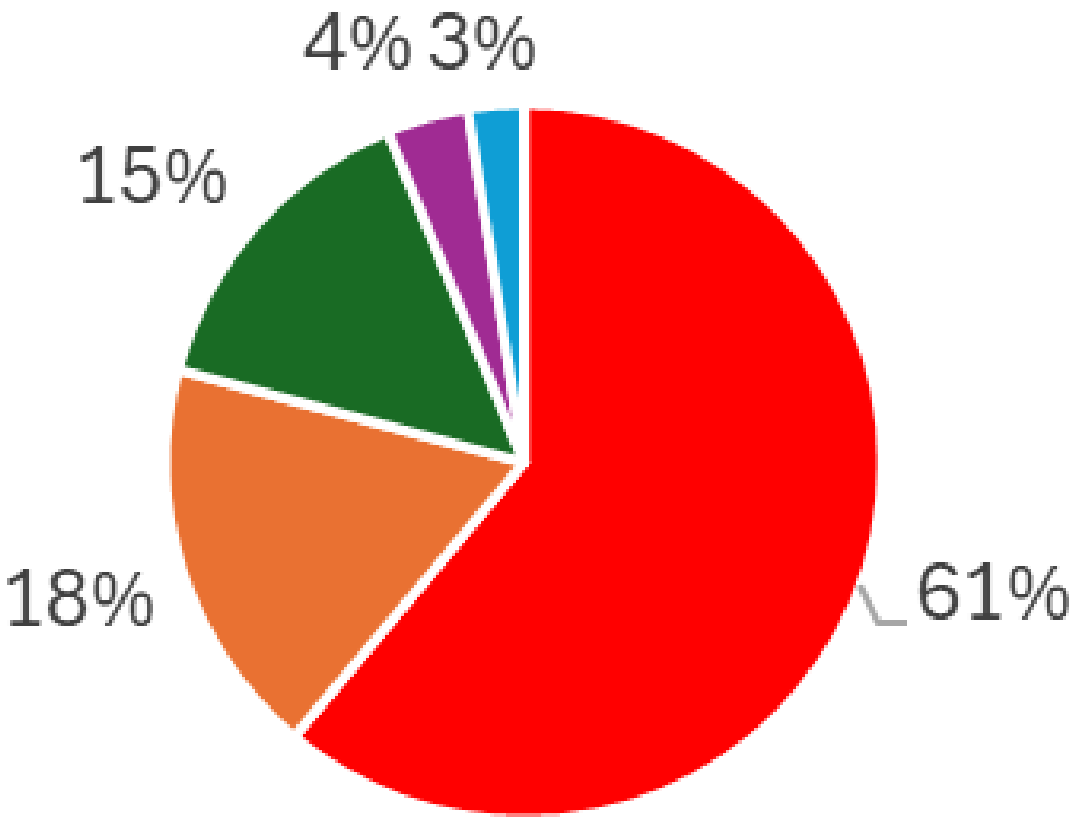
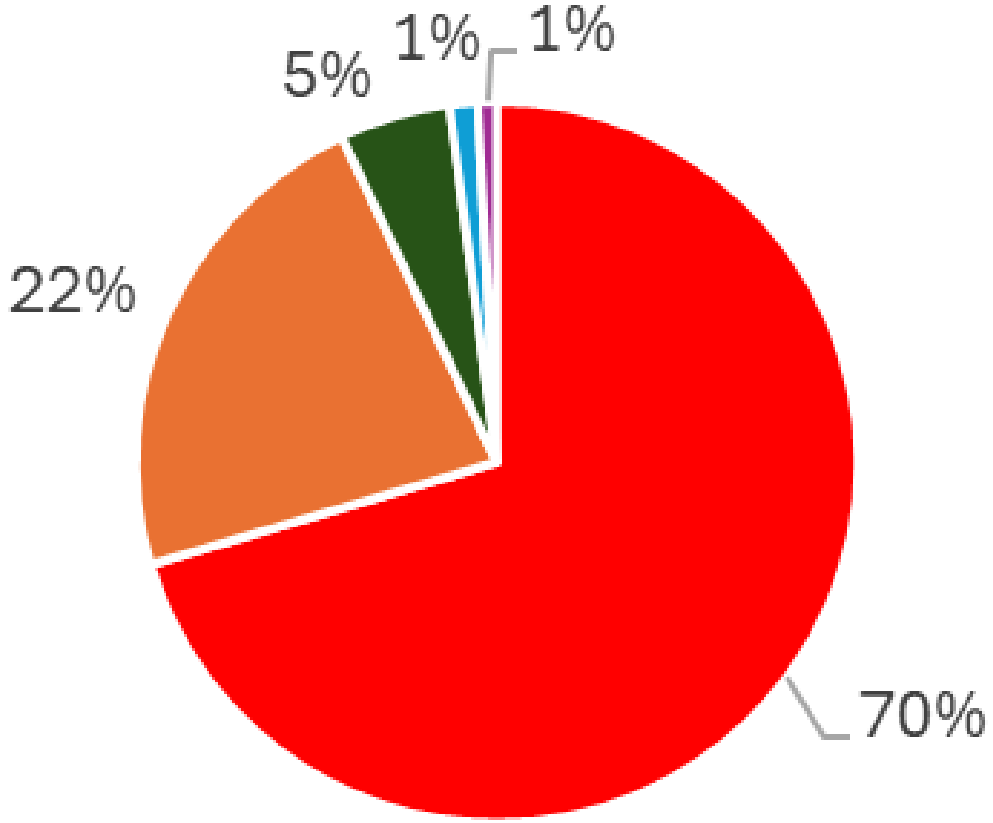
Where do Ontario's Building GHGs come from?

