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CORPORATE REPORT

NO: R013 COUNCIL DATE: January 24, 2011

REGULAR COUNCIL

TO:	**Mayor & Council**	DATE:	**January 20, 2011**
FROM:	**General Manager, Engineering**	FILE:	**0970-11**
SUBJECT:	**District Energy System – City Centre Area**		

RECOMMENDATION

The Engineering Department recommends that Council:

1. Receive this report as information; and

2. Authorize staff to establish a District Energy Utility as generally described in this report for the purpose of designing, constructing and operating a district heating system in the Surrey City Centre.

INTENT

The purpose of this report is to provide information to Council regarding district energy (DE) systems and to obtain Council approval to establish a district energy authority for City Centre that will be responsible for the implementation and operation of a district energy system in the City Centre area.

BACKGROUND

The term 'district energy system' refers to the process of distributing thermal energy for heating and cooling of interior spaces and/or to provide domestic hot water to buildings in a discrete geographical district using a central heating/cooling source and a closed-loop pipe configuration with a carrier fluid to transfer heat energy between locations.

DE systems reduce the need for individual furnaces and boilers in each building and boast significant energy efficiency improvements over conventional methods of heating and cooling individual buildings. They also have the advantage of being able to use a wide range of energy sources. DE systems are best suited to implementation in dense urban areas with a diverse mix of land uses.

Although this technology has been available and in use for over a century, system efficiency improvements, rising energy costs, and demand for clean energy have led to the re-emergence of district energy systems in North America. In an urban setting, a DE system can capitalize on the diversity of energy customers and diversity of energy sources with the end product being a

reduction in overall energy consumption, increased reliability and reduced GHG emissions. Waste heat from high energy users, such as ice rinks, pools and industrial processes, can be recaptured and easily redistributed to other users in the system.

District Energy in City Centre

During is Regular meeting on May 17, 2010 Council considered Corporate Report R109; 2010, a copy of which is attached as Appendix I, that noted that a DE system could help the City meet the commitments set forth in the Surrey Economic Investment Action Plan and the Surrey Sustainability Charter with respect to energy security, energy efficiency, waste reduction and economic development.

Staff has recently completed a City Centre District Energy Strategy that confirmed with the expected land uses, densities and resultant energy demands of future buildings, that a DE system is viable. Further, when compared to the conventional approach, a DE system has the potential to reduce GHG emissions, increase energy security, stimulate local economic development, provide competitive energy pricing and increase public awareness around the sustainable use of energy.

Building on the work of this study, staff has initiated two additional studies. One such study is focused on investigating how best to establish a DE system in the vicinity of the Surrey Central node that includes the new City Centre Library and the new City Hall and the second study will assist in establishing how best to encourage the implementation of hydronic heating systems in typical high rise multi-unit residential buildings so as to allow such buildings to be in a position to connect to the DE system.

DISCUSSION

The City Centre District Energy Strategy report identified three separate locations in City Centre where a DE system could be implemented; these being in the vicinity of each of the Gateway, Surrey Central and King George SkyTrain stations, as illustrated in the map attached as Appendix II. These anchor locations will form the initial nodes, or "islands" from which DE service areas can expand over time.

Staff has engaged a Swedish consulting firm with extensive experience in DE system development and municipal energy utilities to lead a separate DE feasibility study for the Campbell Heights and Grandview Heights areas. Experience from Sweden shows that most DE systems start out as small DE networks in areas where further high density development is expected. These small-scale systems reinforce the efficacy of the DE system and can be expanded as demand increases in conjunction with new development in the same area.

Surrey Central Node

With the construction of the City Centre Library well underway and the construction of the new City Hall expected to commence in the next few weeks both of which are located in the Surrey Central node, analysis for the development of a DE system in this node is well underway. A conceptual design of a DE system that will connect the new City Hall and Library with a central energy distribution facility is being completed with the capability to be expanded to allow other new buildings in the same area to be connected in the future.

Analysis of the energy supply options for this system favour ground source heat exchange (GHX) as the primary supply for serving the heating and cooling demands. Site specific geological testing was completed in December 2010 to establish the maximum capacity of the geothermal energy source and preferred system design.

