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Planning for Low Carbon Energy in Ottawa Gatineau

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Public Services and Procurement Canada

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ESAP PASE

Program Overview

The **Energy Services Acquisition Program (ESAP)** is modernizing the District Energy System (DES) which provides heating services to over 80 buildings and cooling services to 67 buildings in the National Capital Region (>1.6M m^2 of floor space), accommodating 55,000+ occupants

There are **two stages** to ESAP:

- Stage 1: DES Modernization
- Stage 2: Deeper Greening

ESAP Has Two Stages

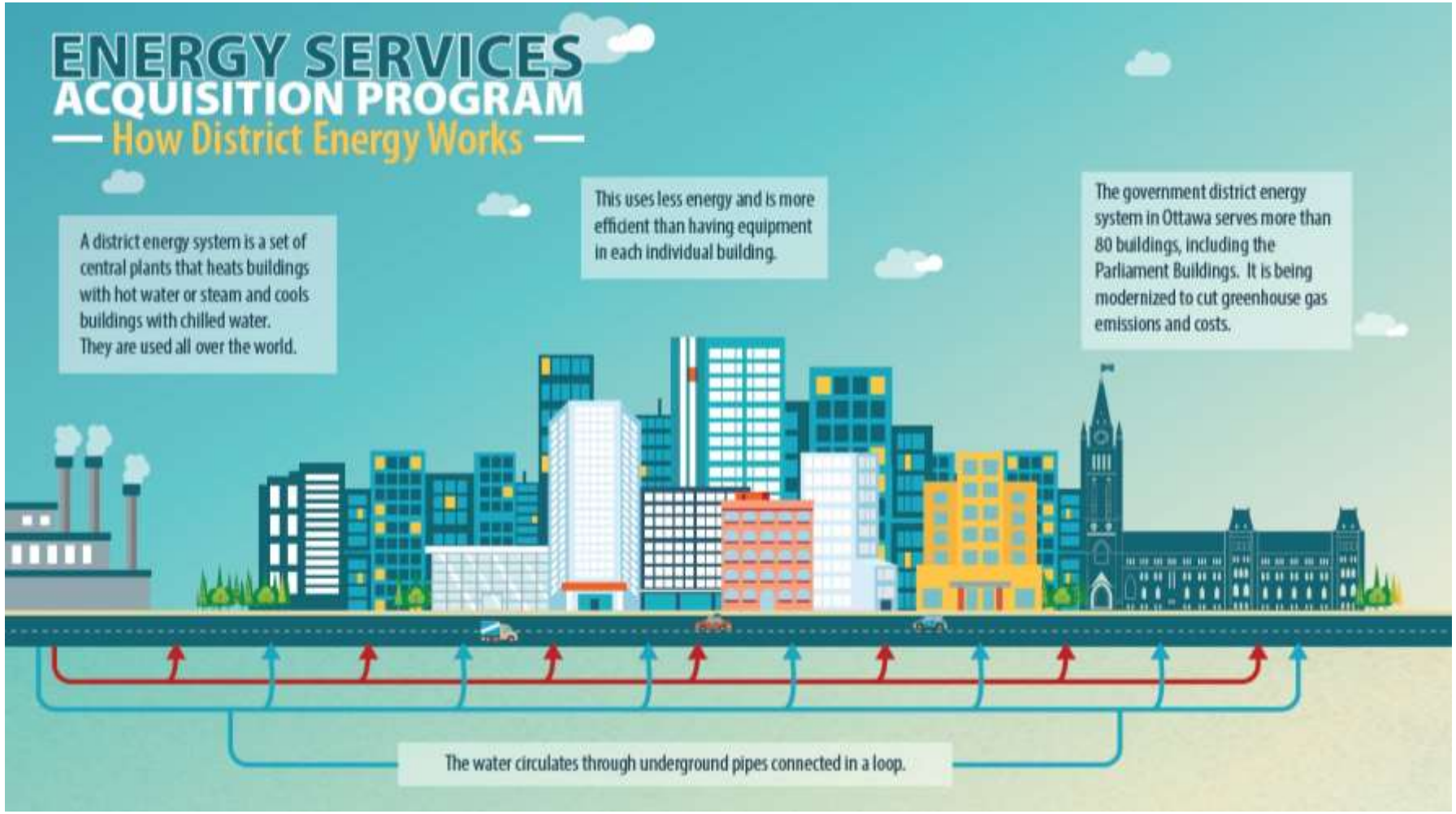
Stage 1 – DES Modernization

- Convert to industry-standard low temperature hot water technology (LTHW)
- Switch from steam to electric chillers
- Implement Smart Buildings data analysis to improve efficiency
- Test new low carbon fuels
- Complete building conversion

Stage 2 – Deeper Greening

- Convert heating base load to low carbon fuels
- Explore using renewable natural gas for peak load
- Support switch to 100% clean electricity by 2025
- Above measures prepare ESAP for expansion to new buildings (federal and other clients)

What is a District Energy System?



Exciting Models are an Inspiration for ESAP

New models are emerging across the world for heating and cooling – ESAP will be a model for others once completed

Innovative design for incineration plant in Copenhagen, Denmark

The Optic Cloak
Greenwich Peninsula Energy Infrastructure (London, UK)

Supporting Government Priorities

The ESAP program will help the Government of Canada to meet the following commitments:

- **Paris Agreement** committing Canada to reducing GHG emissions by 30% by 2030;
- **Federal Sustainable Development Strategy** and **Greening Government** committing to lead by example by greening government operations and reducing emissions in government buildings and fleets by 40% by 2030 at the latest; and
- **Pan-Canadian Framework on Clean Growth and Climate Change** committing to move toward smart and sustainable buildings that use less energy and open the way for using renewable energy sources

Supporting Government Priorities

Work completed as part of the ESAP program will also help to meet the following commitments set out by the **Centre for Greening Government**:

- Move towards low-carbon, sustainable, and climate resilient real property;
- Reduce Scope 1 and Scope 2 GHG emissions from federal government facilities and fleets by 40% below 2005 levels by 2030, with an aspiration to achieve this target by 2025;
- Further reduce these emissions by 80% by 2050; and
- **Use 100% clean electricity by 2025**, as set out in the Pan-Canadian Framework on Clean Growth and Climate Change.

Where are the Plants?