Residential Energy



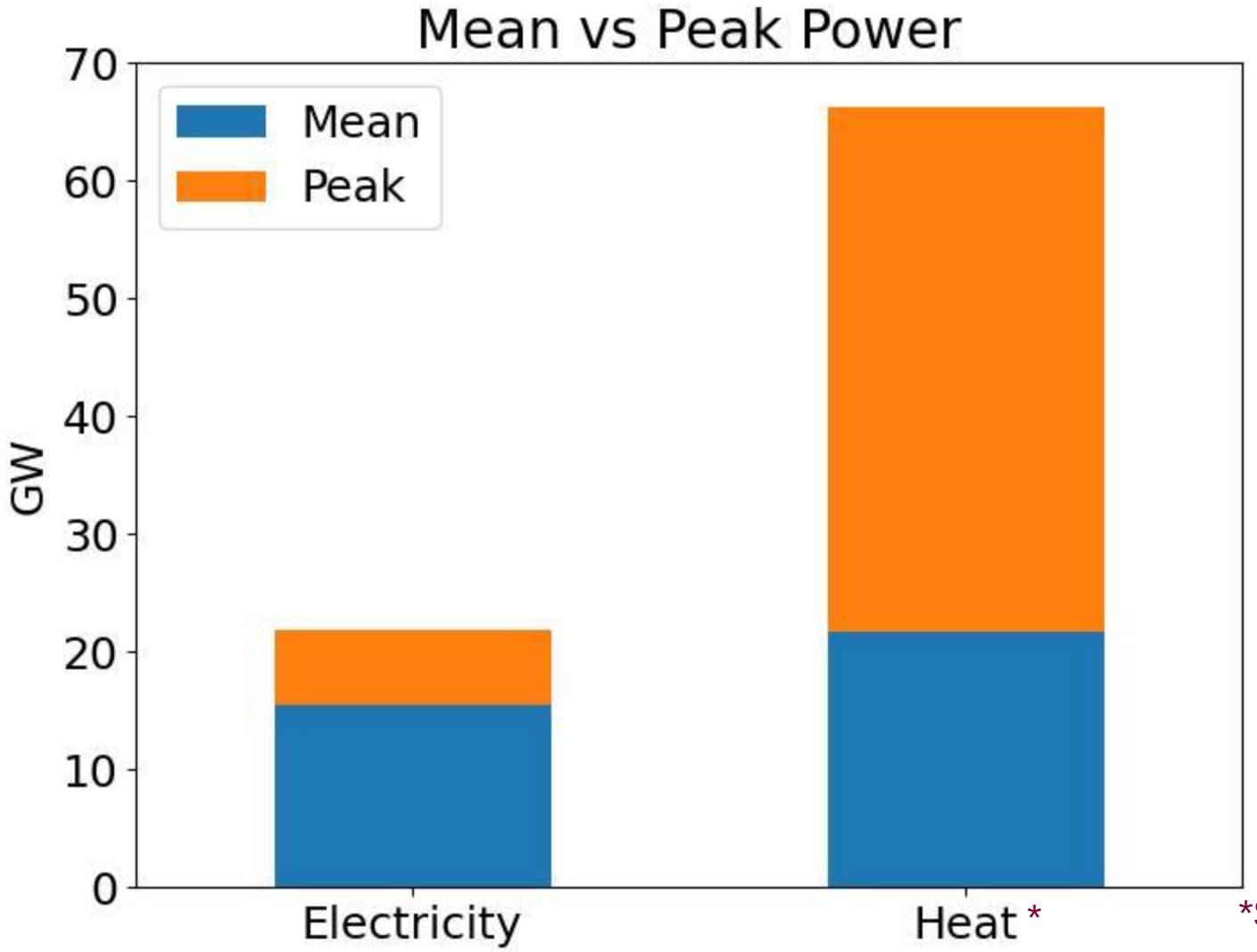
Residential GHGs



Space Heating | Water Heating | Appliances | Lighting | Space Cooling