A GHX system taps into the thermal energy that is stored in the ground at a relatively constant temperature throughout the year. Water, or some combination of water and refrigerant, is circulated deep into the ground through a network of vertical pipe loops. Using heat pumps, the thermal energy collected in the vertical pipe loops is extracted and converted to a useable temperature for space heating and/or domestic hot water use in the buildings. The heat pumps and vertical pipe loops are capable of operating in reverse to provide space cooling in the summer months with the added benefit of providing seasonal temperature stability to the GHX field.

Conventional heating and cooling systems for a building such as the new City Hall would typically consist of a series of natural gas fired boilers and cooling towers. The proposed GHX system will dramatically reduce natural gas consumption, resulting in significant reductions in GHG emissions and also significant energy cost savings. The heat pumps used in GHX systems are typically around 400% efficient. This means that the amount of electricity required to provide thermal energy in comparison to conventional systems is reduced by a factor of 4. This will provide significant savings over time.

System expansion and future energy sources are also being reviewed and will include a range of options based on specific energy sources available in the area and projected build-out scenarios.

King George and Gateway Nodes

Current and forthcoming developments near the King George node indicate the need for a prompt assessment of DE system potential at this node before an opportunity is lost in relation to new high density development. Staff has initiated a DE feasibility study for the area around the King George SkyTrain station. Specific developments of interests in this area are the new RCMP "E" Division Headquarters, the Surrey Memorial Hospital expansion and re-development project as well as high density residential development projects on the properties adjacent to the King George SkyTrain station and along King George Boulevard in the area. Based on discussions with stakeholders involved in each of these projects, they have indicated a general interest in a DE system and a willingness to collaborate with the City.

There is likely similar potential around the Gateway node based on forecasted development for that area. Staff will monitor development activity in that area and proceed with a study of a DE system following completion of the Surrey Central and King George studies.

District Energy Utility

As energy management is a relatively new concept for the City, careful study is required to ensure that the establishment of the City's first DE system is successful. Governance and regulatory models of DE utilities vary across jurisdictions. Arrangements vary from being 100% municipal ownership and operation to 100% private sector ownership and operation and include a variety of hybrids between these two extremes. Utilities in the cities of Vancouver, North Vancouver and Victoria provide various local examples of DE governance and regulation models that span the full

spectrum of possibilities. The following table documents the unique characteristics and potential benefits of each of these models.

Table 1 – Governance and Regulatory Characteristics of Local DE Utilities

CITY	VANCOUVER	NORTH VANCOUVER	VICTORIA
Service Area	*South East False Creek*	*Lower Lonsdale Area*	*Dockside Green Development*
Connected Floor Area	6,266,000 sq.ft [1]	600,000 sq.ft.	1,300,000 sq.ft.
Capital Expendiatures[2]	$43.2M	$8M	$20M
Governance Model	Municipal ownership and operation	Municipal ownership, private sector operation	Private sector ownership and operation
Regulatory Framework	City retains full regulatory control	Energy rates set by the City Municipal oversight of operations	Utility regulated by the BC Utilities Commission
Funding Implications	Eligible for government grants and low-interest loans	Eligible for government grants and low-interest loans	Private Sector responsible for full costs. Higher ROI required
Management of Utility	Utility fully managed by City staff	Private sector management with local government oversight	Utility fully managed by private sector
Policy Tools Utilized	Connection mandated by service area by-law	Connection mandated by service area by-law	Connection mandated through Master Development Agreement
			Property tax exemption through "Green Power Facility Bylaw"
Partnerships	No partners	City, Terasen/ Corix	City, Windmill, VanCity, Corix, and Terasen

[1] Projected developed floor area at build out.

[2] Including capital grants

With the establishment of a DE utility, there are two key decisions that need to be made; firstly with respect to the ownership of the DE system and, secondly, its operational structure. At this time, staff is of the view that to best meet the City's sustainability and economic development goals, municipal ownership of the DE utility is preferred over private sector ownership. The following table highlights some of the key considerations in the selection of an ownership model between city ownership and private sector ownership. It should be noted that there are many possible hybrid ownership models that could be explored moving forward and the recommendation to proceed under municipal ownership does not rule out any of these hybrids in the future.

