



REPORT
Electrical Utility
Engineering Services Department
Office of the Chief Administrative Officer

To: Mayor J. Coté and Members of Council Date: 11/07/2016

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Subject: Business Case and Next Steps for Sapperton District Energy System

RECOMMENDATION

THAT Council:

- 1. Direct staff to proceed with next steps on project implementation, including the adoption of a building connection bylaw, for a district energy system in the Sapperton and Brunette Industrial Area that is based on a renewable, low-carbon energy source;*
- 2. Endorse Sewer Heat Recovery (SHR) as the energy source for the system;*
- 3. Direct staff to consult with the community and stakeholders on the proposed renewable district heating system and connection bylaw;*

4. *Direct staff to proceed with preliminary design and Class B (+/- 15%) cost estimate to finalize the business case for the system, with a target In-Service Date of June 2019 to coincide with the commissioning of the new RCH energy centre;*
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PURPOSE

The purpose of this report is to update Council on the status of the Sapperton District Energy Work Plan for 2015-2016, present key elements of the business plan for the Sapperton District Energy System, and seek Council's support regarding project next steps to implement this system, with a target in-service date of 2019-2020.

BACKGROUND

Existing Policy

Over the past three years, in conjunction with the redevelopment of the Royal Columbian Hospital, the City has been studying the technical and economic feasibility of a neighbourhood-scale energy system serving the Sapperton area to supply clean, renewable heating at a competitive price to the end user.

City policy supports district energy as a means to significantly reduce greenhouse gas (GHG) emissions, through the introduction of renewable sources of heating for buildings as a long-range investment in sustainable infrastructure. Identifying viable district energy opportunities and establishing a supportive policy and a regulatory framework is strongly supported by the *Envision 2032* sustainability framework and is one of the top implementation priorities from our *Community Energy and Emissions Plan (CEEP)*. With an estimated greenhouse gas reduction of up to 8,600 tonnes annually at full build-out of the system, the Sapperton District Energy System represents a major step forward in achieving emission reduction targets expressed in the *Official Community Plan*. This GHG emission drop is equivalent to removing 1,700 vehicles from our roads each year.

District energy also provides an opportunity for the City's Electrical Utility to diversify its service offering through the provision of renewable thermal energy to future customers. This direction is strongly supported by the Utility Commission Strategic Plan, which sets a goal to embrace opportunities offered by smart micro grids, digital infrastructure and the green economy.

Sapperton District Energy System also supports the sustainability objectives of the IDEA Centre (Innovation, Discovery, Education, and Advancement) by providing "green" infrastructure for the emergence of low-carbon residential and commercial neighbourhoods in Sapperton and the Braid Industrial Area.

Project Evolution

Since 2012, the City of New Westminster has been working in collaboration with Fraser Health Authority and Metro Vancouver Regional District in concept development, a series of technical studies and a Class C (+/- 30%) cost estimate for a neighbourhood-scale, low-carbon district energy system serving the Sapperton area. Work completed to date includes:

- District Energy Feasibility Study (completed April 2013);
- Sensitivity analysis and preliminary concept development (September 2013 to July 2014);
- Joint analytical work in support of Fraser Health Authority's business case for Phase 1 expansion of Royal Columbian Hospital, which includes a new energy centre and mental health facility (September 2015 to May 2016);
- Planning policy, utility governance and regulatory work on the district energy service area, connection bylaw, thermal rate design and rate-setting principles, and finalization of the concept plan, including timing and staging (June 2015 to present).

The above investigations confirmed that a district energy system, with baseload provided by renewable energy, is technically and economically feasible in the Sapperton area. Two renewable energy sources are feasible for this system:

- **Wood Chip (Biomass) Heating**, where clean, urban-source waste wood chips are combusted in high-efficiency boilers to produce hot water heat for buildings; and,

- **Sewer Heat Recovery**, where low-grade energy is recovered from Metro Vancouver's nearby sanitary sewer trunk using electric heat pumps to heat water for distribution to buildings.

The Sapperton Renewable District Energy System would be sized to serve the existing and expanded Royal Columbian Hospital, as well as mixed-use residential and commercial development in the larger Sapperton neighbourhood. The hospital has a large heating requirement that would constitute an anchor load for this system (i.e., representing 41% of total annual thermal demand at full build-out of the district energy service area).