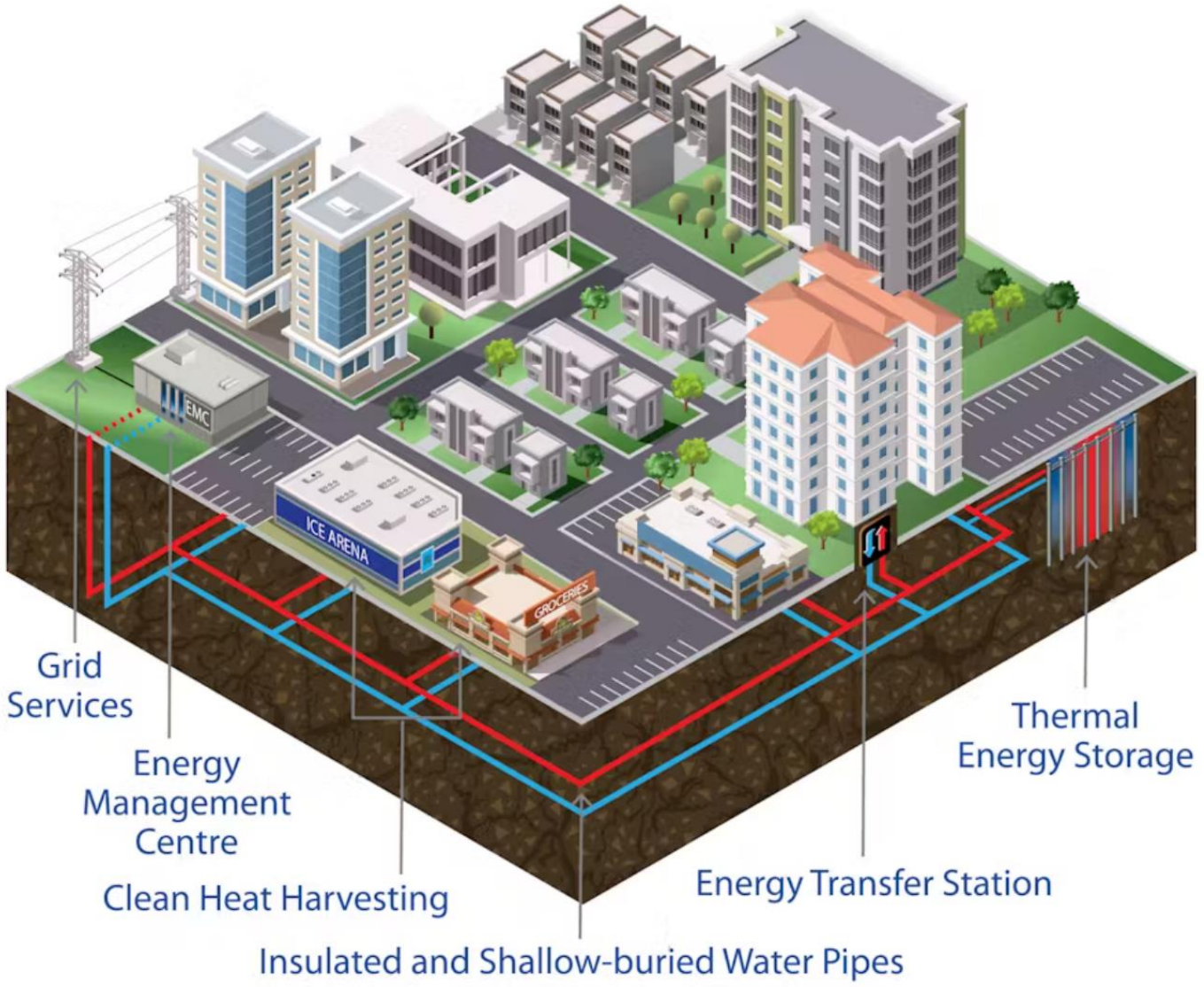
Canada - Natural Resources Canada - Energy Use Data Handbook Tables (2020)

