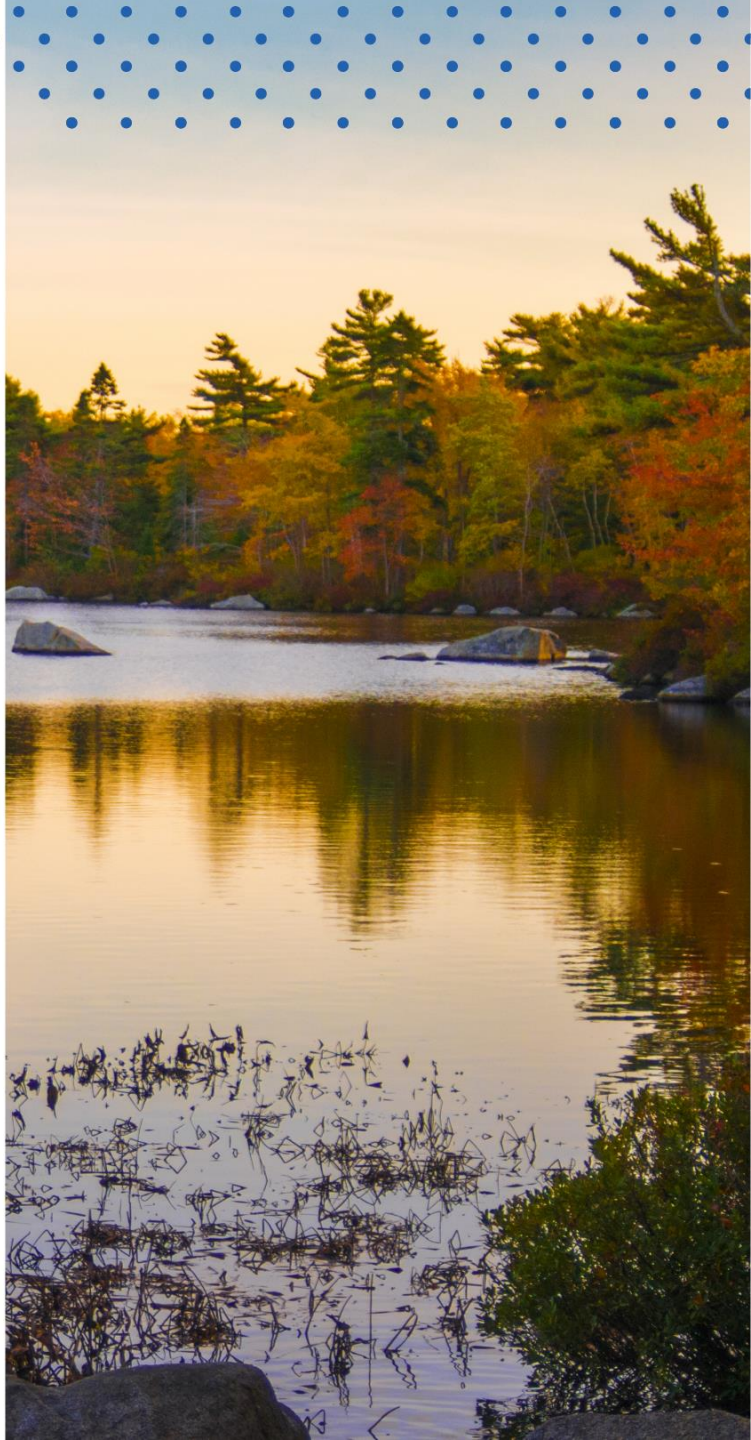
Halifax Water

Cogswell DES – Energy from Wastewater

CWWA - National Water & Wastewater Conference 2022
Halifax, NS

November 8, 2022

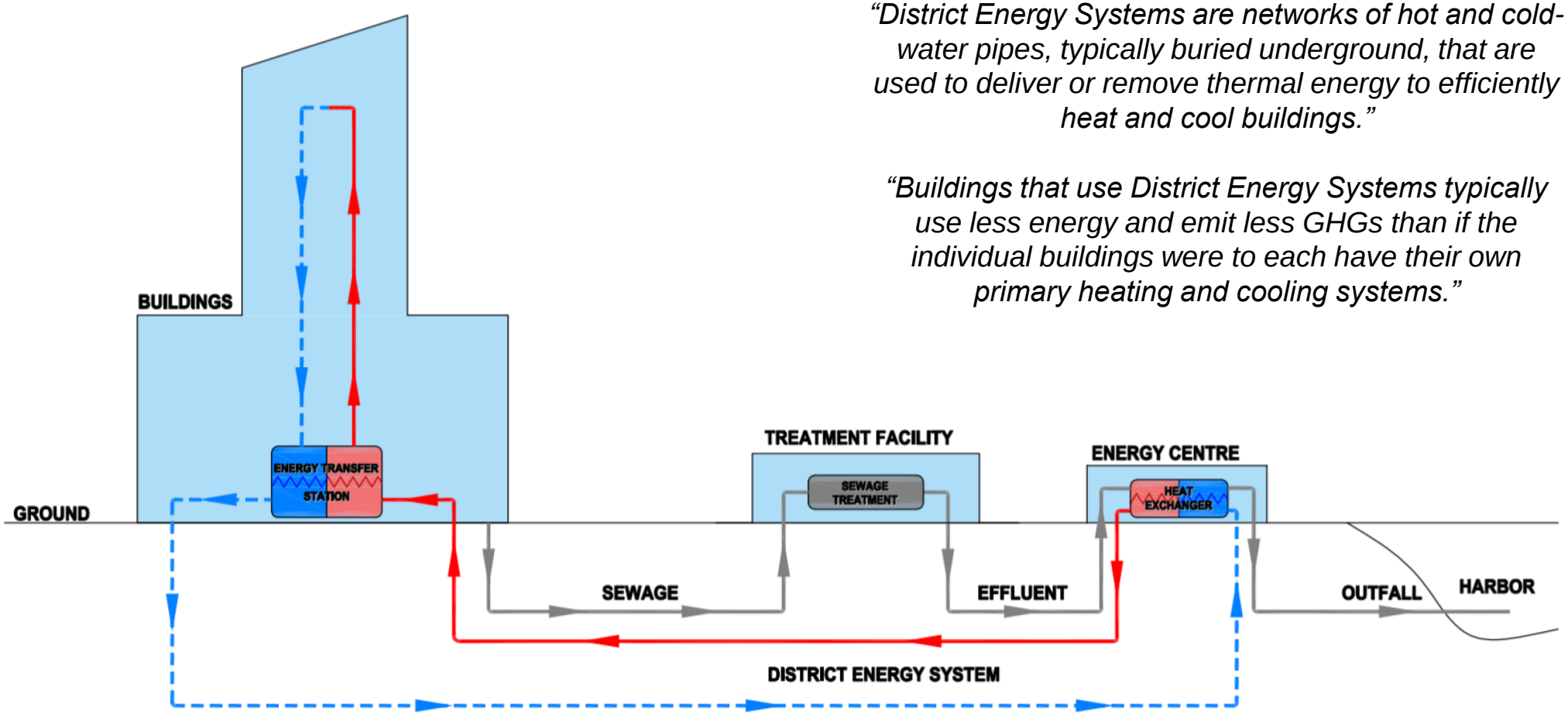
STRAIGHT from the SOURCE



Outline

- What is District Energy?
- Benefits of DE
- A Brief History of DE
- Types of DE Systems
