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Cogswell District Energy Feasibility Study

HRM - Environment & Sustainability Standing Committee (ESSC)

October 6th, 2016

Delivering Quality & Value
For Over 70 Years

District Energy at Halifax Water

- 2010 investigation demonstrated feasibility in Bedford (Mill Cove WWTF) and downtown Halifax (Halifax WWTF)
- 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 system for the Cogswell redevelopment area

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Benefits of District Energy

- Improved Energy Efficiency
- Improved Local Air Quality
- Reduced GHG Emissions
- Environmental Protection
- Energy Resilience & Access
- 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

High vs. Ambient Temperature?

- 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
  - Less DES piping losses – better energy efficiency
  - Individual back-up systems in each building – better security of supply
  - Opportunities for heat recovery and renewable supply
    - Distributed Solar
    - Building Heat Sharing
    - Connected CHP

District Energy Systems – Proven Technology

- Cheakamus Crossing ATDES, Whistler, BC (2010, 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)*
  http://vancouver.ca/home-property-development/southeast-false-creek-neighbourhood-energy-utility.aspx
  http://vancouver.ca/docs/planning/renewable-energy-neighbourhood-utility-factsheet.pdf
- 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
- Ball State University, Muncie, IN (2013, Geo-Exchange)
  http://cms.bsu.edu/about/geothermal
- 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 Applications

** Examples of municipally mandated district energy systems*

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Cogswell DES – Energy from Wastewater