Ontario's Total Electricity and Building Heat Demand

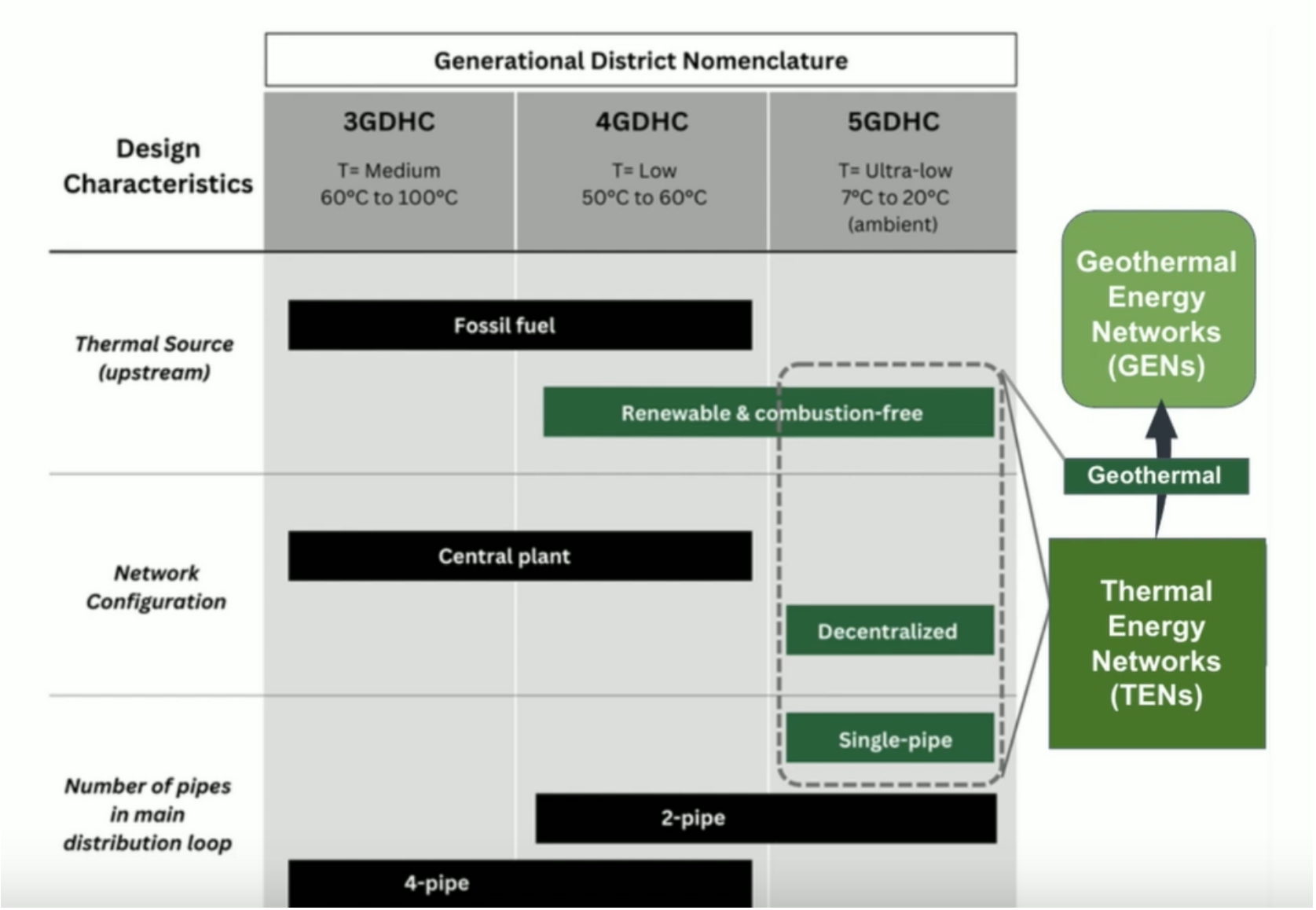


*Space & Water Heat Demand

What are Thermal Networks?

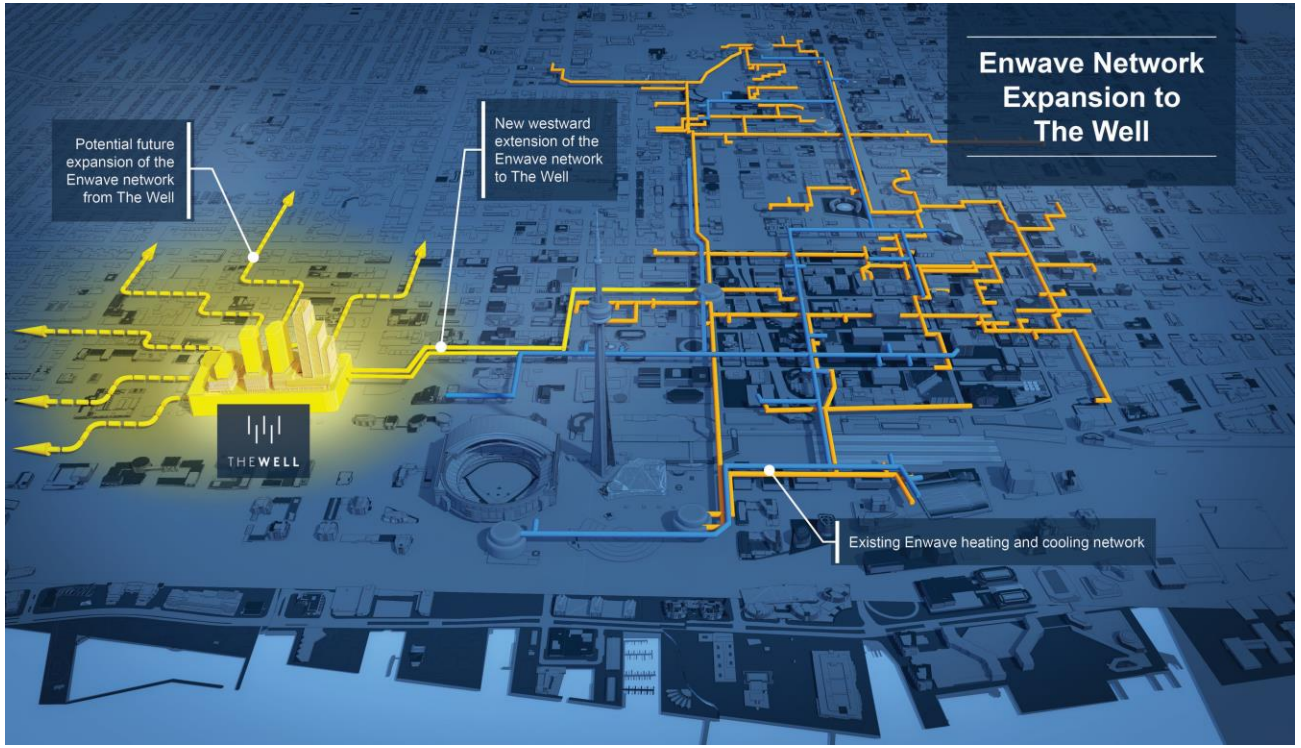


New York State – Nomenclature needs to be clear to get intended outcomes



Source: Building the Regulatory Standard for Thermal Energy Networks, Zeyneb Magavi of Home Energy Efficiency Team, New York Geothermal Energy Organization 2024 Conference

Thermal Networks Exist and Work



District heating network at the Beznau Nuclear Power Plant, Switzerland. [NEA, 2022]

Source: REFUNA AG (2015b).