Table 2 – Comparison of Public and Private Ownership Models

Ownership Model	City	Private Sector
Financing	100% debt financing, low cost of capital, lower required ROI	50% equity financing likely required, higher required ROI, subject to income tax and risk premiums
Regulation	Self regulated	Subject to BC Utilities Commission regulation
Expertise	New staff would likely be required for management of the utility and operation of energy generating facilities	Private sector provides required expertise
Access to funding	Grants and low interest loans from other orders of government	N/A

A DE utility is able to make long-term investments in renewable energy alternatives that might not be economically viable on systems that only serve one building. Investments made by a City-owned entity have the added ability to be 100% financed using the City's long-term borrowing rate, which is typically lower than rates that private sector partners can achieve. A private utility would need to put up some equity financing and therefore would require a higher return on investment including premiums for the higher cost borrowing, risk and the payment of income tax.

As a regulator of land-use and development, the City has control over the form and scale of development in City Centre, both of which have a direct impact on the viability of a DE system. A City-owned utility has the ability to capitalize on synergies with other traditional municipal utilities (i.e., water, sewer, waste management) with respect to timing of infrastructure improvements and sharing of resources.

A municipally owned utility has the potential to provide a long-term source of revenue for the City and greater flexibility in terms of control when compared to a private utility. Significant potential exists for capital grants and low-interest loans to municipalities from senior levels of government for the implementation of DE systems. The City of North Vancouver received $4 million in grant & loan funding from the Federation of Canadian Municipalities (FCM) and the City of Vancouver received an $8.5 million grant from the Union of BC Municipalities and a $5 million loan from the FCM for their respective DE systems.

Private utilities in this province are regulated by the BC Utilities Commission (BCUC) and are required to obtain approval for the establishment of customer rates as well as expansion or replacement of capital infrastructure, service extensions, and any disposal or transfer of assets. Provided that it does not cross municipal boundaries, a City-owned utility is self-regulated, providing greater flexibility to the City than would be available to the private sector.

The decision to establish a DE utility as a municipal entity does not preclude future private sector involvement as the City establishes the different components required of the DE system. By retaining ownership over the utility, the City preserves the flexibility to transfer any part of the DE system to the private sector if this emerges as a preferable arrangement in the future. The reverse would not likely be possible. Based on this assessment, staff is proposing that the City proceed with the establishment of a DE utility under municipal ownership.

Ensuring Connection of Future Customers

Buildings must be designed to be hydronicly heated (heated with a distributed hot water system) to be connectable to a DE system. For most commercial and institutional buildings, this is the norm. However, this is not the convention for high-rise residential development in BC where electric baseboard heaters are typically installed for heating of individual units. This is due to the lower capital cost of such an installation and the short-term return on investment that is typically the focus of the developers of such buildings. Electric baseboard heaters are inefficient employing a high-grade form of energy (electricity) to produce a low-grade energy output (heat). Installation of hydronic systems has been mandated in some jurisdictions in all new construction to ensure compatibility with existing or future DE systems.

Staff has initiated a study to quantify the cost premium of hydronic heating systems in high rise residential buildings with a view to providing both the City and the development industry with

accurate and up-to-date information regarding the cost implications of DE to projects. This information will guide staff in developing a strategy to encourage the construction of projects that are connectable to DE systems.

Funding

Funding for the Surrey Central Feasibility Study has been secured from B.C. Hydro, through the Sustainable Communities Program, and from the Federation of Canadian Municipalities, through the Green Municipal Fund, who will contribute 50% and 40% of total consulting fees, respectively.

It is expected that future funding opportunities will be available for capital infrastructure on a similar scale to those received by the other local municipalities referenced previously in this report. Staff will continue to pursue additional funding from a variety of sources including FCM, UBCM, BC Hydro, etc., in support of the design and construction of DE infrastructure.

Partnerships

The City has recently engaged in a partnership with Powertech Labs Inc., Simon Fraser University Surrey and BC Hydro, intended to support various sustainability and clean energy demonstration projects throughout the City. Of relevance to the development of DE in City Centre is a potential project focusing on a biomass-fuelled combined heat and power (CHP) facility that could supply heat to a DE system and produce electricity to be sold back to BC Hydro. This partnership is viewed as a valuable collective of expertise and investment in the area that could help advance DE objectives in City Centre.