- High Temperature vs. Ambient Temperature DE
- Cogswell DES
- Progress To-Date & Next Steps

What is District Energy?



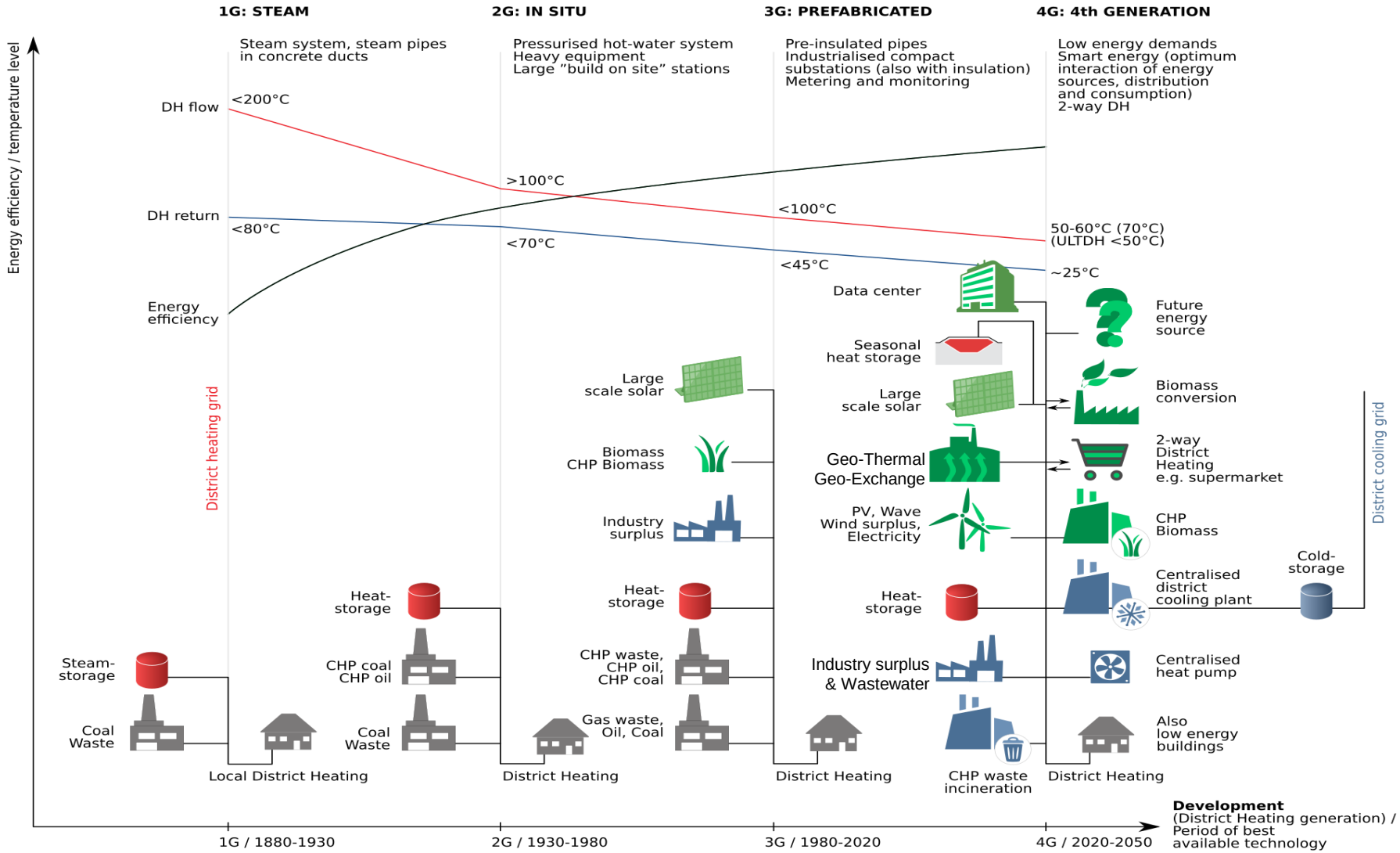
"District Energy Systems are networks of hot and cold-water pipes, typically buried underground, that are used to deliver or remove thermal energy to efficiently heat and cool buildings."