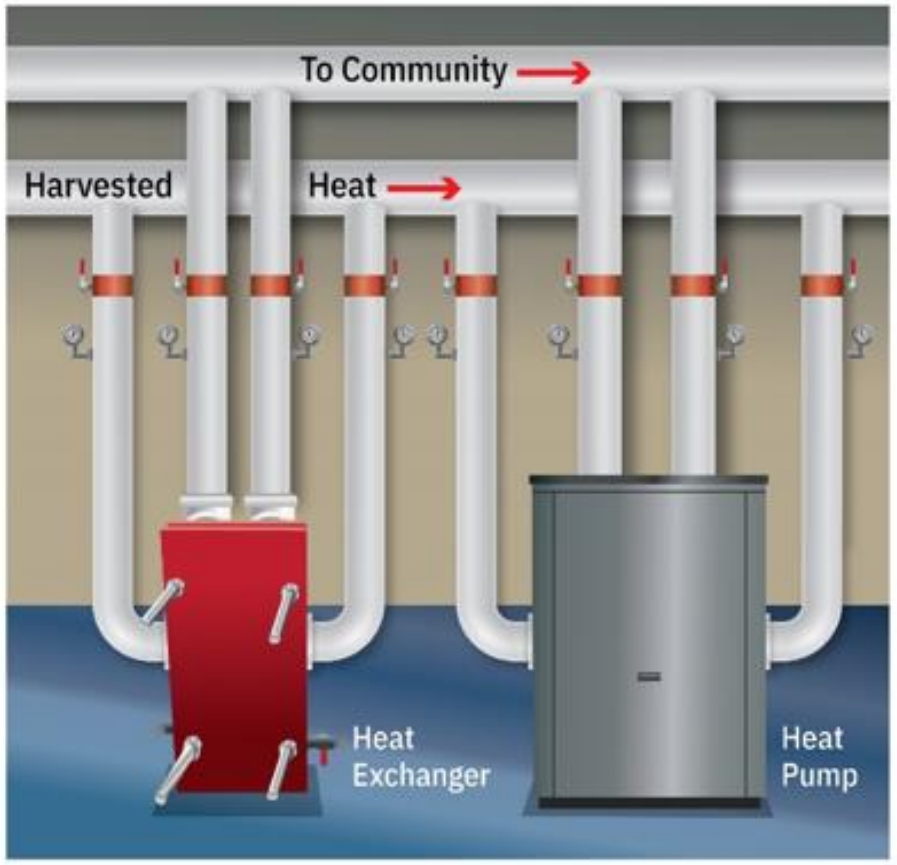
Source: https://www.axpo.com/ch/en/energy-knowledge/nuclear-power-plant-beznau.html www.enwave.com

Thermal Networks in Practice

- Shallow-buried, pre-insulated pipes.
- Disruption not unlike other municipal infrastructure.
- Installed above other infrastructure – freezing not a problem.
- Can be routed around other utilities, trees etc.

Building requirements for connecting to Thermal Networks

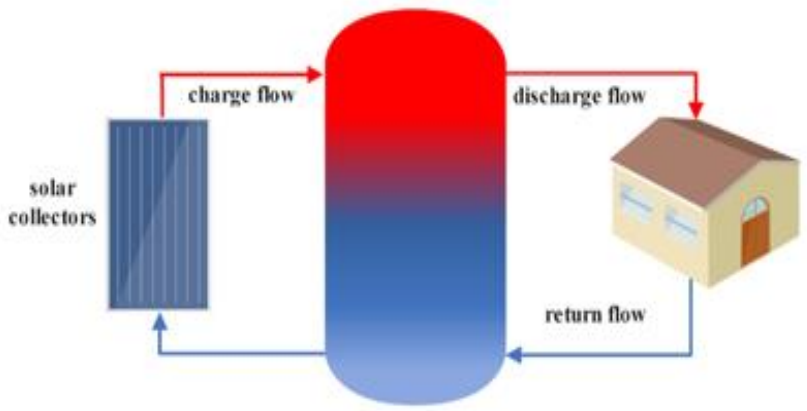
Typical Energy Transfer Station



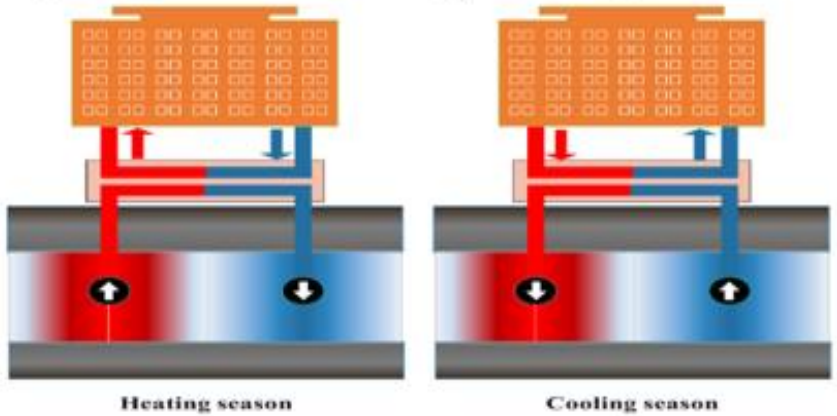
Energy Harvest Transfer Station with Heat Recovery Heat Pump