National Printing Bureau

Cliff

Tunney's Pasture

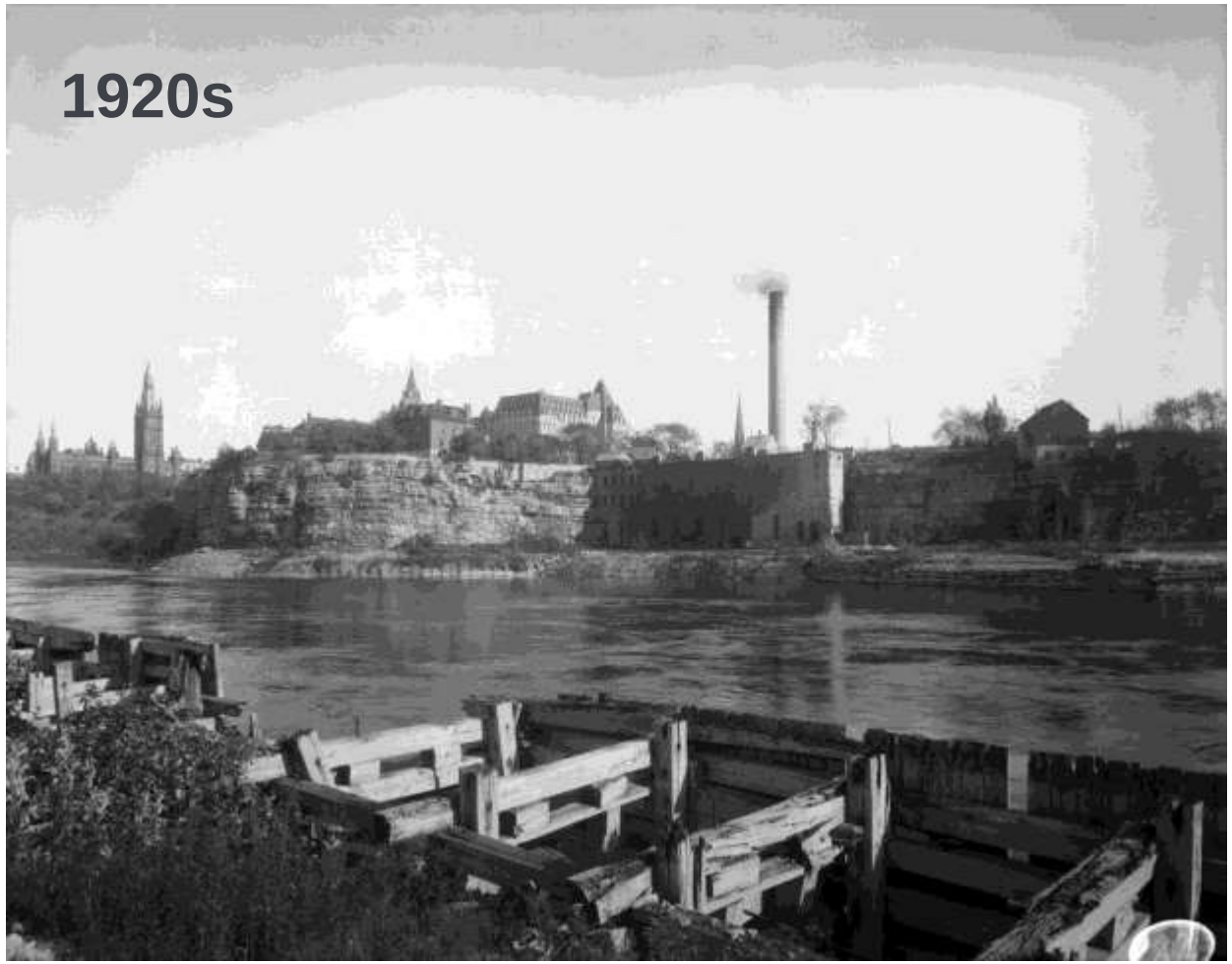
New connections

NRC

Confederation Heights

Sneak Peak at the Design for Stage 1: Modernization

Cliff Plant – Historically



Architectural Design – Cliff Plant

View of the Cliff plant from Gatineau showing the exterior and the stainless steel stacks.

Aesthetic Design Overview - Cliff Plant

View of the Cliff CHCP from the NCC's multiuse pathway (MUP).

Architectural Design - Cliff Plant

View from the public meeting area. Notice the access from top to bottom by staircase and by elevator.

Architectural Design – Cliff Plant

View of the upper plateau blending walkways, seating areas, trees and plants and offering spectacular views.

Architectural Design – Tunney's Pasture Plant

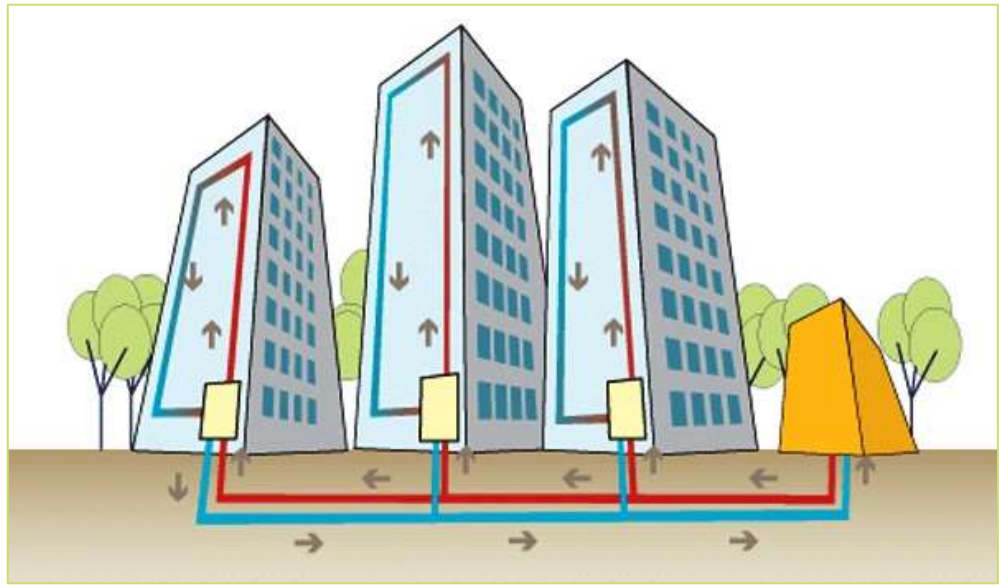
View of the Tunney's Pasture CHCP looking towards the Ottawa River.

Architectural Design – Tunney's Pasture Plant

View of the Tunney's Pasture CHCP from the street in front.

ESAP Stage 1 – Creating a Thermal Grid

- In Stage 1: Modernization, one of the most important benefits will be the creation of a thermal grid
- It will be able to distribute hot and cold water as energy sources
- This will include not only delivering energy but also receiving energy from other plants, buildings and waste heat sources



Stage 2: Plan for Low Carbon Heating and Cooling

- By 2025 the DES in the National Capital Region will be modern and highly efficient
- Cooling will use 100% clean electricity and will be **carbon neutral**
- Studies and pilot projects are underway to examine carbon neutral energy sources and how they can be used for heating

Community Solar Panels in Ottawa (orec.ca)

Stage 2: Enabling Low Carbon Government

- Modernizing the DES is a GOC priority that will provide long term financial savings and greenhouse gas (GHG) emissions reductions
- It is part of a portfolio of solutions for GHG reduction:
  - Smart buildings and plants
  - Reducing building energy demand with efficient retrofits
  - New building construction to highest standards
  - Adding renewable energy generation capacity on site

Geo-exchange well in Surrey, BC

Stage 2: Aligning with Net Zero Design

- Centre for Greening Government states that departments need to “determine the most cost-effective pathway to achieve low-carbon operations”
- “All new buildings should be constructed to be *net-zero carbon ready* at the latest in 2022”
- ESAP can help clients to move towards Net Zero buildings by acting as thermal storage
- We can accept excess energy on sunny days and being a source of heating on cold days

Biomass Facility at UBC

Stage 2: What are the Options for Low Carbon Heating?