"Buildings that use District Energy Systems typically use less energy and emit less GHGs than if the individual buildings were to each have their own primary heating and cooling systems."

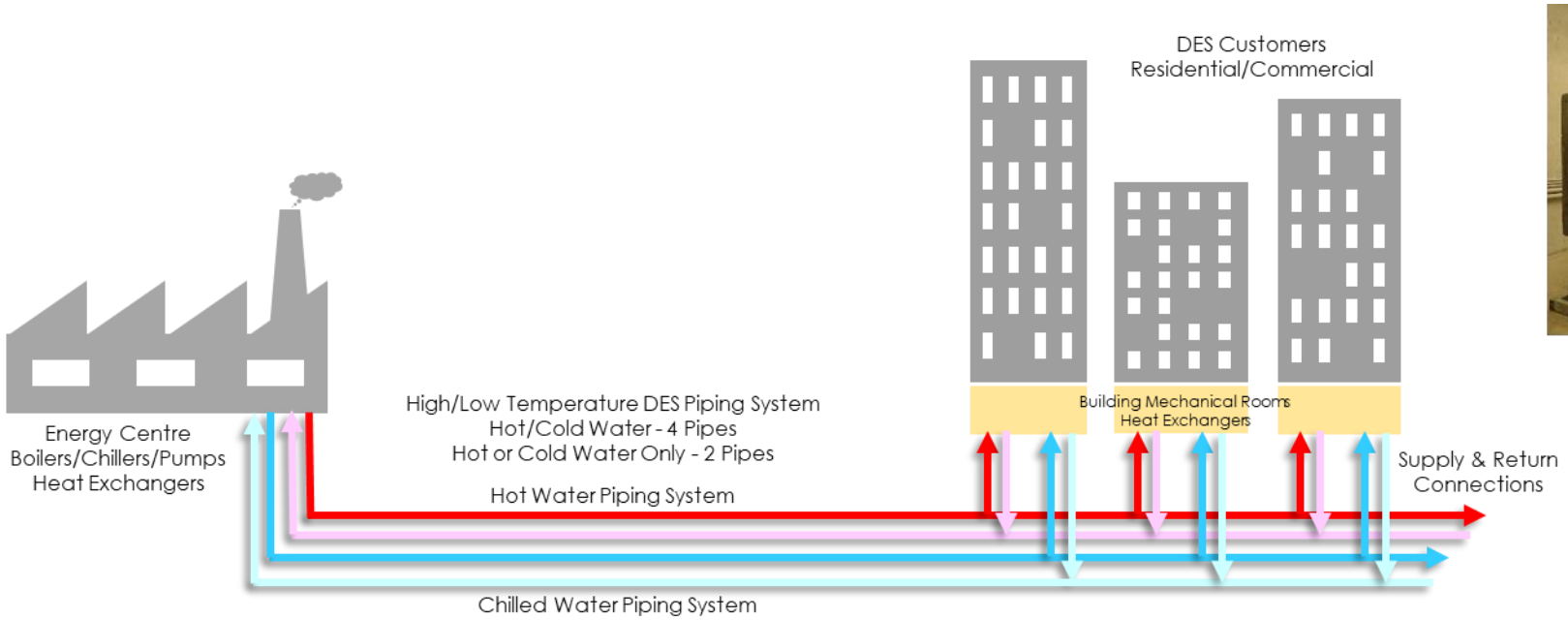
Benefits of District Energy

- Improved Energy Efficiency
- Improved Local Air Quality
- Reduced GHG Emissions
- Environmental Protection
- Energy Resilience & Access
- Energy Rate Stability
- Ease of Operation & Maintenance
- Reliable, Proven Technology
- Comfort & Convenience
- Decreased Life-Cycle Costs
- Decreased Developer Costs
- Decreased Building Capital Costs
- Improved Architectural Design Flexibility
- Improved Marketability & Value of Real Estate