Thermal Energy Storage Technologies

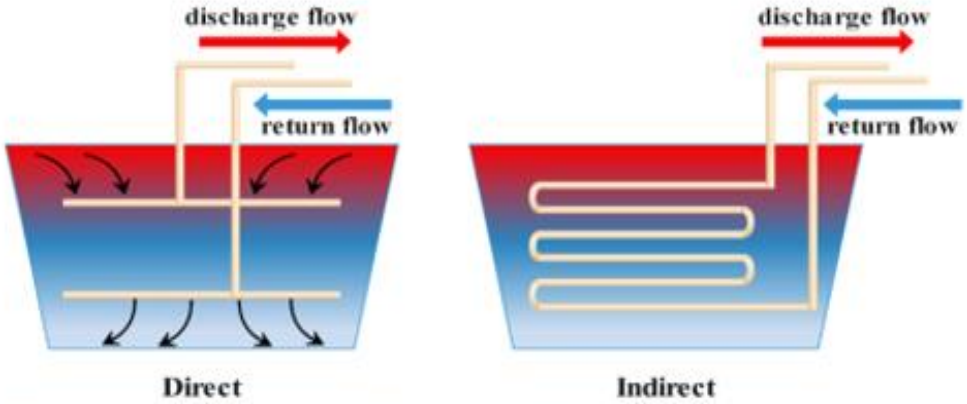
Tank Thermal Energy Storage



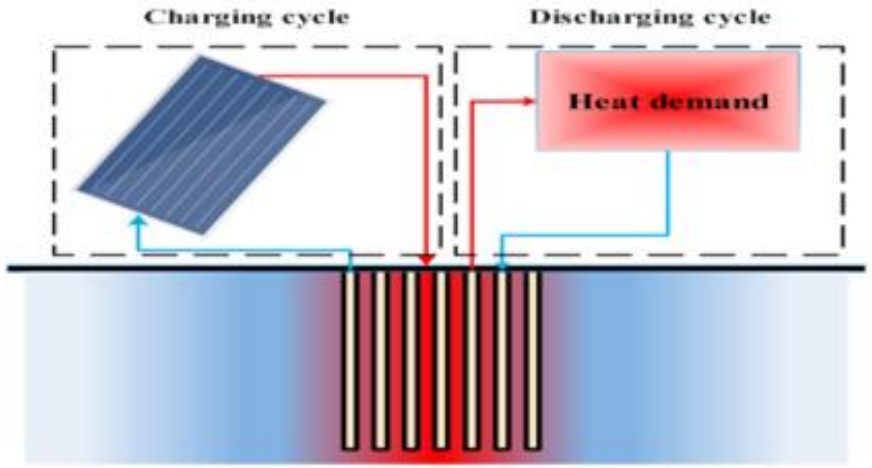
Aquifer Thermal Energy Storage



Pit Thermal Energy Storage



Borehole Thermal Energy Storage



Source: A. Pourahmadiyan, M. Sadi, and A. Arabkoohsar, Seasonal thermal energy storage. INC, 2023

Tank Thermal Storage

Markham District Energy – can provide 40 MW of heating capacity using excess heat from gas fired CHP plant and from heat pumps.

Source https://group.vattenfall.com/press-and-media/newsroom/2022/germanys-largest-heat-storage-in-the-starting-blocks
www.enwave.com

Regulated Utility Ownership of Thermal Networks - New York State

Utility Thermal Energy Network and Jobs Act

- The legislation allows public utilities to own, operate, and manage thermal energy networks, as well as supply distributed thermal energy, with Public Service Commission (PSC) oversight.
- Allows gas and electric utilities deliver thermal energy services through district thermal energy networks.
- Creates a regulatory process for piloting thermal energy networks and developing appropriate regulations for thermal energy networks, which transfer heat in and out of buildings as needed in a district network with low or zero emissions
- Requires the PSC to initiate support the development of thermal energy networks for the purpose of meeting the GHG emissions and equity goals.
- Mandate that these networks are constructed by a skilled and trained workforce with the goal of employing utility workers transitioning to new systems

New York State - Proposed regulatory stages for new utility infrastructure

DEMONSTRATION

First project in the ground – a learning experience for all

Ratepayer cost low.

Begin the process of:

- Education
- Definitions
- Data gathering
- Collecting possible approaches

DEVELOPMENT

Increasing projects coming down the learning/cost curve while gathering data needed to inform fair deployment decision making and ratemaking

Ratepayer cost 'fair' but not linked to capital cost yet.

- Intense data gathering
- Test possible approaches and models

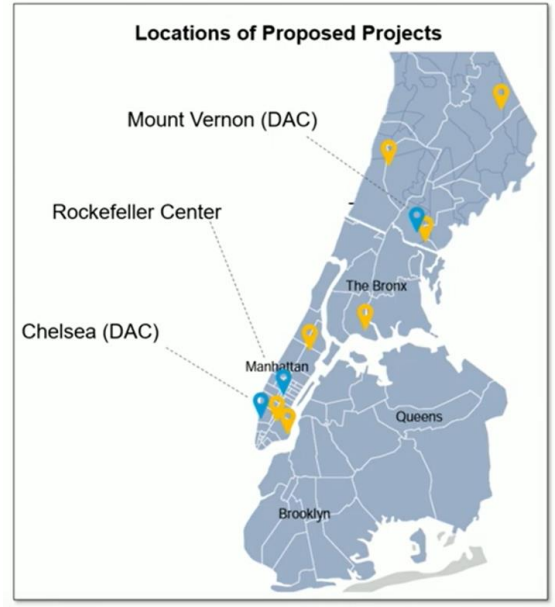
DEPLOYMENT

A stage of significant scaling with guidelines and guardrails with fixed

- Ownership structure
- Financing model
- Ratemaking process
- Approval process

Con Edison - What will be needed to scale post-pilot

- Rigorous fact base grounded in pilot learnings and data
  - Cost/benefit analysis of networks at scale (societal value, customer economics)
  - Customer learnings
  - Prioritization (use cases, configurations, types of locations)
- Thoughtful regulatory framework
  - Criteria and processes to create / expand regulated networks
  - Flexibility for UTEN to be deployed as
    - Electric peak reduction / Non Wires Solution
    - Non Gas Pipe Alternatives