We have assessed the feasibility of using many options:

- Biomass Thermal
- Biomass CHP
- Biogas (Locally Produced)
- Renewable Natural Gas
- Bioliquids
- Electric Boilers (non-GHG emitting sources)
- GeoExchange
- River Heat Pump
- Waste Heat Recovery
- Chiller Heat Recovery
- Industrial Heat Recovery
- Solar Thermal Energy
- Waste-to-Energy CHP
- Deep Geothermal

Stage 2: Possible Options for Base Load Heating

- **Biomass Thermal** – good in terms of distance to system; energy costs; GHG reductions; jobs & economic development; and reliability
- **Electric Boilers** – good in terms of reliability; distance to system; GHG emissions; and other environmental and social factors
- Other technologies could be incorporated on a smaller scale and on case by case basis e.g. waste heat from a data centre

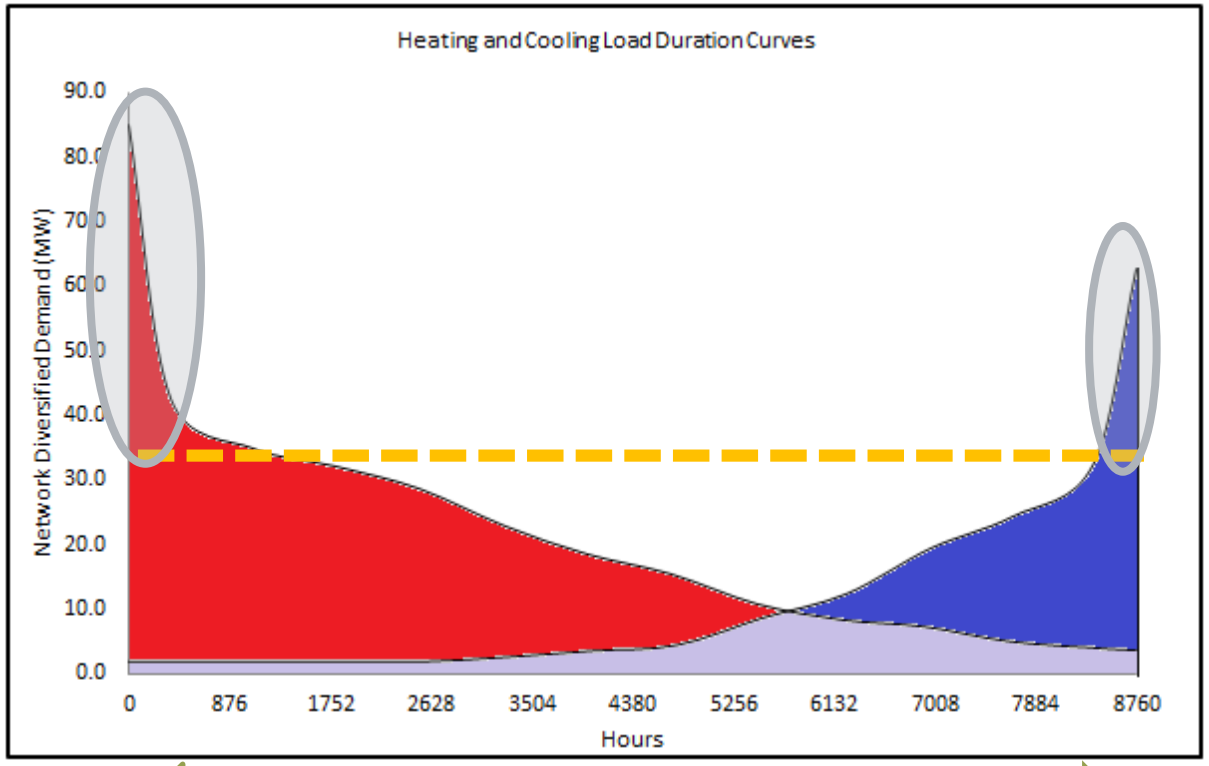
Tour of Biomass Pilot Project at Confederation Heights CHCP

Stage 2: If Biomass, Focus on Wood Residue

- Wood residue, broadly defined, is any woody material that is a by-product of another industrial process (e.g. timber harvesting) or chipped material from tree clean up
- ESAP has commissioned a study that shows that the amount of wood residue available within a 200 km radius is at least five times what would be required for current base load