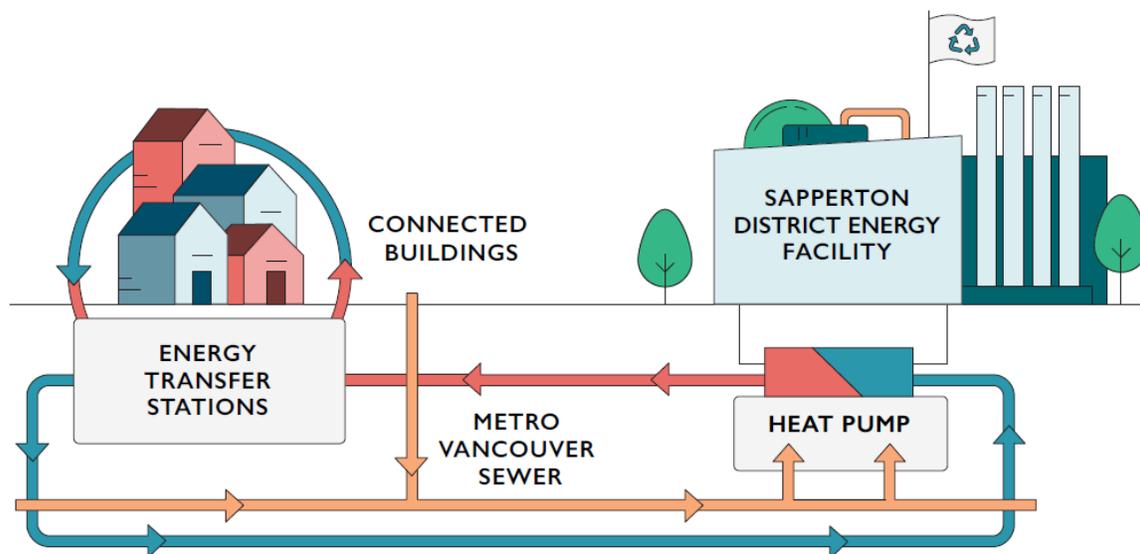
Detailed design on the new RCH heating plant began in September 2015 to develop a finalized performance and equipment specification for district energy integration at the hospital, determine installation timing of distribution piping from the Renewable District Energy Centre to the hospital, and minimum supply temperatures. This technical work is now completed and has been incorporated into the design-build bid documents that Fraser Health Authority has released for tender on Phase 1 hospital expansion, including preliminary design of the proposed new RCH acute care tower in Phase 2 of planned expansion. The City and Fraser Health Authority have aligned timing for delivery of renewable heat to RCH following final commissioning of the Sapperton Renewable District Energy Centre in 2020, approximately one year after construction completion and commissioning of the new heating plant at the hospital.

Progress on the 2015-16 Work Plan

In 2015, Council endorsed the interim work plan and business case development for the Sapperton District Energy System, outlining project tasks to be completed between mid-2015 to mid-2016. The approved work plan included nine components, which have been substantially advanced or completed to date, with the exception being preliminary design engineering of Phase 1 district energy components with a Class B (+/- 15%) cost estimate. This final component of work is proposed be initiated in Spring 2017 to allow for construction of the Renewable District Energy Centre and connection piping in 2018-19 to meet RCH energy centre commissioning deadlines.

In summer 2016, staff sought direction regarding the preferred renewable energy source for the system, with the Electrical Utility Commission indicating Sewage Heat Recovery (SHR) was preferred, with the secondary choice being biomass (wood chip) heating if SHR proved to be unfeasible.

The following illustration provides a conceptual overview of the sewer heat recovery process, which is the preferred technology option, given its proximity to the Metro Vancouver's sewer trunk, and its contribution to the clean technology and innovation objectives in this area of the city.



Updated Sapperton District Energy Concept

Updates have been made to the original Sapperton DES concept as a result of:

1. Joint work with Fraser Health Authority staff and mechanical engineering team in support of RCH Phase 1 expansion and integration of district energy at the new RCH energy centre (September 2015 to present);
2. Thorough review and update of assumed development timing within the Sapperton DES service area, resulting in a revised heating demand forecast at full buildout of the system; and

3. Concurrent technical, policy and regulatory work in support of the Sapperton District Energy business case, including revised capital and operating cost forecasts.

Staff has now developed a timeline for completion of the renewable energy centre to align with the construction schedule for RCH Phase 1 and commissioning of the mechanical components of the RCH energy centre in the second half of 2019.

ANALYSIS

System Heating Load and Cost Analysis

An analysis of forecasted initial and buildout heating loads and costs for the system has been completed. The table below shows capital costs for the sewer heat recovery system.