As specific energy technologies to supply future phases of the DE system are selected, new partnerships may become advantageous. The partners will vary depending on the type and scale of energy systems that are used. While analysis is ongoing to determine the future configuration of the City Centre DE system, staff will continue to keep options open with regard to future partnerships.

DE Opportunities Outside of City Centre

Staff is also investigating the potential for a DE system in the Grandview Heights and Campbell Heights NCP areas. Campbell Heights has large energy demands from industrial customers and significant potential for utilization of waste heat. The nearby Grandview Heights NCP areas are expected to receive a large amount of medium and high density residential development in the near future. This mix of land uses and diversity of energy demand presents a favourable context for establishment of a DE system.

As new NCP plans are prepared, staff will consider ways to incorporate energy planning into the completed plans.

Next Steps

Given the time sensitivity of the City Hall and Library projects, the schedule for implementation of the initial DE system connecting these two facilities has been accelerated. The long-term analysis of DE feasibility in the Central City area will also be detailed in the Feasibility Study

Report. This will address the feasibility of a range of sources of local renewable energy supply and the ability of each to service the projected energy demands from the area. Consideration will also be given to the potential DE expansion scenarios and the eventual connection with the King George and Gateway nodes.

Subject to Council approval, staff will proceed with the development of a DE utility under municipal ownership. Further analysis will be conducted as to the optimal operating structure to best achieve the City's sustainability and economic development goals for the City Centre area.

The Engineering Department will complete the following tasks toward the implementation of a DE strategy for City Centre:

- Complete a DE feasibility study focused on the King George node;
- Further engage with construction and design teams for the RCMP 'E' Division Headquarters, Surrey Memorial Hospital, Concord Pacific Park Place development and other developers with projects in the City Centre area to assess the potential for connection of these other developments to a DE system;
- Undertake further planning to develop and refine a specific district energy system for the Gateway service area;
- Work with the Development Advisory Committee to address the obstacles (real and perceived) in relation to implementing a district energy system in the City Centre area;
- Develop a strategy to ensure that new developments in the area incorporate heating and hot water systems that are compatible with DE including investigation of a by-law that would provide incentives to developers to incorporate DE compatible systems;
- Research the existing market for biomass feedstock to be used for both small-scale combustion or gasification facilities and large-scale combined heat and power (CHP) facilities as potential sources of heat and electricity to be integrated with future DE system expansion; and
- Pursue further funding opportunities from the Provincial and Federal Governments, through the BC Hydro PowerSmart Program and from the Federation of Canadian Municipalities' Green Municipal Fund for design and construction of DE infrastructure.

Further reports complete with recommendations will be forwarded to Council as development of the City Centre DE system advances.

SUSTAINABILITY CONSIDERATIONS

The implementation of a District Energy System in the City Centre will support the Economic and Environmental Pillars of the City's Sustainability Charter under the following specific elements of the Charter:

- EC8: Energy Security: by promoting the use of low-impact, renewable energy sources and promoting community energy solutions;
- EN1: Energy Efficiency: by incorporating alternative energy systems such as geo-exchange and solar heating systems for City facilities;
- EN2: Waste Reduction: by potentially introducing waste to energy conversion opportunities;
- EN10: Integrated Community Energy Master Plans: by developing an Integrated Community Energy Master Plan for the City Centre and by working with private property

owners to promote upgrades and retrofits that increase building energy efficiency such as through the connection to a district energy system; and

- EC8: Increase Energy Security: by the provision of a district energy system that is potentially fuelled from a sustainable fuel source such as waste.

CONCLUSION

Based on the above discussion, it is recommended that Council authorize staff to establish a District Energy Utility as generally described in this report for the purpose of designing, constructing and operating a district heating system in the Surrey City Centre.

Further reports complete with recommendations will be forwarded to Council as the process of design, development of a financial strategy, development of an operating strategy, tendering and construction and other matters related to the implementation of a DE system in the City Centre area continue.