Example of wood residues produced by forestry operations

Understanding Energy Demand



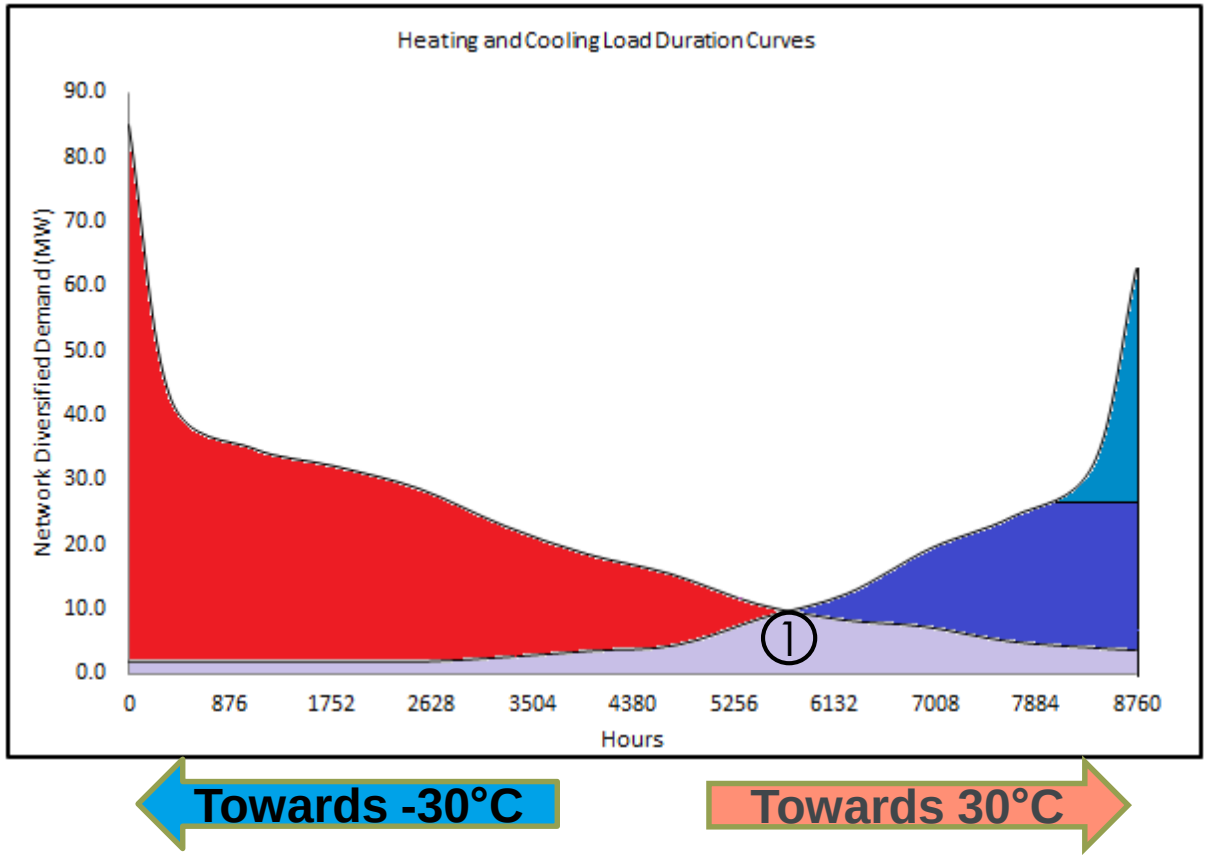
- The Load Duration Curve is the key to understanding energy demand
- Base Load produces the bulk of the annual energy use
  - ➢ Focus for low carbon sources
- Peak Demand is critical for customer comfort but is small % of total energy use
  - ➢ Focus for RNG, Offsets (ON elec.)