Component	Capital Cost (\$ million)
Energy Center – Renewable Energy Sources	32.7
Energy Centre – Natural Gas Peaking Boilers	3.4
Land Cost	2.0
Distribution Piping System	9.2
Energy Transfer Stations	5.6
Total	52.9

This Class C (+/- 30%) cost estimate has been upgraded from earlier estimates as a result of a number of refinements, including:

- Changes in the US dollar exchange rate, from near parity in 2013 to \$0.75 CDN for \$1 US in 2016;
- Contingencies increased on capital costs to reflect standard practices;
- Natural gas peaking boilers being added to serve the neighbourhood that were previously assumed to be in the RCH energy centre;
- Land cost contingency being included for the renewable energy centre;
- Increased costs for sewage diversion, screening and pumping to and from Metro's new grit chamber at Sapperton Pump Station; and
- Cost of three energy transfer stations (ETS) within new RCH heating plant.

A full analysis has been completed of the “levelized” cost for energy for all system users, including institutional (e.g., RCH) and non-institutional (i.e., commercial and residential properties) users, which informs the rates that would need to be charged for energy over a 30-year lifecycle to recover project costs and allow for a reasonable rate of return on the City’s investment. Costs include capital, operations and maintenance and fuel costs as well as a contingency fund.

Service Area and Connection Bylaw

An essential component for overall viability and financial success of the system is confidence that the City will be able to connect all forecasted heating loads that have been included in the business case. This includes the existing RCH campus and all expansion phases, as well as new residential and commercial development within the Sapperton DES service area. For district heating systems in BC, the preferred local government regulatory mechanism is a District Energy Connection Bylaw that specifies hydronic (hot water) heating compatibility requirements for buildings over a certain size and within a defined service area.

In November 2015, the City engaged the Integral Group consultants to work with Engineering Services and Development Services staff to:

- Finalize the service area for the Sapperton District Energy System;
- Create a Service Area Bylaw that defines connection requirements, rate schedules, operations and maintenance procedures, and potential application fees; and
- Recommend policies, potential incentives and regulatory mechanisms to ensure the connection of new buildings to the system.

A map of the proposed service provision area for the Sapperton District Energy System is attached as Appendix 1. Note that since a number of buildings have already been completed within the Brewery District, connection to the district energy system is not feasible for current buildings. However, City staff are in discussion with Wesgroup (developer) to explore potential service provision to future buildings within the Brewery District.

As of June 2016, a final draft Service Connection Bylaw and technical design guidelines for DES compatibility has been submitted for review. Staff will be bringing back the finalized Bylaw with implementation recommendations for Council review by end of the year or early 2017.

In the “Most Likely” development scenario, the total floor space within the service area by 2032 is conservatively estimated by staff to be six million square feet, excluding RCH, which is considered to be an adequate load to justify investment in the system. While there is an additional initial cost to making buildings “hydronic ready,” hot water heat is considered to be more even and comfortable than the current electric baseboard heater default. The additional initial capital cost to users would be a consideration in the setting of rates, consistent with draft rate setting principle #5 below.

It may be possible at a later date to connect a number of existing multi-family residential and commercial buildings in the service area, including a number of older apartment buildings that currently use hot water heat, to replace their aging boilers, but it will not be mandatory for these buildings to connect to the system.

Proposed Rate Setting Principles

A study has been undertaken to create draft rate setting principles that are designed to ensure an equitable assignment of system costs while ensuring that there is an adequate revenue stream to finance the system. The proposed principles are:

1. Rates should recover the following City costs:
 - a. In the near term, as mitigated by a Rate Stabilization Fund:
 - i. Direct operating costs associated with the DES;
 - ii. All debt service costs associated with the DES;
 - iii. City administrative overheads that are attributable to the DES; and
 - iv. An appropriate level of compensation for the risks and liabilities assumed by the City associated with the ownership and operation of the DES.
 - b. In the long term, repayment of funds provided through the Rate Stabilization Fund.

2. Revenue generation risks to the City should be minimized by recovering, to the maximum feasible extent, fixed costs in fixed charges and variable costs in energy charges;
3. A Rate Stabilization Fund should be established and used to ensure competitive rates and smooth out annual rate variations in the early years of DES growth;
4. Rates should facilitate use of low-carbon energy sources;
5. Rates should be competitive with full costs of self-generation of heat, including capital amortization, operation and maintenance, and cost burdens otherwise borne by customers related to GHG reduction;
6. Rates should fairly apportion costs among customers;
7. Rates should be understandable to customers;
8. Rates should be set and modified in a transparent manner; and
9. Rates should provide price signals that encourage energy conservation.

In general, rates would be set at a level that would cover all capital and operating costs while creating a reserve fund for contingencies. Rates would be set at or near the cost of conventional (business-as-usual) energy sources.