Canadian Example - British Columbia Regulations

Thermal Network Regulation is not new in Canada. BC has regulated Thermal Networks

bcuc
British Columbia
Utilities Commission

Suite 410, 900 Howe Street
Vancouver, BC Canada V6Z 2N3
bcuc.com

P: 604.660.4700
TF: 1.800.663.1385

Thermal Energy System Guidelines

British Columbia Utilities Commission

February 26, 2025

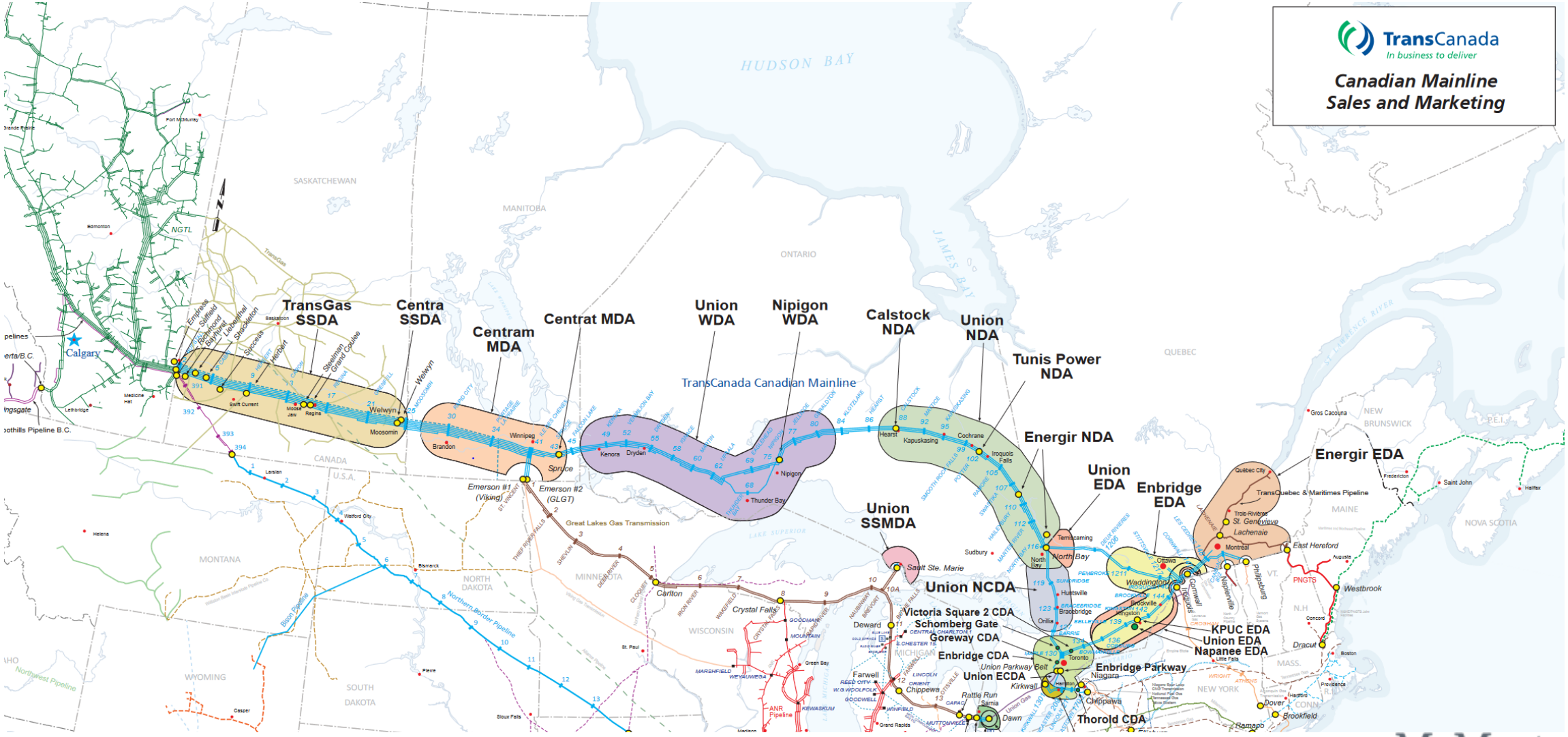
Source: https://docs.bcuc.com/documents/Guidelines/TES-Guidelines.pdf

Vancouver's False Creek Neighbourhood Energy Utility

- Goal of 100% by 2030 energy supply to come from renewable energy sources (waste thermal energy captured from sewage, cooling towers) to provide space heating and hot water to buildings in False Creek area.
- City of Vancouver Owned
- Rate Setting- The rates are set annually by City Council. To ensure fair and appropriate rates
- By-law 9552: New developments required to connect as per the Energy Utility System By-Law No. 9552.

