

NO: R154

COUNCIL DATE: July 27, 2009

REGULAR COUNCIL

TO: **Mayor & Council** DATE: **July 27, 2009**
FROM: **General Manager, Planning and Development** FILE: **5280-11**
SUBJECT: **Semiahmoo Town Centre Integrated Energy Master Plan Study – Phase I Results**

RECOMMENDATION

The Planning and Development Department recommends that Council:

1. Receive this report as information; and
2. Direct staff to utilize the findings of the study related to Phase 1 of the Integrated Community Energy Master Plan for the Semiahmoo Town Centre, in the development of policies and plans, including the Official Community Plan ("OCP"), the City Centre Plan Update and town centre plans and the design guidelines and utility servicing strategies associated with these plans.

INTENT

The purpose of this report is to:

- Advise Council of the results of Phase 1 of the Integrated Community Energy Master Plan for the Semiahmoo Town Centre (the "Study"), which focused on the proposed redevelopment of the Semiahmoo Mall site; and
- Report on the lessons learned from this Study that can be applied to future plans and development within the City to save energy and reduce greenhouse gases (GHGs).

POLICY CONSIDERATIONS

Significant reductions in GHG emissions related to the use of fossil fuels, by promoting compact land use patterns, energy efficient buildings, and transit use, are essential to:

- Support Surrey's Sustainability Charter's policies on Energy and Climate Protection;
- Meet commitments made under the BC Climate Action Charter, to which the City is a signatory; and

- Address provincial Green Communities legislation (Bill 27) requirements related to setting and meeting GHG targets for the City and establishing in the OCP policies for reducing GHGs.

The City is committed to making Surrey a "complete community," which offers a wide range of business opportunities, local employment, housing choices, convenient services, and viable alternatives to the use of private automobiles for transportation. The planning and building of a complete community also includes consideration of safety, a people-friendly built environment, and energy demand/supply issues. These policy directions were addressed in the Semiahmoo Town Centre Plan concept, adopted by Council in September 2006.

The City's Sustainability Charter and OCP both support energy efficiency, the use of alternative energy, community energy planning and the exploration of district energy systems within the City's urban centres. The Semiahmoo Town Centre Plan process supports these sustainability directions and identifies the potential of district energy systems for reducing energy consumption and incorporating low-impact energy sources.

BACKGROUND

On September 25, 2006, Council considered Corporate Report No. Co18 – "Stage 1 Land Use Component of the Updated Semiahmoo Town Centre Plan". The Stage 2 component of the Plan, currently underway, includes the development of sustainability guidelines. The Plan's land use concept supports a number of sustainability principles. These features include compactness, a higher density and mix of land uses, walkability and transit orientation. The City is developing a "Made in Surrey" Sustainable Development Checklist as one of the Immediate Actions currently underway in support of the Sustainability Charter.

Throughout 2007, the City worked on a number of programs and studies with the Provincial Ministry of Energy, Mines and Petroleum Resources, the Community Energy Association, Geoexchange BC and the major utilities, including Terasen and BC Hydro, to promote energy efficiency and the use of alternative energy sources. One of these studies, a Community Energy Plan for City Centre, recommended the promotion of buildings with high-energy efficiency. The potential benefits of district energy systems that could operate with a variety of alternative fuel sources were also identified in this plan.

BC Hydro subsequently approached the City, in the context of their community sustainability initiatives, to use Surrey as one of three pilot communities in the Province to create an Integrated Energy Master Plan. The proposed redevelopment of the Semiahmoo Mall, the largest single property in the Semiahmoo Town Centre planning area, was identified as having the appropriate scale and urban form for an energy master plan pilot project. City staff discussed the proposal with Bosa Development Corporation, the owner of the Semiahmoo Mall, who agreed to participate as a stakeholder in the study.

On December 17, 2007, Council considered Corporate Report No. R273 – "Memorandum of Understanding – Semiahmoo Town Centre Integrated Energy Master Plan" and approved the City entering into a Memorandum of Understanding with BC Hydro to initiate a Semiahmoo Town Centre Integrated Energy Master Plan, which included cost-sharing and a joint steering committee for the study. Compass Resource Management, in association with the Canadian subsidiary of FVB Energy of Sweden, EnerSys Analytics, Hughes Condon Marler Architects and Hemmera Energy, was commissioned to undertake the study.

DISCUSSION

The interest in an Integrated Master Energy Plan pilot project, which incorporates a district heating and optional cooling system, is based on concerns over energy security and GHG emissions that are related to climate change. The City has signed on as a supporter of the Province's Climate Action Charter, which calls for significant reductions in GHG emissions, and is required to set GHG reduction targets.