Heating

Cooling

Heating and Cooling

Energy From Renewables

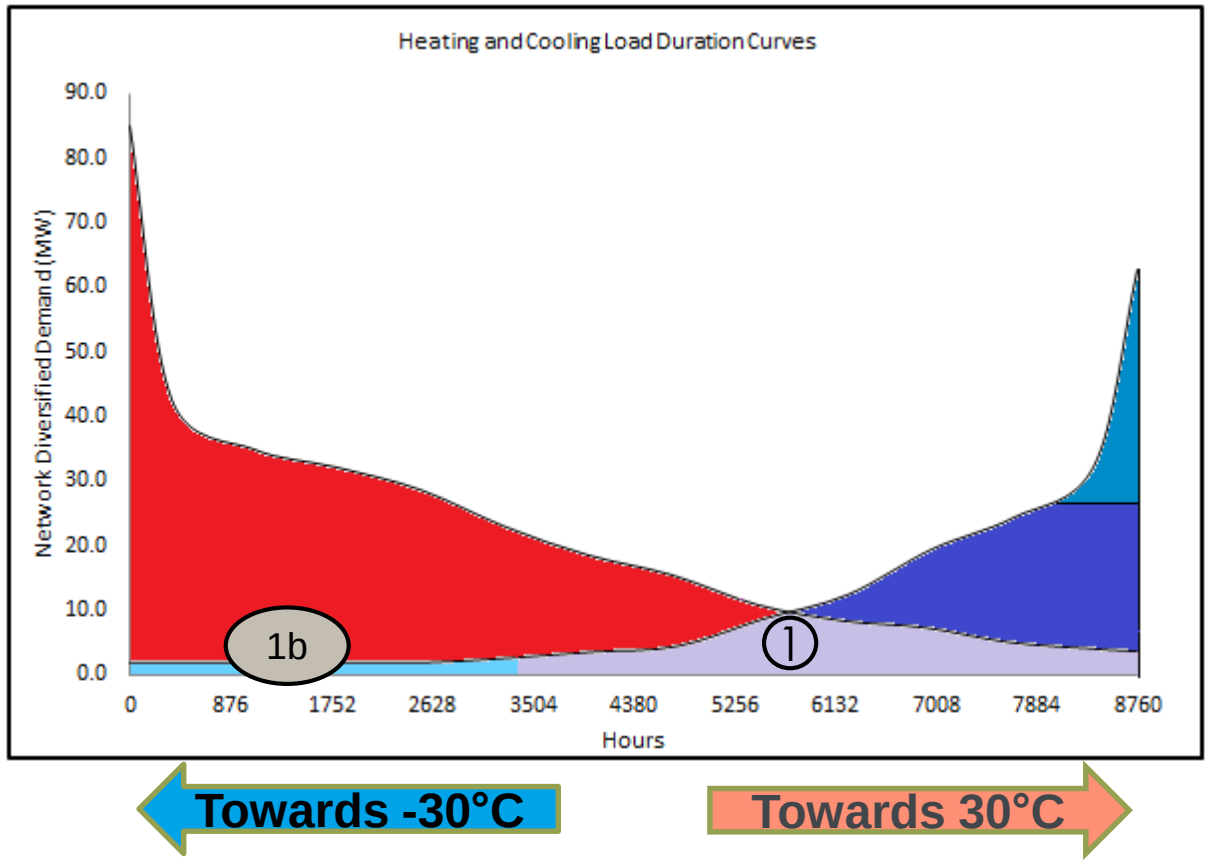


ESAP Stage I - Modernization

1. Chiller Heat Recovery (HPs)

- Natural Gas
- QC Electricity
- ON Electricity
- HR Heat Pumps

Energy From Renewables



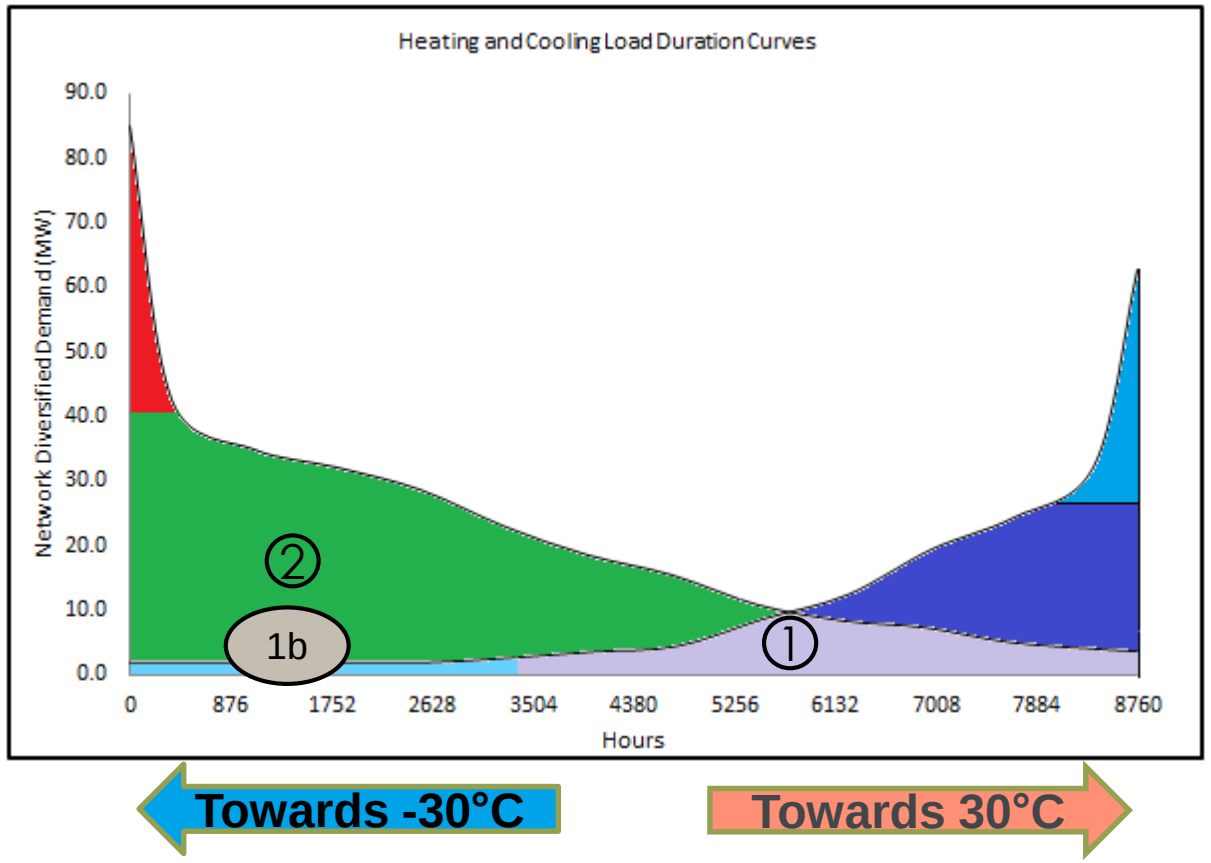
ESAP Stage I - Modernization

1. Chiller Heat Recovery (HPs)

1b. River water free cooling

- Natural Gas
- QC Electricity
- ON Electricity
- HR Heat Pumps
- River Water Cooling

Energy From Renewables



ESAP Stage I - Modernization

1. Chiller Heat Recovery (HPs)

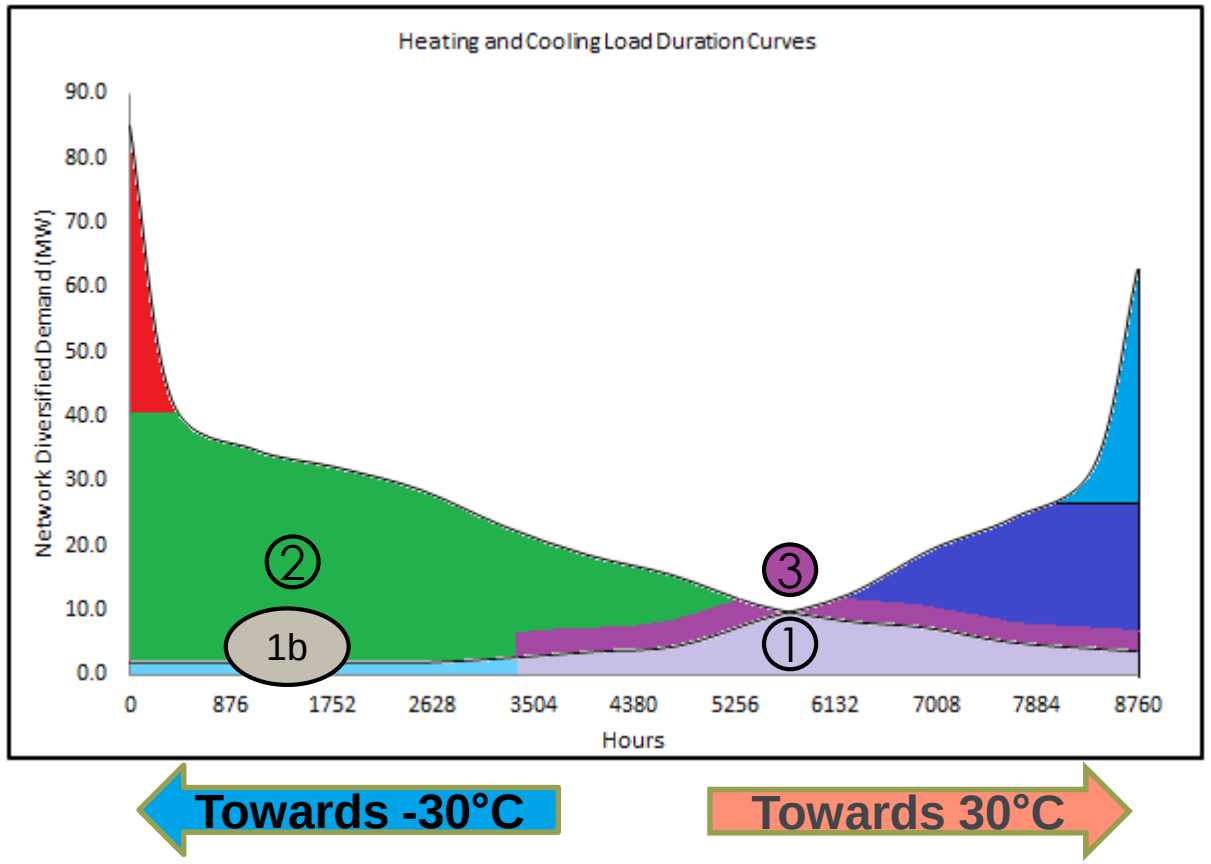
1b. River water free cooling

ESAP Stage II – Deeper Greening

2. Low Carbon (LC) Source (large)

- Natural Gas
- QC Electricity
- ON Electricity
- HR Heat Pumps
- River Water Cooling
- LC Source (large)

Energy From Renewables



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ESAP Stage III – Future Opportunities