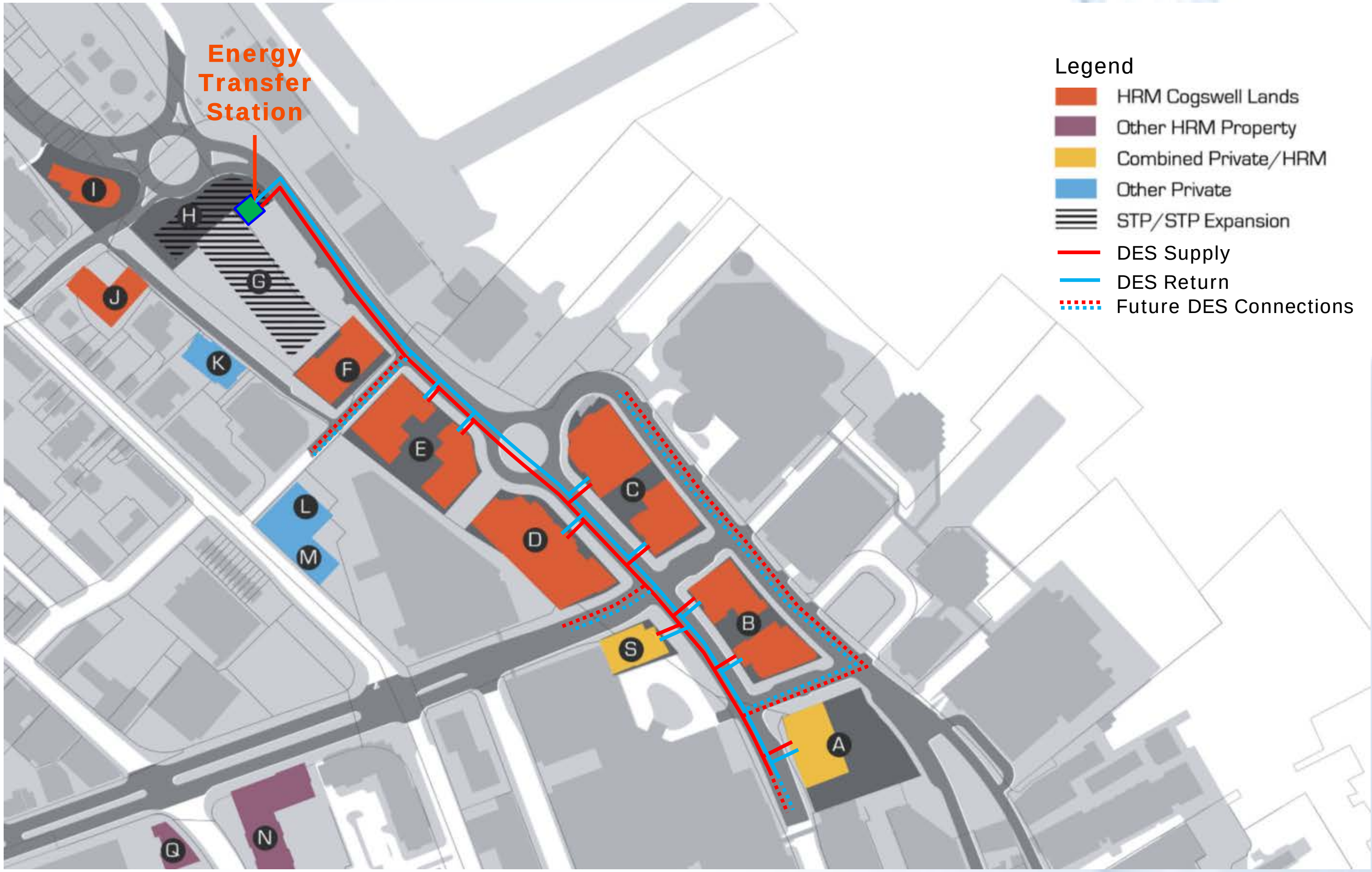

Image Credit: Ekistics Planning & Design

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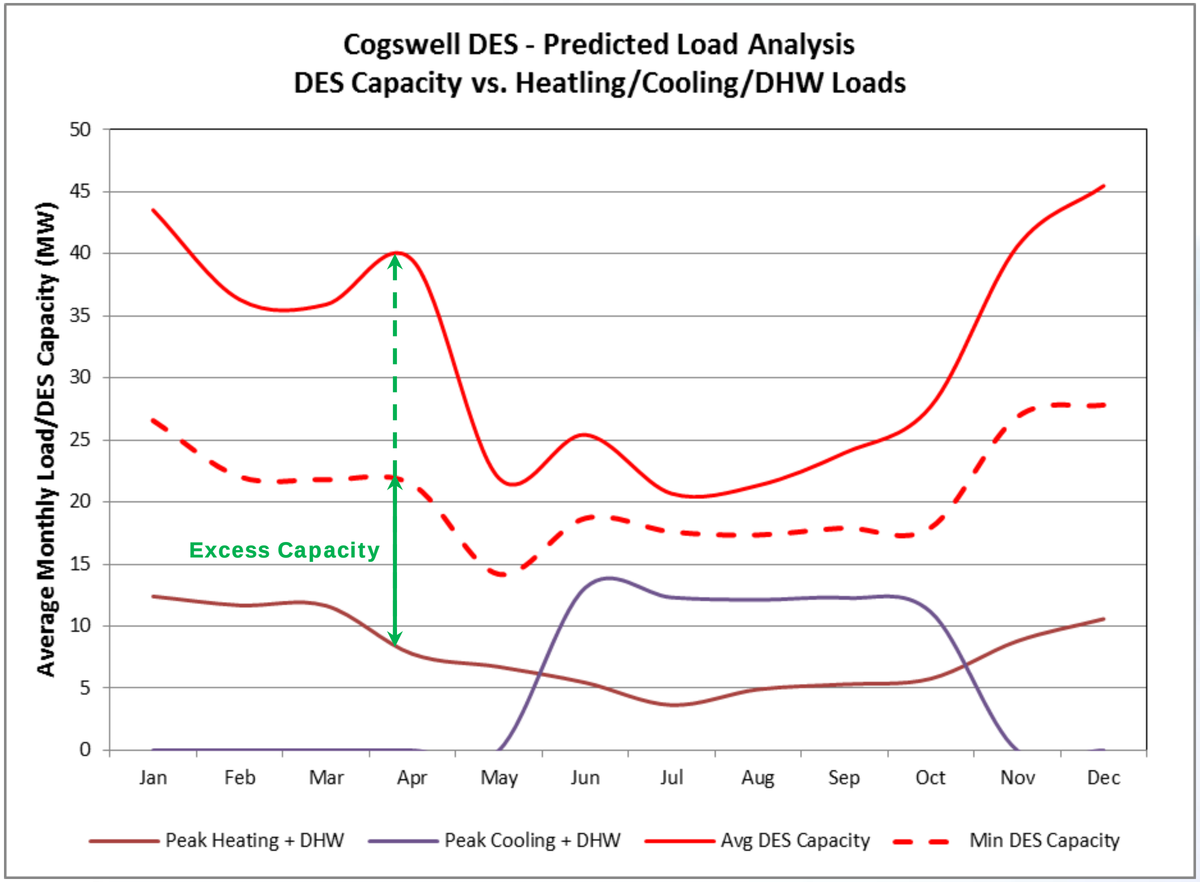
Halifax WWTF Effluent Heat Capacity