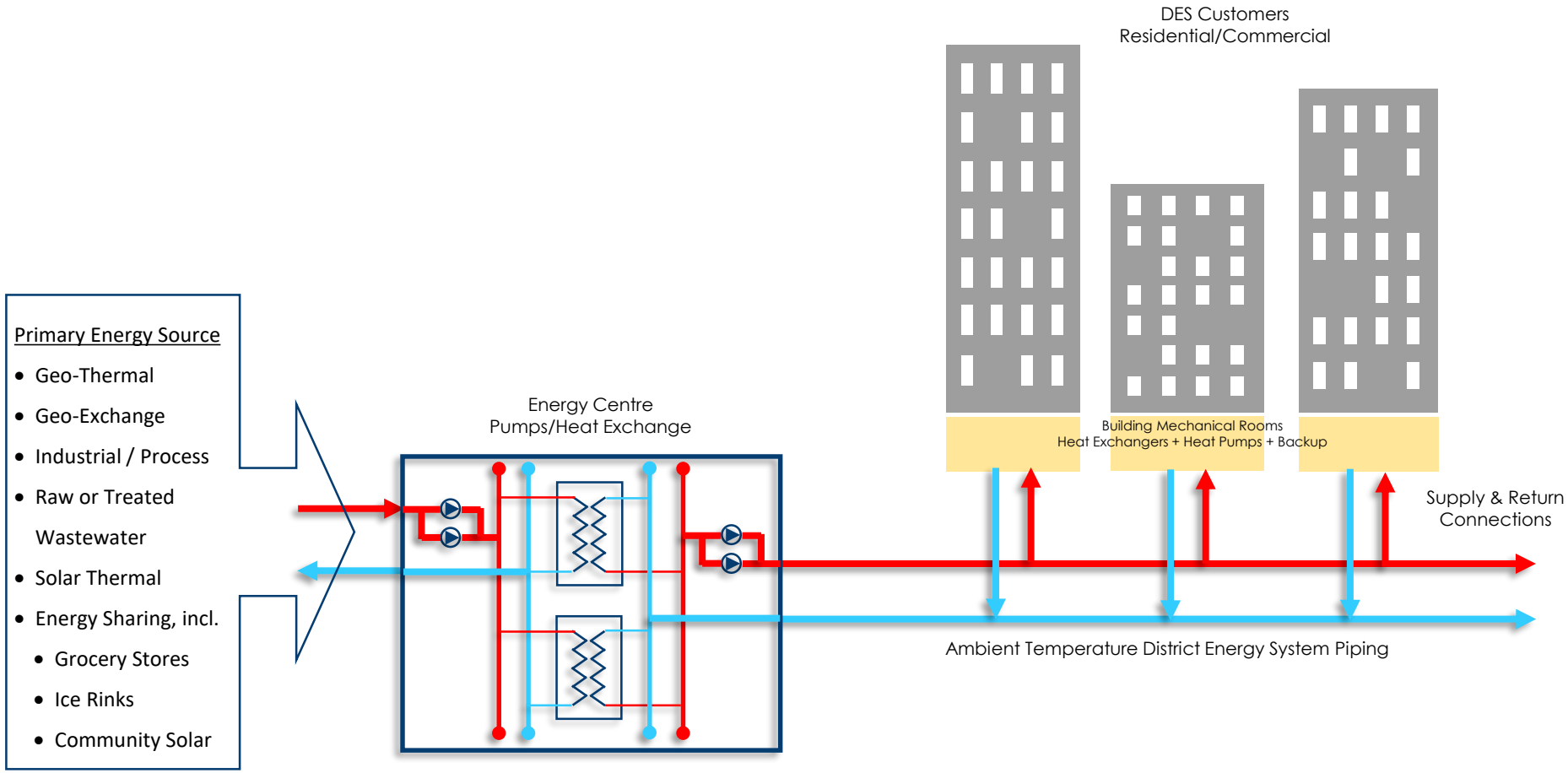
A Brief History of District Energy



1st – 3rd Generation HTDES



4th/5th Generation ATDES

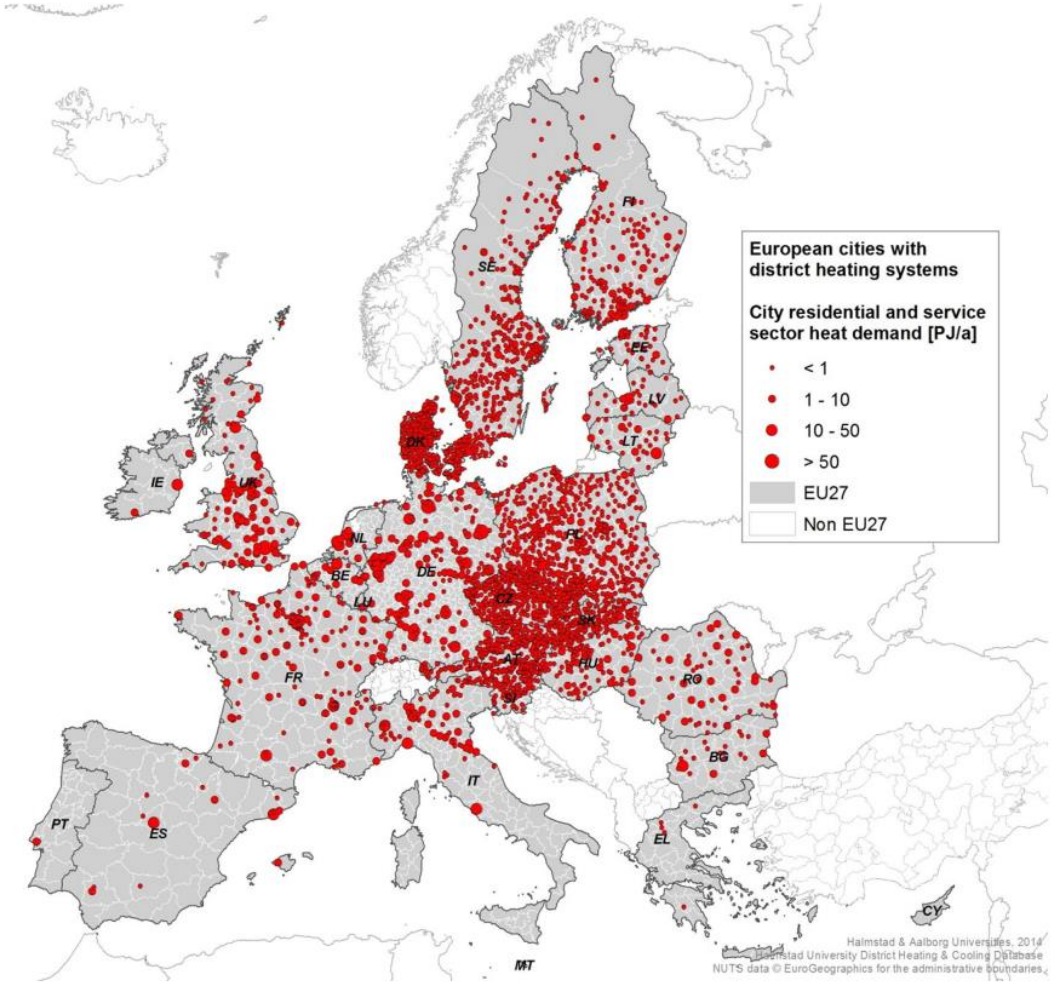


High Temp. vs. Ambient Temp.