3. Geoexchange (building scale)

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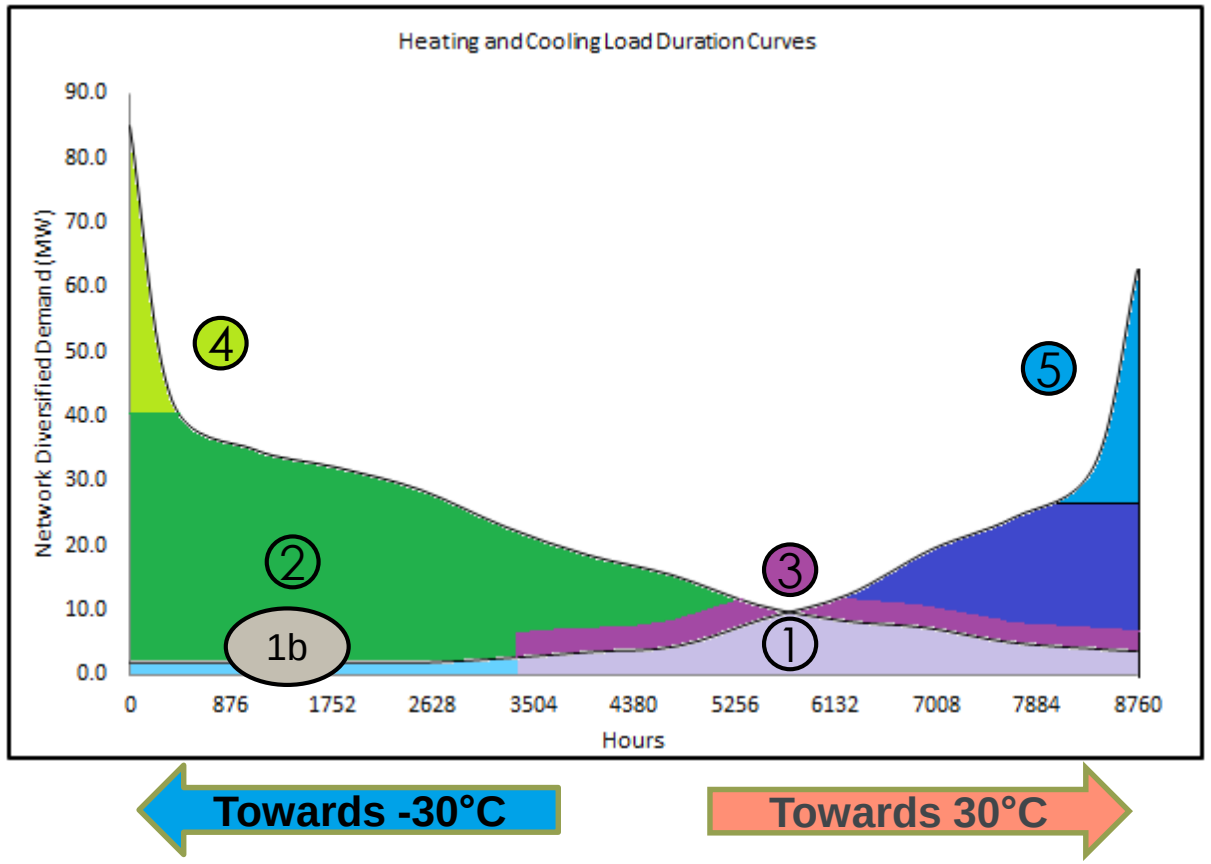
- QU Electricity
- ON Electricity
- HR Heat Pumps
- River Water Cooling
- LC Source (large)
- Geoexchange

Energy from Renewables



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ESAP Stage II – Deeper Greening

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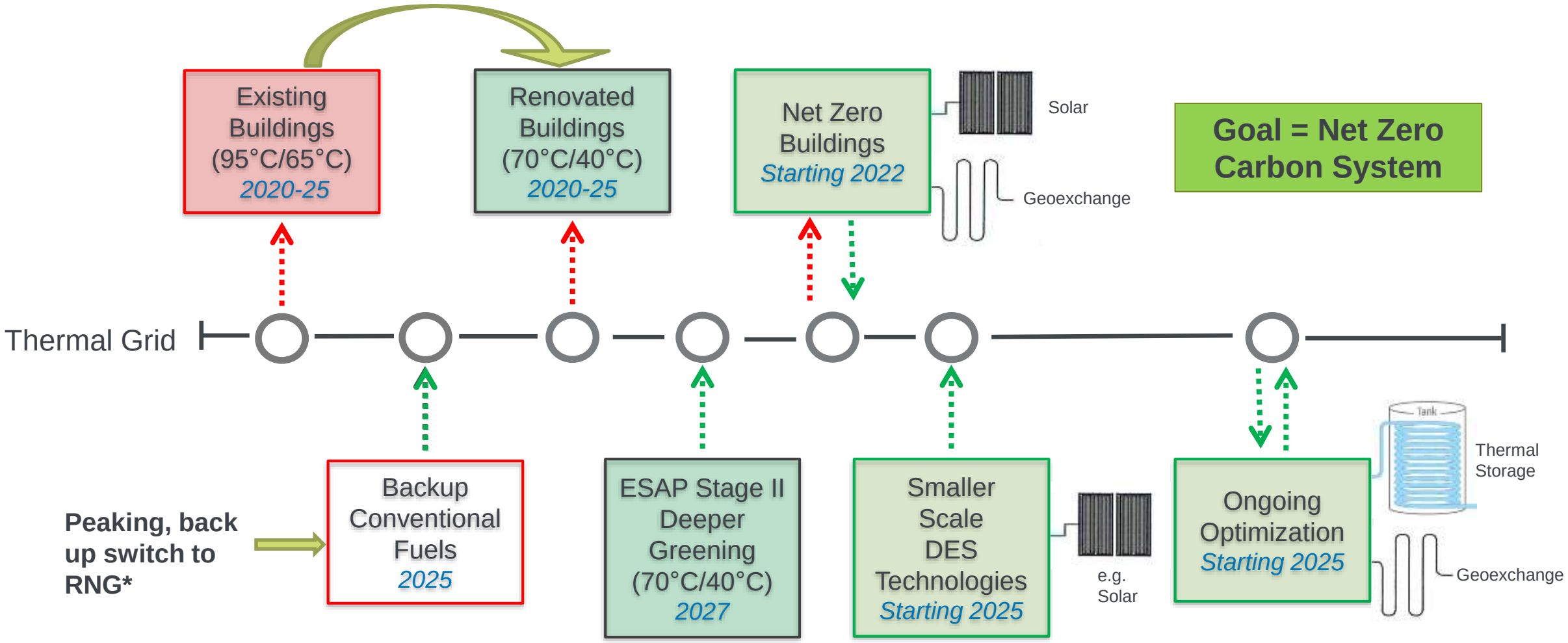
ESAP Stage III – Future Opportunities

3. Geoexchange (building scale)
4. RNG
5. ON Elec Offsets

- QU Electricity
- ON Electricity
- HR Heat Pumps
- River Water Cooling
- LC Source (large)
- Geoexchange
- RNG