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

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Halifax Heating Energy Source Comparison

	Electric Baseboard Heating	Air Source Heat Pump Heating + Cooling	Gas Hydronic Heating (BAU) (4)	Oil Hydronic Heating	ATDES Heating + Cooling
Energy	1 MWh				
Fuel Source	Electricity	Electricity	Natural Gas	Heating Oil	Electricity + DES
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)	$149.54 (1)	$149.54 (1)	$50.40 (2)	$69.70 (3)	$149.54 (1)
Fuel Cost ($/MWh Delivered Heat)	$149.54	$62.81	$59.47	$87.13	**$35.60**
GHG Emissions (tCO_2e/MWh Delivered Heat)	0.652	0.274	0.212	0.313	**0.166 (5)**

Notes:
(1) Based on NSPI Rate Class 2 – Domestic, May 2016.
(2) Based on Heritage Gas, Rate 1 – Residential, May 2016
(3) Based on #2 Fuel Oil @ $0.75/L
(4) BAU = Business As Usual
(5) Does not include GHG emissions from back-up heat source (NG)

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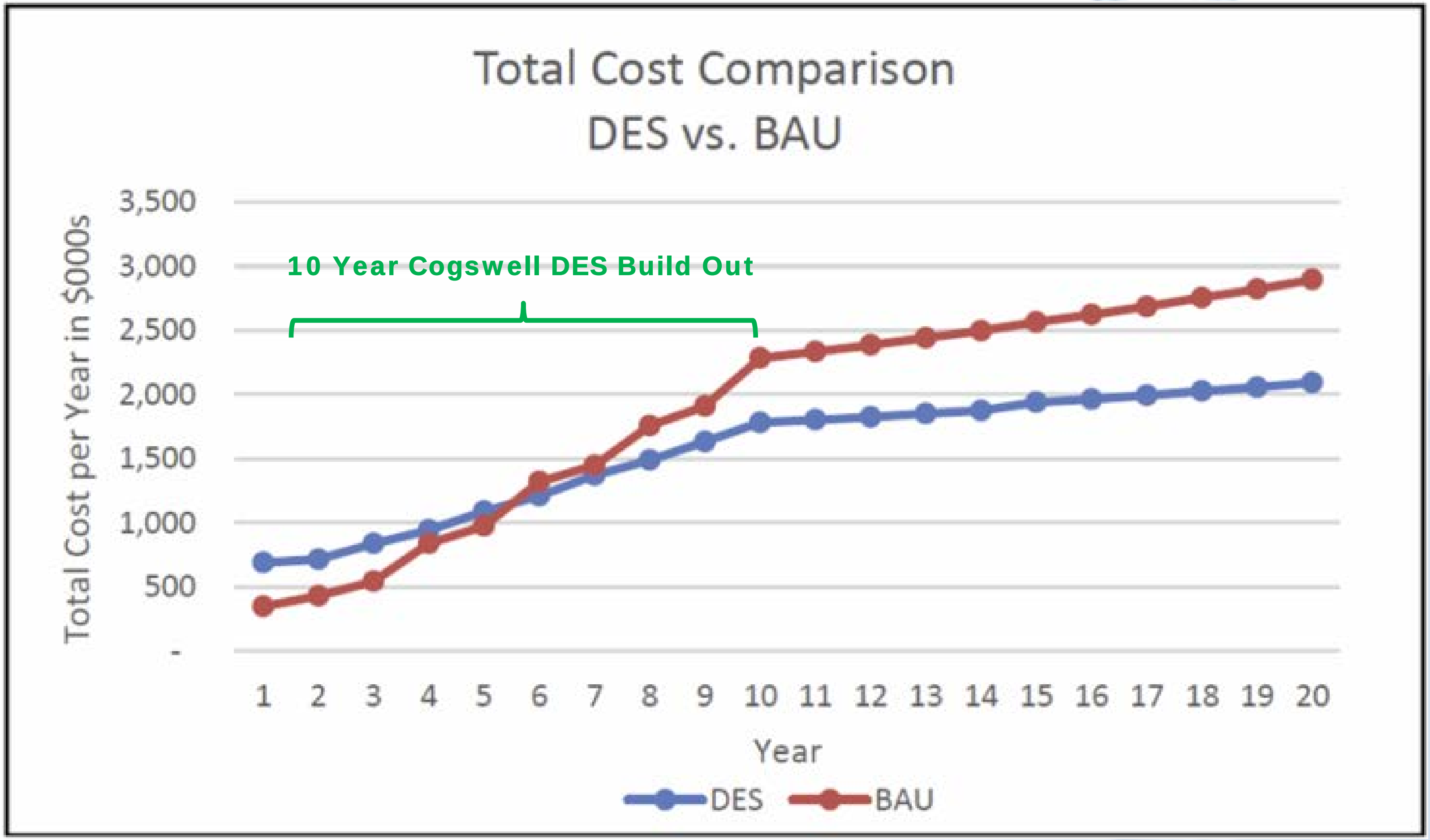
Preliminary Financial Analysis