System Governance

As a utility entirely located within the City of New Westminster, the DES would not be subject to regulation by the BC Utilities Commission. It is proposed that it would instead be regulated in a manner similar to the existing Electrical Utility which is governed by the Utilities Commission. This model has been successful for the City in the past and will provide a smooth transition to a future fiscal management system.

Fraser Health Authority Timelines

The Fraser Health Authority has advised the City that they require technical details of the DES' energy centre by the end of year in order to ensure that their energy centre equipment is compatible with the City's system. As FHA intends to commission the new energy centre for the hospital campus in June 2019, the City will need to begin detailed design for the system in early 2017 in order to meet this system commissioning deadline. Before the City commits significant additional

funding for engineering design and project management, estimated to be 15% of the total project cost, or approximately \$5 million, a thermal energy purchase agreement (a “Definitive Agreement”) will need to be in place no later than April 2017 to allow detailed design and construction to proceed.

Community Consultation and Next Steps

The City has previously conducted extensive consultation with project stakeholders, including the Fraser Health Authority and major developers as well as the community, including the McBride Sapperton Residents Association. Community Open Houses were also held in 2013 and 2014 to increase awareness of the project in the community and identify local issues to be addressed. Public consultation by Fraser Health regarding the redevelopment of RCH in 2015 has also included information on the proposed district energy system.

In order to meet the timelines required for decision making and implementation of the system while ensuring appropriate consultation, the proposed next steps are:

- Initiate a second round of open houses and consultation with local businesses and the development community in late 2016 and early 2017 on the proposed service area connection bylaw;
- Work with the Electric Utility Commission to finalize the business plan in February/March 2017;
- Present the detailed business plan that will be used as the basis for negotiating an energy purchase agreement with Fraser Health for review by Council in March/April 2017
- Conclude an energy purchase agreement with Fraser Health in Q2 2017;
- Initiate detailed system design and procurement in Q2 2017;
- Project construction 2018 – 2019; and
- System commissioning end of 2019 and/or start of 2020.

FINANCIAL IMPACT

Feasibility and engineering studies to date have cost approximately \$400,000 from Electrical Utility funds. The estimated 30-year lifecycle cost of implementing the

proposed SHR system is approximately \$52 million. These costs would be recovered through connection and energy charges to the utility's customers.

The financial analysis in the final business case to be presented to Council in 2017 will include, for the full lifecycle of the system, the timing of the:

- Major project milestones;
- Capital and operating expenditures;
- Connected institutional and non-institutional floor space;
- Cumulative debt load; and
- Revenue stream and cumulative return on investment.

SUSTAINABILITY CONSIDERATIONS

From a strategic and long-range perspective, the City of New Westminster is interested in renewable district energy as a way to help 'future proof' our community, leaving it in better shape to handle a changing global climate, but to also support multiple objectives associated with creating a more robust, sustainable and diversified economy. At full build-out of the service area (estimated at 2032), Sapperton District Energy System will reduce greenhouse gas emissions by 8,600 tonnes per year. This represents a significant step towards achieving the GHG emission reduction target in our Official Community Plan, thus helping to meet our climate change objectives.

The Sapperton District Energy System also supports the sustainability objectives embedded within a City-led economic development strategy called the IDEA Centre (Innovation, Discovery, Education and Advancement), centred on the Royal Columbian Hospital, by providing green infrastructure that supports the emergence of a low-carbon innovation district in the Sapperton neighbourhood and adjacent Brunette Industrial Area (the location of the planned Renewable District Energy Centre).

OPTIONS

Five options are presented for Council's consideration:

1. *Direct staff to proceed with next steps on project implementation, including the adoption of a building connection bylaw, for a district energy system in the Sapperton and Brunette Industrial Area that is based on a renewable, low-carbon energy source;*
2. *Endorse Sewer Heat Recovery (SHR) as the energy source for the system;*
3. *Direct staff to consult with the community and stakeholders on the proposed renewable district heating system and connection bylaw;*
4. *Direct staff to proceed with preliminary design and Class B (+/- 15%) cost estimate to finalize the business case for the system, with a target In-Service Date of June 2019 to coincide with the commissioning of the new RCH energy centre; or*
5. *Provide staff with other direction.*

Staff recommends Options 1 through 4.

CONCLUSION

District Energy has been identified in the City's Community Energy and Emissions Plan as an initiative that would result in significant reductions in Greenhouse Gas emissions with minimal environmental impacts. District Energy would use a renewable energy source and buffer system users from anticipated future increases in conventional energy costs.

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Approved for Presentation to Council

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Attachment 1

Proposed Service Area for Sapperton District Energy System