Thermal Grid - The Pathway to Net Zero DES



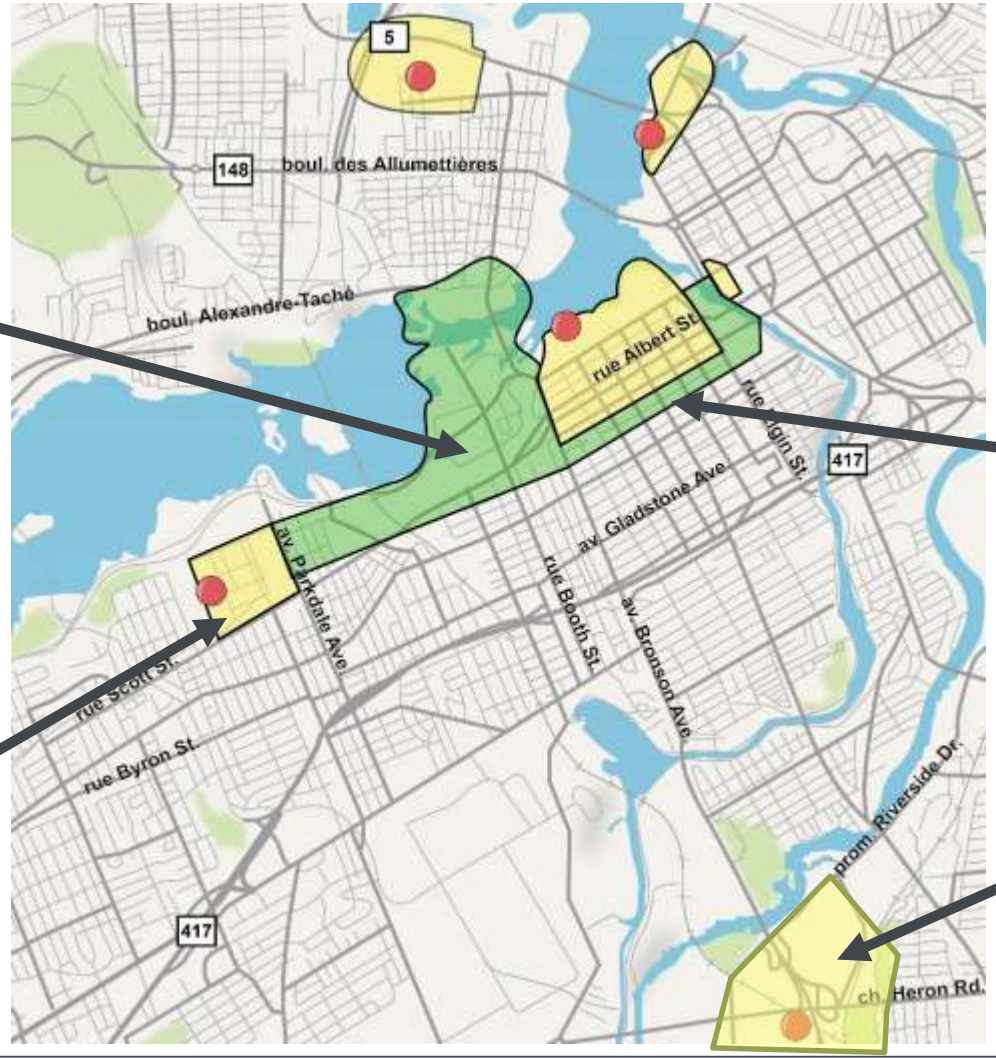
** Renewable Natural Gas (landfills, Organic digestion)*