- Refers to the temperature at which the heat transfer fluid is delivered to the customer.
  - High temperature ~ 70 to 90 °C
  - Ambient temperature ~ 10 to 25 °C

- Ambient Temperature DES Advantages:
  - Lower capital cost – no large energy center
  - Modular build out – delivers only energy that is needed
  - More energy efficient – less DES piping losses
  - Individual back-up systems in each building – better security of supply
  - Opportunities for integration of other renewable/waste energy sources
    - Distributed Solar
    - 2-Way Energy Sharing
    - Geo-Exchange
    - Connected CHP

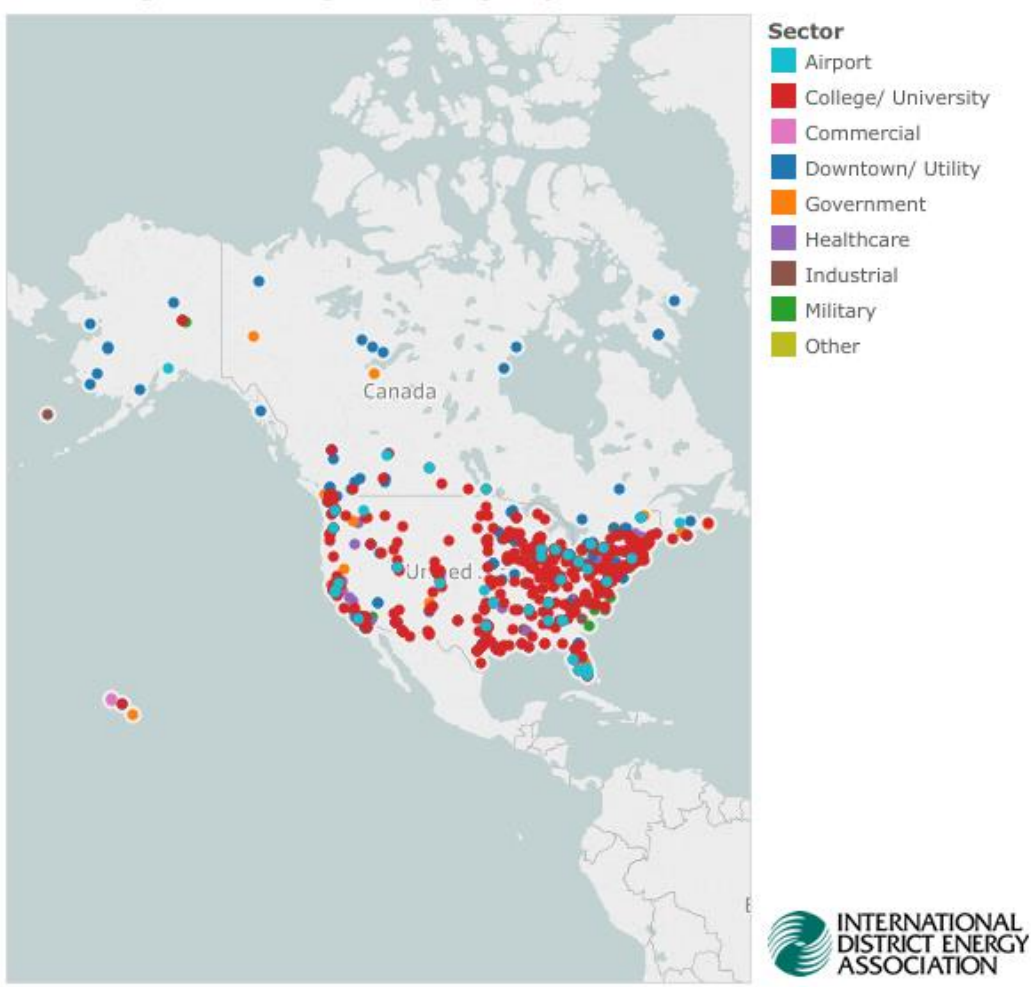
District Energy in Europe



Primary Fuel Sources

- Fossil Fuels (Natural Gas + Oil + Coal)
- Biomass
- Solid Waste
- Wastewater (Process + Sewage)
- Geo-Exchange (Geothermal + Lake/Sea Water)

District Energy in North America



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District Energy – Canadian Examples

- Cheakamus Crossing ATDES, Whistler, BC (2010, AT WW Effluent)*
  https://www.whistler.ca/services/water-and-wastewater/district-energy-system
  http://www.cheakamuscrossing.ca/
- Southeast False Creek DHS, Vancouver, BC (2010, Raw Sewage/NG)*
  http://vancouver.ca/home-property-development/southeast-false-creek-neighbourhood-energy-utility.aspx
  http://vancouver.ca/docs/planning/renewable-energy-neighbourhood-utility-factsheet.pdf
- Blatchford DESS, Edmonton, AB (Raw Sewage/Geo-Exchange)*
  https://blatchfordutility.ca/
- Saanich ATDES, Victoria, BC (2011, WW Effluent)*
  https://www.crd.bc.ca/project/past-capital-projects-and-initiatives/saanich-peninsula-water-transmission-main-heat-recovery
  https://www.pembina.org/reports/ctax-casestudy-saanich.pdf
- Markham District Energy, Markham, ON (2000 + 2012, NG CHP)*
  http://www.markhamdistrictenergy.com/
  https://www.markham.ca/
- Alexandra DEU, Richmond, BC (2015, AT Geo-Exchange)*
  http://www.richmond.ca/sustainability/energysrvs/districtenergy/energyutility.htm
- University of British Columbia, Kelowna, BC (2011, AT Geo-Exchange)
  http://facilities.ok.ubc.ca/geoexchange/des-operation.html
- Many other Canadian, US, European and Asian Systems

** Examples of municipally mandated district energy systems*

District Energy at Halifax Water

- HRWC considering DE in downtown Halifax and Mill Cove (Bedford) areas since <2010.
- 2012 HRWC Act amendments to allow the utility to engage in business activities related to the generation of energy in whole or in part from by-products of its operations.
- 2016 Feasibility study completed by DEC Engineering for Halifax Water shows a positive business case for a DES within the Cogswell Redevelopment Area.
- Ambient Temperature DES shown to be the most promising, cost effective and efficient DES for the Cogswell area.
- This project aligns with our core values of environmental stewardship, HRM's Community Energy Plan, and Municipal, Provincial and Federal clean energy and environmental objectives, and benefits our customer base.