	DES	BAU
Levelized Rate (1)	$0.079/kWh	$0.092/kWh
Capital Costs (2)	$39,762	$32,696
Present Value (3)	$19.8M	$23.2M
Net Present Value (3)	$2.28M	
Internal Rate of Return (3)	5.7%	

Notes:

(1) Year 1 Levelized Rate – includes energy + capital + operating costs.
(2) Ref. DEC Report (June 2016) – Appendix D, Detailed Capital Cost Estimates.
(3) Ref. DEC Report (June 2016) – Section 7.1, Cost Comparison, for financial assumptions.

Preliminary Financial Analysis



Conclusions

1. Initial analysis shows a positive business case for the Cogswell DES.

2. The Cogswell DES project would demonstrate environmental leadership in the community.

3. Ambient Temperature DES from wastewater heat recovery is a demonstrated and reliable solution.

4. Halifax WWTF effluent has sufficient thermal energy to meet the heating and cooling requirements of the proposed DES loads and much more.

5. The DES can offer the customer thermal energy more cost effectively and with more rate stability compared to conventional natural gas, electricity, or heating oil systems.

Conclusions

6. Halifax Water ownership advantages include:
   - Existing operating expertise;
   - Existing billing and customer service systems;
   - Lower cost of financing;
   - Secure public utility.

7. The proposed DES would likely be considered a "public utility" under the definition of the *Public Utilities Act* and interpretations provided by the Utilities and Review Board.

8. Cogswell DES Business Case depends on mandatory connection to the system within the Cogswell development area. Additional customer connections would improve the energy rate and the business case.

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Next Steps

1. With support from the ESSC, request HRM Council to mandate connections to the DES within the Cogswell re-development area, thus providing the exclusive right to provide thermal energy. Potential methods for mandatory connection include development agreements, restrictive covenants, or municipal by-laws.

2. Complete a preliminary design (including technology and regulatory review) and update the business case. If positive, seek formal approvals and initiate integration into the Cogswell project.

3. Continue to share findings with stakeholders (e.g. HRM, NSDOE, NSUARB, NRCan, QUEST, DND).

4. Investigate the potential for connecting the DES to buildings outside of the Cogswell redevelopment area as a competitive energy source in order to further improve the financial performance of the DES.

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Cogswell Ambient Temperature DES

An Ambient Temperature District Energy System (ATDES) can deliver energy more efficiently and affordably than alternative systems while saving GHG emissions and reducing dependence on fossil fuels.

An ATDES can provide value to Halifax Water, HRM, developers, the customer, and the Cogswell development.

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Thank you!

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