How ESAP Can Expand The Network

We can expand to supply new customers with low carbon heating and cooling

Supply new development at LeBreton Flats

Supply new development at Tunney's Pasture

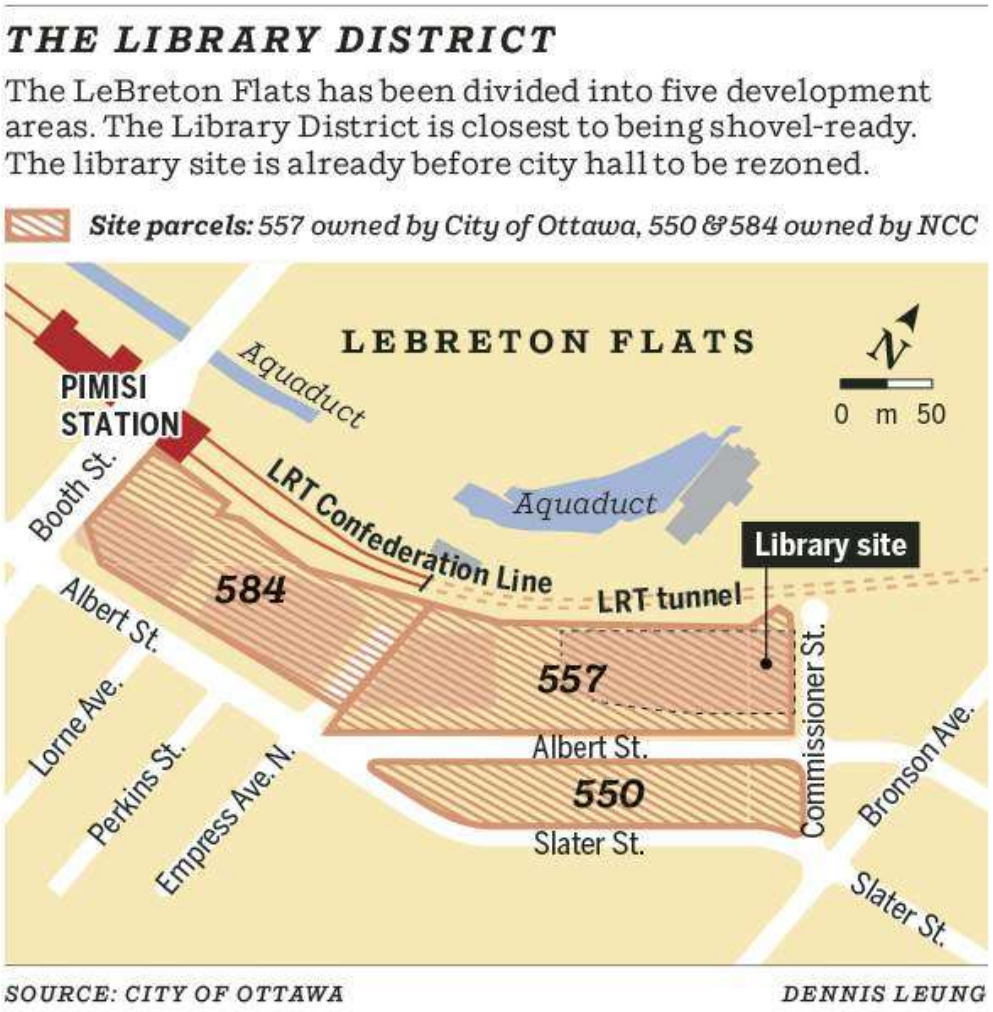


Connect to more buildings in the downtown core

Supply new development at Confederation Heights

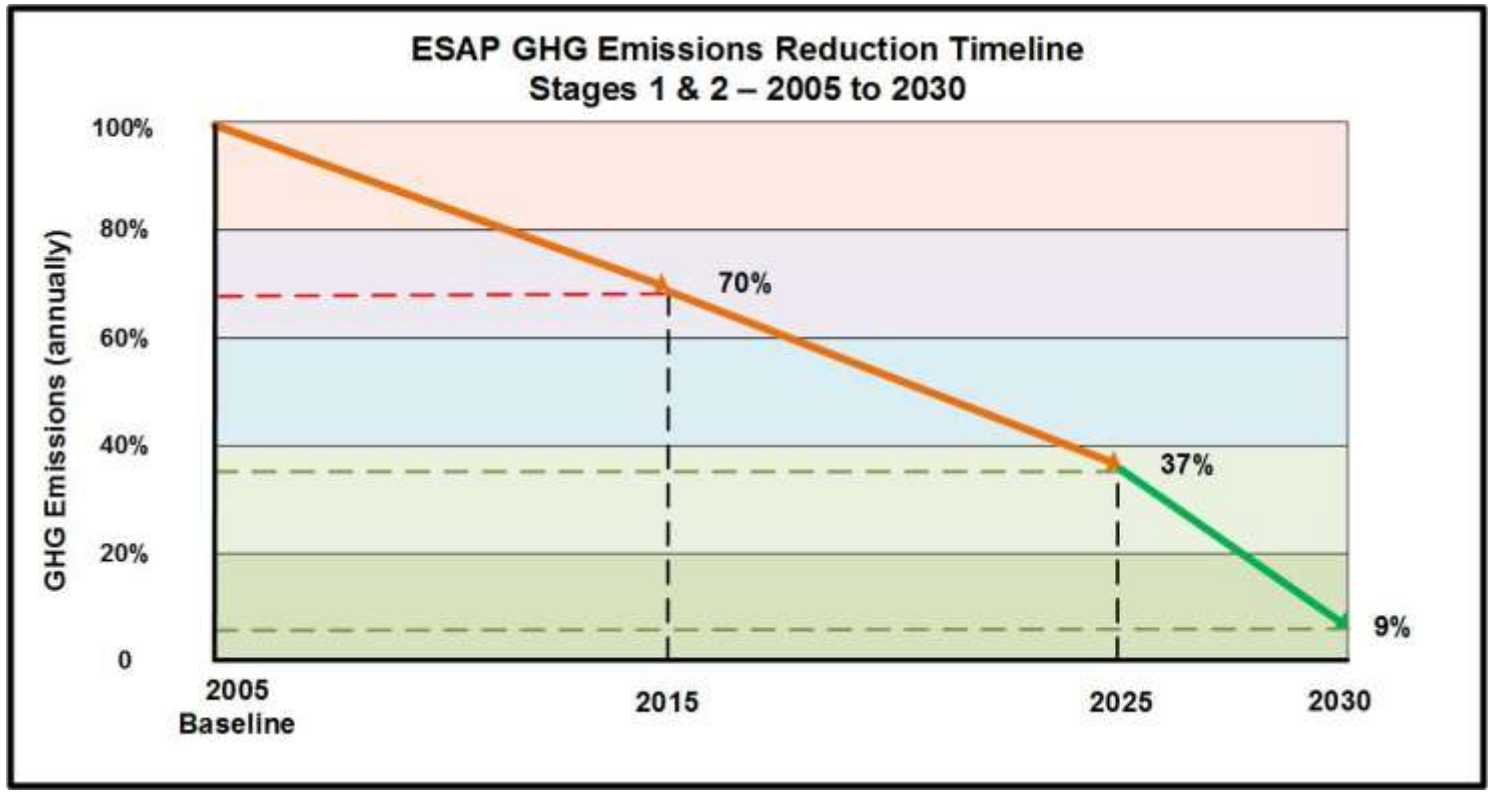
- Existing PSPC DES locations
- Potential DES Growth and Expansion
- Existing Plants

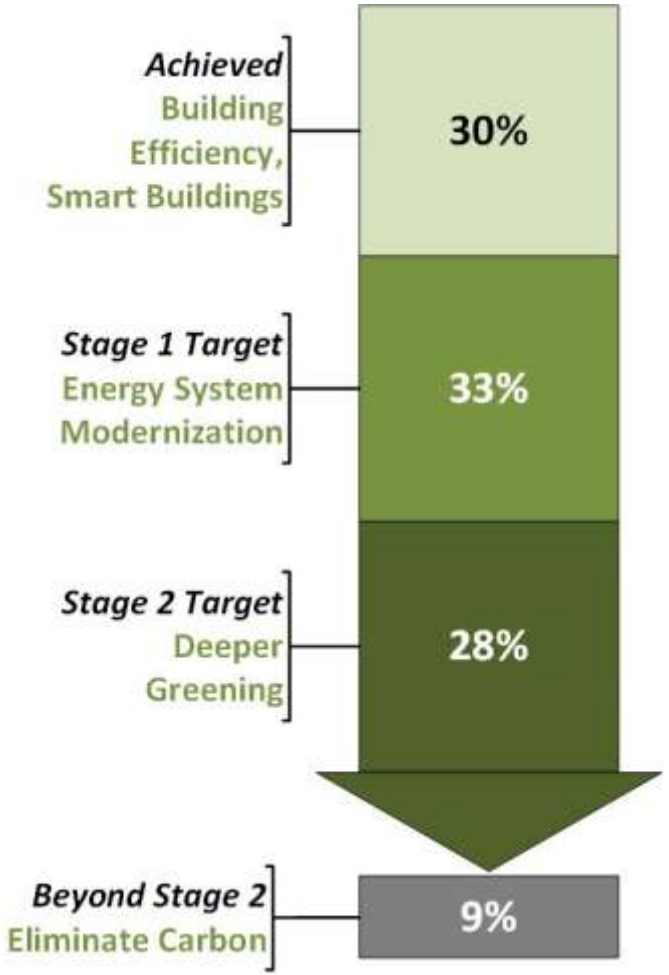
Linking to LeBreton Flats and Tunney's Pasture



Tunney's Pasture Master Plan Visualization

Expansion Makes Sense Because of GHG Reductions





By 2030, GHG emissions will be reduced to less than 10% of 2005 baseline emissions after we complete Stage 2

Expansion Value Proposition

- Carbon free cooling and low carbon heating
- Cost of energy competes with ‘business as usual’ solutions
- Uses river water for ‘free’ cooling
- No heating/cooling generation equipment on-site
- Flexible, fuel agnostic, low carbon approach to heating
- Energy input flexibility – easier to change sources in centralized DES
- Resiliency, redundancy and back up in case of emergencies
- Ability to accept energy from individual buildings or campuses
- State of the art refrigerant equipment provides LEED credit

Thank You -> Any Questions ?

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