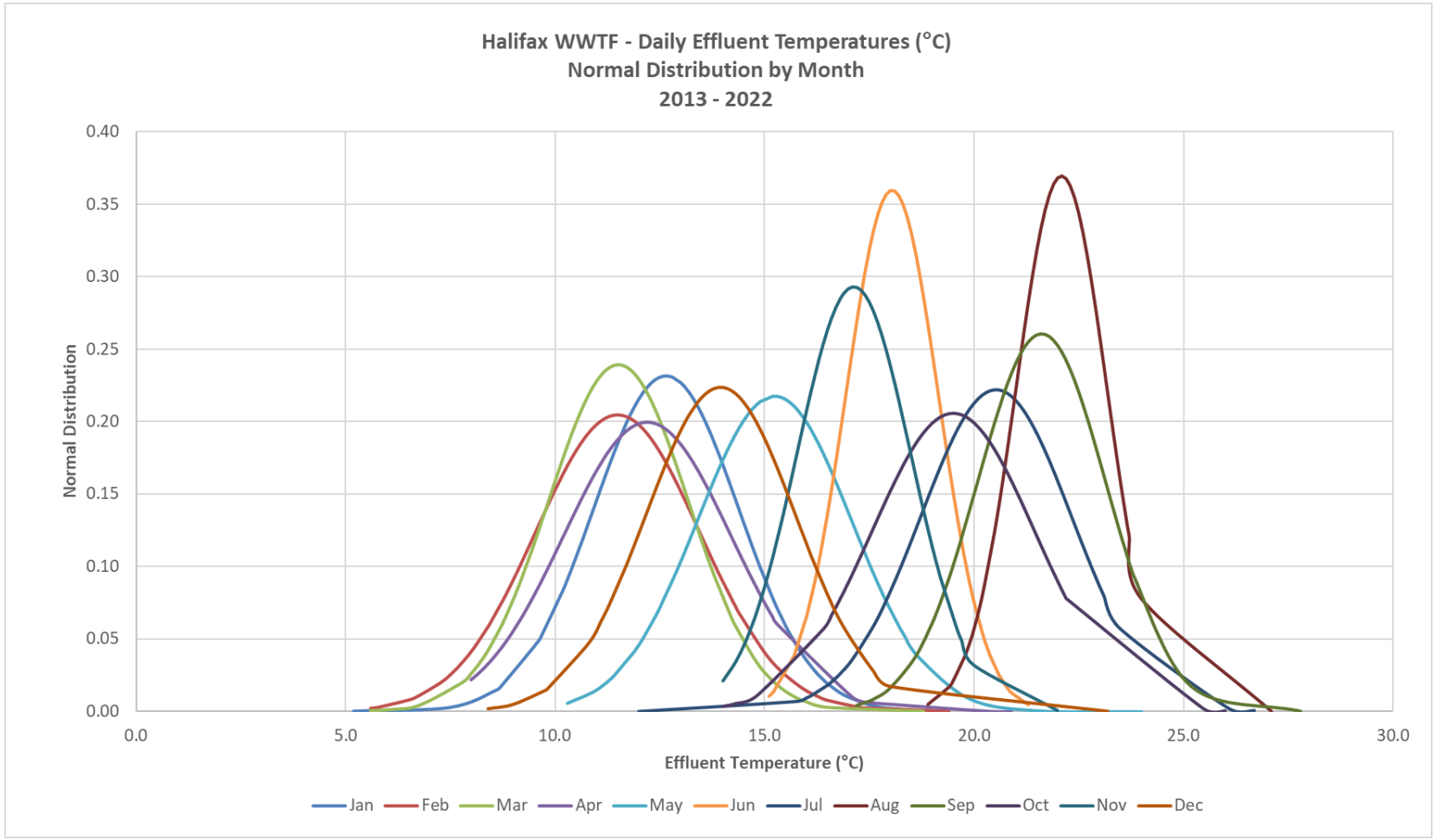
Cogswell District Energy System

Cogswell ATDES

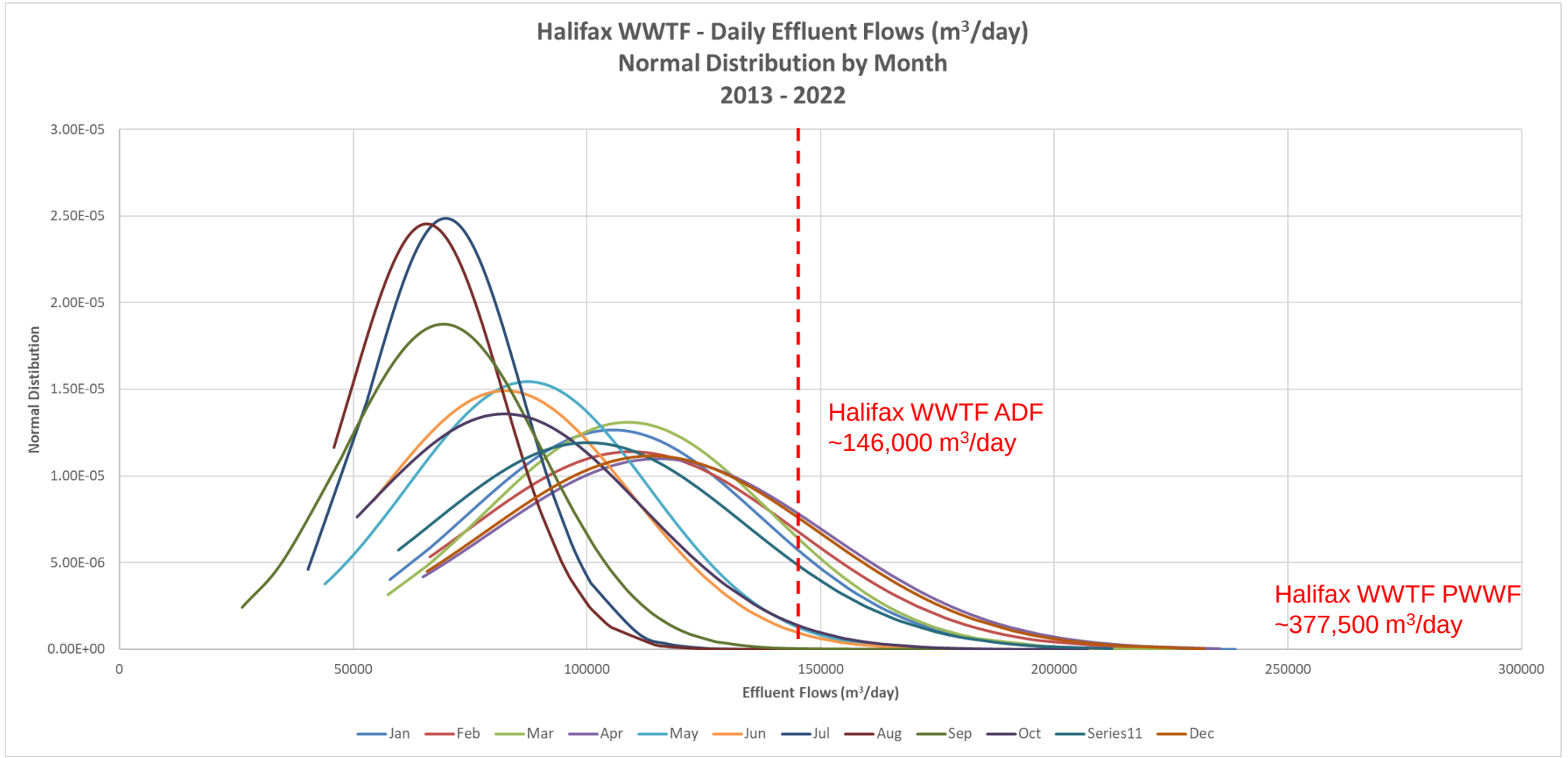
Photo: Marine Gateway DES, Vancouver, BC

Photo: Marine Gateway DES, Vancouver, BC

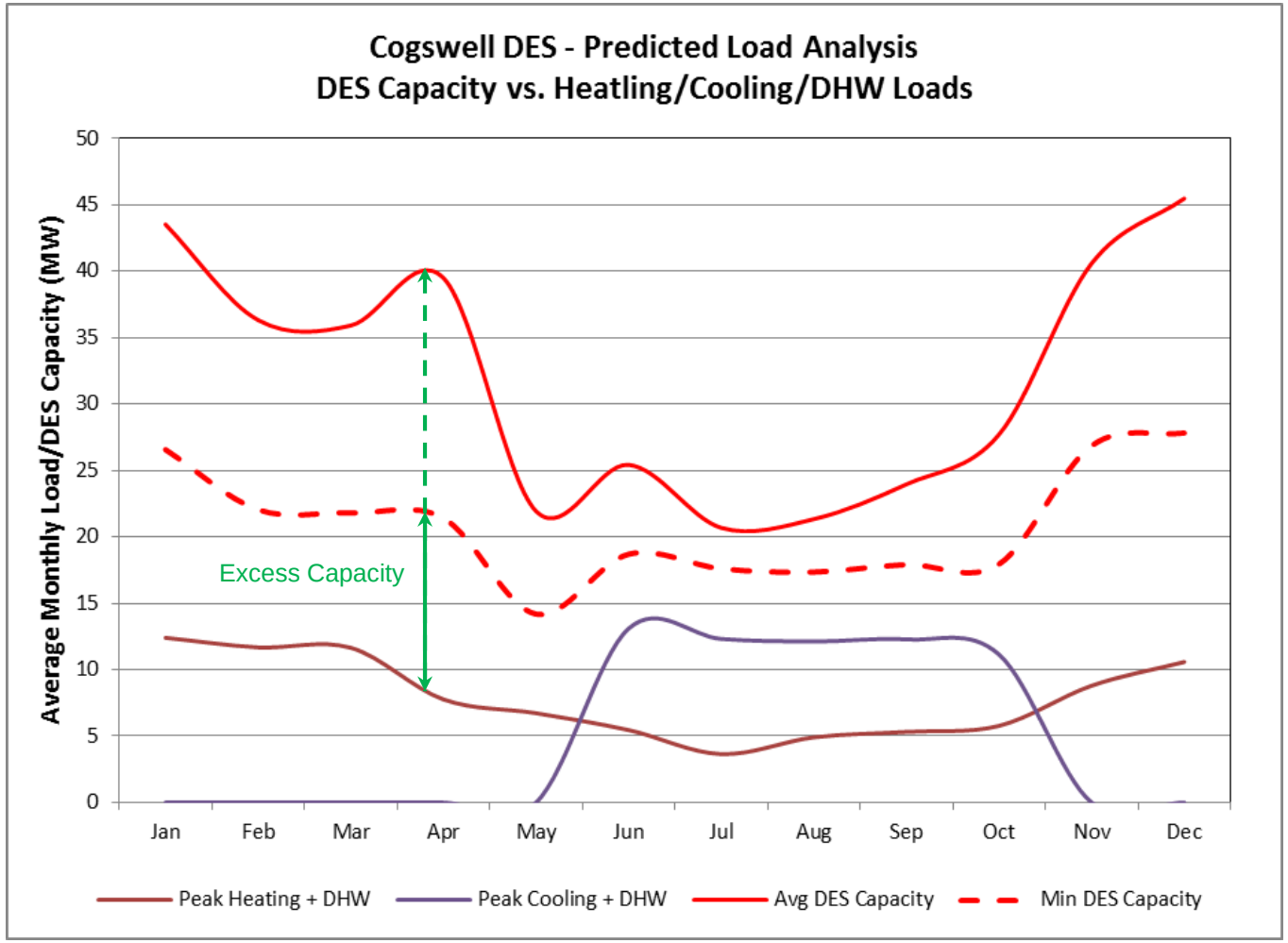
Halifax WWTF Effluent Temperatures



Halifax WWTF Effluent Flows



Halifax WWTF Effluent Heat Capacity



Effluent Temp	Heat Capacity @ Flow	
	2,000 m³/h	3,500 m³/h
14 °C	17 MW	31 MW
12 °C	13 MW	22 MW
10 °C	8 MW	14 MW
8 °C	3 MW	6 MW