Source: https://docs.bcuc.com/documents/Guidelines/TES-Guidelines.pdf

Our Gas Network Evolved from the 1950s



M. Green, Boltzmann Institute, IESO and Environment Canada data

Recommendations

1. Launch public education and consultation to expand public understanding of Thermal Networks and acceptance of distributed energy resources and nuclear CHP

2. Recognize (waste) residual heat, as a strategically important form of energy. Promote the conservation and re-use of heat as a key enabler of Canada's net zero transition.

3. Formally recognize Thermal Networks as part of Canada's energy critical infrastructure, Deploy Thermal Networks at scale to make residual and renewable heat resources affordable, reliable and accessible.

4. Adopt a utility approach for Thermal Networks to eliminate barriers and provide options to support equitable, rapid decarbonization of building heating. Fund amortization of infrastructure and of building conversions through usage charges.

5. Integrate governance, planning and operation of Electricity, Gas, and Thermal Network infrastructures to create and leverage opportunities for synergies, greater efficiency and societal good in the energy sector transition in Canada by 2050.

6. Assess the business case to configure nuclear power plants, at all scales, for Combined Heat and Power (CHP) , where they can provide economic heat to Thermal Networks, maximize the benefits of nuclear power

Key Takeaways

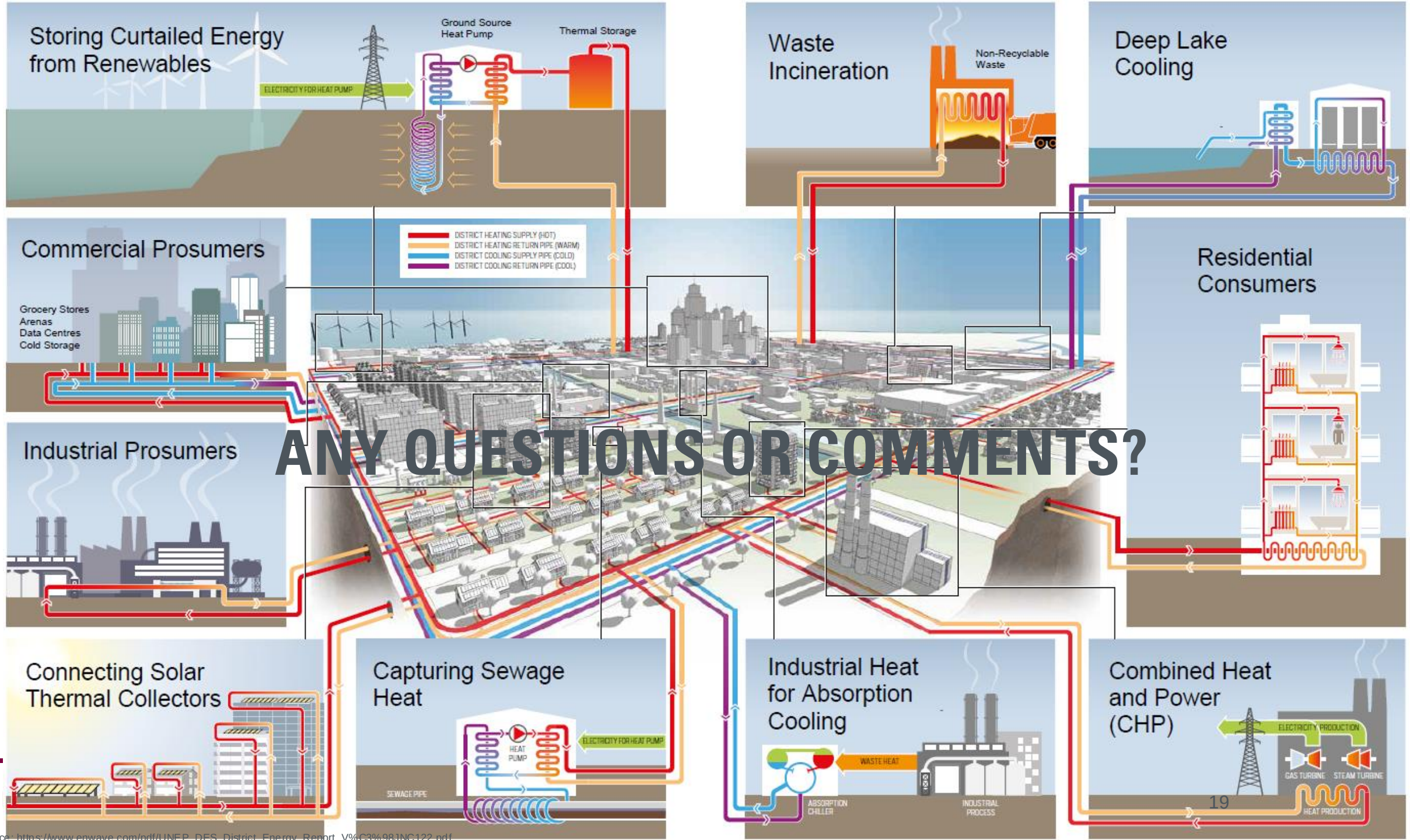
- ✓ Conserve: Building conversion and low temperature design,
- ✓ Connect: Modernize, expand and integration of the thermal networks,
- ✓ Convert: Incorporate residual heat and non-GHG emitting sources.

Thermal networks and thermal batteries are feasible. They exist and work

This is a practical solution for Canada

Our Position Paper

McMaster University



Source: https://www.enwave.com/pdf/UNEP_DES_District_Energy_Report_V%C3%98JNG122.pdf