Vincent Lalonde, P.Eng.
General Manager, Engineering

VL/JO/brb

Appendix I - Corporate Report R109; 2010
Appendix II - City Centre District Energy Nodes

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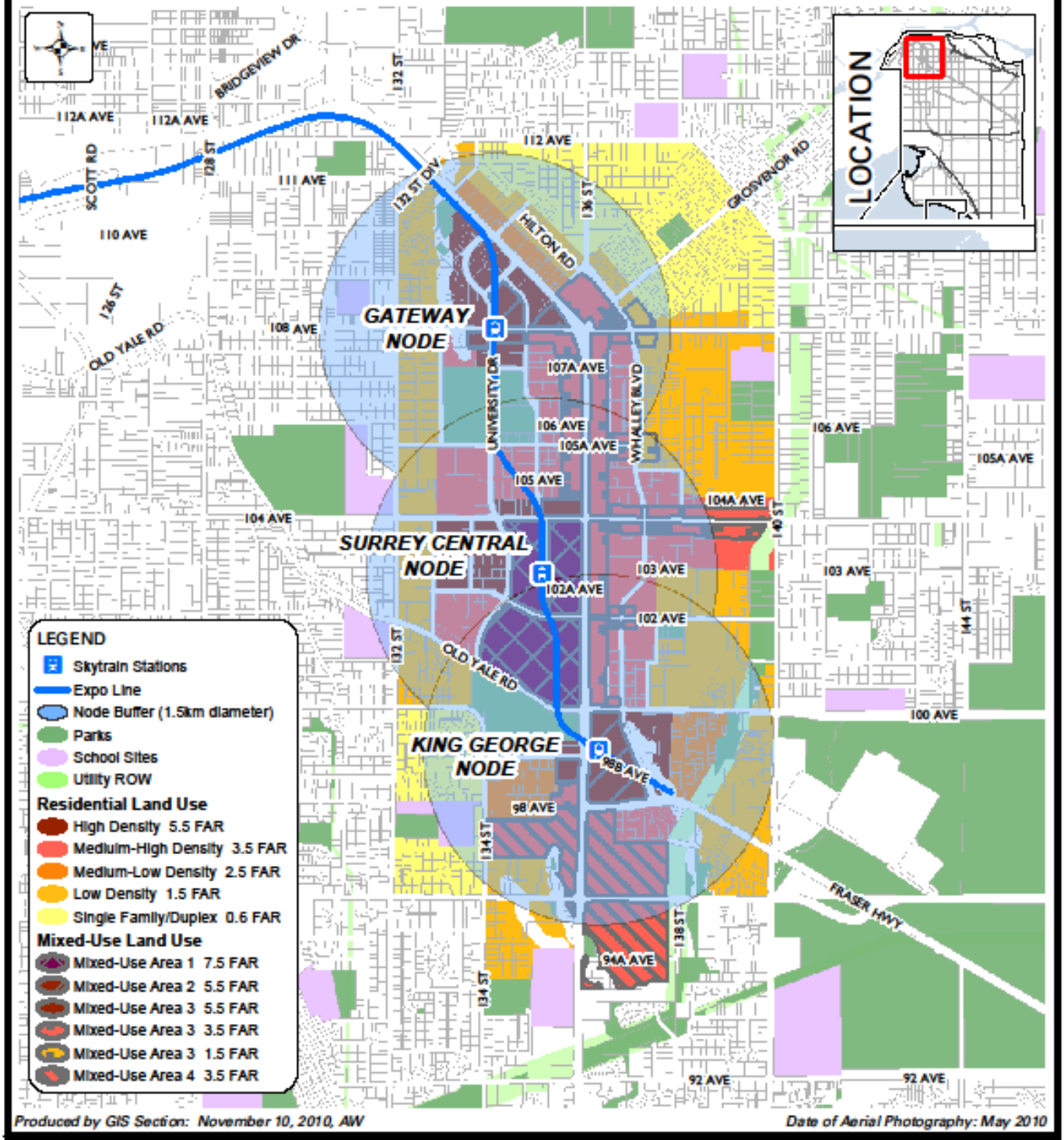
APPENDIX II



Produced by GIS Section: November 10, 2010, AW

Date of Aerial Photography: May 2010

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CITY CENTRE DISTRICT ENGERGY NODES

ENGINEERING DEPARTMENT

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