A district heating and cooling system, which is based on a water distribution system, is a flexible system. While it can use traditional fossil fuels, such as natural gas, to heat the water in the system, it also allows a wide range of alternative energy sources to be used, such as geo-exchange, solar, wind and biomass.

The Semiahmoo Integrated Energy Master Plan Study was broken into two phases:

- A Phase 1 feasibility study that focused on demand forecast, building efficiency analysis and the screening of district energy supply concepts; and
- A Phase 2 investment-grade study to consider detailed development phasing issues, investment performance and ownership and governance options for operating an energy supply system.

It was agreed that, following the completion of Phase 1, BC Hydro and the City of Surrey would mutually agree on whether to proceed with Phase 2. Phase 2 was to proceed only if there was a reasonable expectation that a district energy system would be competitive, based on the Phase 1 feasibility study, which considered different supply options and costs at full site build-out.

If the Study demonstrated that an energy plan was shown to be feasible, the City would be expected to support the implementation of the plan by considering the adoption of policies, Zoning By-law amendments, design guidelines and other mechanisms consistent with its legislated mandate and corporate policies. The system would be designed in such a way that it could be expanded beyond the Semiahmoo Mall site, outwards to the entire Town Centre area and, potentially, into White Rock, including a connection to the Peace Arch Hospital site.

In late 2008, as Phase 1 was nearing completion, the redevelopment proposal for Semiahmoo Mall site was withdrawn. As Phase 2 of the Study was dependent on the availability of a final development plan, it was decided that the completion of the Study should be postponed.

Nevertheless, it was determined that a number of important results from the Phase 1 screening process could be applied to future developments in the Semiahmoo Town Centre, the City Centre and other town centres within Surrey. These results are outlined below.

Energy Demand Forecast

The consultants were asked to examine the energy demand for future buildings in the Study area based on three scenarios, including a minimum "base case" (i.e., current building code) scenario, a moderate efficiency scenario and a high efficiency scenario, as described in the table below.

Scenario	Base Case (Provincial Building Code as of April 2008)	Moderate Efficiency Effort	High Efficiency Effort
Part 3 Buildings (multi-family, commercial)	19% better than Model National Energy Code (i.e., ASHRAE 90.1 2004, the existing Green Building Code requirement)	25% better than Model National Energy Code (i.e., LEED* base standard for energy)	38% better than Model National Energy Code (i.e., gain maximum energy points under LEED* standards)
Part 9 Buildings (single family, and commercial less than 3 stories and less than 600 m ²)	Residential = EnerGuide 77 Non-residential = prescriptive (see draft Green Building Code)	Residential = EnerGuide 80 standard	Residential = EnerGuide 80 standard

*Leadership in Energy and Environmental Design

The energy required for the 200,000 square metres of proposed floor space in the Semiahmoo development, ranged between 26,000 megawatt-hours for the minimum scenario to 19,000 megawatt-hours for the high efficiency scenario. Based on current trends, the consultants assumed that 25% of this energy would be required for space cooling. If building designs were to incorporate natural cooling methods, such as cross-ventilation and the shading of windows against summer sun, a significant amount of energy could be conserved.

As will be discussed below, a major source of energy loss in cool times of the year and heat gain during summer months is the large window area or "glazing" that has been introduced into many recent building designs. "Floor to ceiling" glass, which has very little insulation value, is typical in new development projects in Metro Vancouver.

Building Efficiency Analysis

The Study found that energy consumption per square metre of floor space is much higher in a typical high-rise residential building than in a townhouse or detached house. While houses have insulation typically rated at R20 in the walls and R40 in the ceilings, multifamily buildings can have wall insulation in the R6 rating range and R12 in the ceilings.

Nevertheless, on a per capita basis, higher density multi-family households still use less energy than households in townhouses and detached homes, due to the reduced floor space per person. While the energy required for transportation was not considered in this Study, the Semiahmoo Town Centre Plan is a transit-oriented development that supports walking and transit use and reduces overall energy use.

As a component of the Study, a workshop was held with the developer's architects, experts in green buildings and energy modelling and staff from the City and BC Hydro. This workshop considered alternative building measures to increase energy efficiency. The consultants studied combinations of proven energy efficiency measures and discovered that it was possible to implement a cost-effective package of measures that significantly reduced:

- The developer's capital costs;
- The building/unit owners' operating costs;
- Use of non-renewable energy;
- Electricity use; and
- GHG emissions.