Heating Source Energy Comparison

	Electric Baseboard Heating	Air Source Heat Pump Heating	Gas Hydronic Heating (BAU) (4)	Oil Hydronic Heating	WSHP with ATDES
Energy	1 MWh				
Fuel Source	Electricity	Electricity	Natural Gas	Heating Oil	Electricity + Waste Effluent Energy
Efficiency	100%	240%	85%	80%	**420%**
Fuel Use	1.00 MWh Electricity	0.42 MWh Electricity	1.18 MWh Natural Gas	1.25 MWh Heating Oil	**0.24 MWh (Electricity) 0.76 MWh (DES)**
Fuel Rate ($/MWh)	$162.15 (1)	$162.15 (1)	$81.72 (2)	$116.17 (3)	$162.15 (1)
Fuel Cost ($/MWh Delivered Heat)	$162.15	$68.10	$96.42	$145.21	**$38.60**
GHG Emissions (tCO_2e/MWh Delivered Heat)	0.603(6)	0.251	0.212	0.313	**0.144** (5,6)

Notes:

(1) Based on NSPI Rate Class 2 – Domestic, 2022.
(2) Based on average 2022 Heritage Gas Rate 1a @ $22.70/GJ.
(3) Based on #2 Fuel Oil @ $1.25/L.
(4) BAU = Business As Usual.
(5) Does not include GHG emissions from back-up heat source (NG).
(6) Based on NSPI System Total Emission Intensities, 2021.

Cooling Source Energy Comparison

	Air Source Heat Pump	WSHP Loop with Cooling Tower	WSHP with ATDES
Space Cooling	1 MWh		
Fuel Source	Electricity	Electricity	Electricity + Effluent Heat Sink
Energy Efficiency Ratio (EER)	12.5	12.4	**22.0**
Fuel Use	0.27 MWh Electricity	0.28 MWh Heating Oil	**0.16 MWh Electricity + 1.16 MWh DES**
Fuel Rate ($/MWh)	$162.15(1)	$162.15(1)	$162.15(1) (Electricity)
Fuel Cost ($/MWh delivered cooling)	$68.11	$94.48	**$38.60**
Fuel GHG Intensity (tCO_2e/MWh)	0.603(2)	0.603(2)	0.603 (Electricity)(2) 0.013 (DES)
GHG Emissions (tCO_2e/MWh delivered)	0.163	0.169	**0.110**

Notes:
(1) Based on NSPI Rate Class 2 – Domestic, 2022.
(2) Based on NSPI System Total Emission Intensities, 2021.

Cogswell DES Benefits

- Demonstrates environmental leadership
- DE is a proven and reliable technology, with demonstrated cost and environmental benefits
- Excess energy availability near the Cogswell development
- More cost effective + rate stability vs. conventional energy sources
- Halifax Water Ownership Advantages
  - Existing Operating Expertise & Customer Service Systems
  - Lower Cost to Operate
  - Lower Cost to Finance
  - Secure Public Utility
- ATDES's Suitable for Energy Sharing
  - Hot Water Solar
  - Building to Building Heat Sharing
  - Other opportunities …

Progress to Date

- HRWC Act amendments to allow the utility to engage in business activities related to the generation of energy in whole or in part from by-products of its operations
- Through the Province, HRM has completed amendments to its Charter to allow HRM to consider district energy and has enacted by-law D-500 respecting mandatory connection within the Cogswell RDA.
- Application with UARB for approval to form the DES utility, complete the Cost-of-Service model and Rate Design, Utility Regulations, and begin detailed design of the remaining DES components.
- Completed a Canadian municipal DES by-law review.
- Completed 100% detailed design for the linear infrastructure.
- HRM approved the Cogswell RDP in September 2021, and the project is now in the construction phase, including the DPS.
- Completed a draft DES stakeholder information package to be used to promote district energy and specifically the Cogswell DES.
- Received $10,263,267 in funding from the Investing in Canada Infrastructure Program (ICIP) – Green Infrastructure, Climate Change Mitigation stream via the Governments of Canada and Nova Scotia

Cogswell DES – DPS Construction

Next Steps

- Seek direction from UARB on regulatory status and approvals at each stage.
- Complete detailed designs for the Energy Centre, Building Energy Transfer Stations, and the Building Design Specification Guidelines.
- Update and evaluate the business case at each milestone to ensure the business case remains positive.
- Develop the Cost-of-Service Model, establish Rules & Regulations, and develop Rate Structures.
- Construction of the DES DPS in conjunction with Cogswell Redevelopment Project.

Estimated Timelines

- Cogswell RDP – 2025 (1)
- DES Utility Approval (UARB) – Spring 2023 (2)
- DES Construction (Energy Center) – 2024 to 2026 (2)
- 1st Building Constructed – 2025 to 2027 (2)
- 2nd – 6th Buildings Constructed – 2027 to 2035 (3)

Notes:
(1) Based on latest HRM construction schedule.
(2) Assumption.
(3) Assumption based on constructing one building every 2 years.

Questions or Comments?

For Further Information Contact:

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