These measures included:

- Limiting the building's glazing to 50% of the external surface area of the building;
- Using low emission ("low-e") glazing for windows;
- Installing fibreglass window and door framing;
- Applying continuous exterior insulation;
- Installing occupancy sensors for lighting of common areas;
- Preheating domestic hot water with heat pumps; and
- Improving building mechanical systems, such as boilers.

District Energy Supply Concepts

District energy has a number of advantages in that it reduces the demand for electricity, can take advantage of local waste heat opportunities and provides a flexible base for using a range of heating sources. For example, the system could use waste heat from a supermarket or ice rink cooling system, incorporate roof-top solar hot water heating, use natural gas or be adapted to use biomass, such as waste wood chips. High-efficiency heat sources can be located in a central plant or in a number of smaller "mini-plants" distributed around the service area.

In the Semiahmoo Town Centre, the presence of a Metro Vancouver sewer main line on 16 Avenue, which contains a significant amount of heat, would provide the site with a significant energy source. If combined with geexchange energy from the site, most of the annual heating load for the site would be provided with these two energy sources.

Geexchange heat involves taking heat from the earth using a "heat pump," similar to how a compressor and heat exchanger transfers energy from the inside a refrigerator to the outside. Auxiliary energy sources such as natural gas boilers could then be used to provide additional heat during peak periods in the winter.

A district energy system requires that buildings incorporate plumbing for heating and cooling by "hydronic" (water) systems using devices such as radiators or radiant in-floor systems. A distribution system of insulated water pipes within private and public rights-of-way also needs to be provided in the study area to connect the energy sources with energy users.

The cost of district energy production, and hydronic distribution systems in particular, is relatively high at this time. For example, the additional cost of a "hydronic-ready" building compared to a building using electric baseboard heaters can be in the range of \$10,000 per unit and the capital cost for district energy sources would be in the \$10-20 million range for a site the size of the Semiahmoo Mall. At current financing and energy rates, the study suggests that the payback period for this investment would be in the order of 20 years.

This relatively long payback period is due, in large part, to the current relatively low cost of conventional energy sources and the cost of constructing the required infrastructure. While reasonable in terms of the long term benefits of energy savings, energy security and the reduction

of environmental impacts, a 20 year payback is not currently considered to be acceptable by some key stakeholders, including developers and home buyers, who expect a shorter payback period for their additional initial investment.

It is expected that the more detailed financial and governance analysis identified for Phase 2 of the Study would provide additional information on mechanisms for managing initial capital and ongoing operating costs to determine ways for implementing the system to be revenue neutral for all stakeholders, including the developer, the City, unit owners and commercial tenants.

Examples of these mechanisms could include:

- Working with a utility or other financial institution with a long-term financial perspective to debt-finance capital costs over a long period to keep utility charges comparable to traditional energy sources. For example, VanCity provided financing to incorporate geoexchange heating in the Verdant development at SFU's UniverCity project, which then is recuperated by a low monthly charge in strata fees;
- Promoting financial incentives by the Province and major utilities to developers, local governments and property owners to reduce electrical energy demand and GHGs; and
- Providing density bonuses to offset the additional capital cost to developers, which is currently included in the interim density bonus policy.

Principle Lessons Learned

The following lessons have emerged from Phase 1 of the Study:

- Increasing performance for townhouse buildings from EnerGuide 77 to 80 appears to be a cost effective measure with a reasonable payback period;
- Improvements in the energy efficiency of commercial spaces would also be expected, but specific measures would be best determined through an "Integrated Design Process" (IDP) once the actual design and commercial uses are identified;
- For multi-family residential buildings with less than 50% glazing, it is possible to reduce energy consumption by 8 to 12%, relative to new BC Building Code requirements in a cost-effective manner based on current energy price forecasts. If energy costs were to increase significantly in the future, as predicted, the return on investment would be even greater. Additional improvements would be the result of mechanical system upgrades, such as boilers, rather than further building envelope and other efficiency improvements;
- It appears cost effective to achieve Building Code energy efficiency requirements with 60% glazing under certain conditions, but there would be a significant up-front cost to developers;
- District energy systems could provide energy efficiency benefits of the same order as improvements to on-site mechanical systems;
- It is possible to achieve energy reductions for space heating through the building's orientation to the sun, but these reductions would be small compared to mechanical or envelope upgrades. The reduction in space heating during cooler months from a south-facing orientation could be offset by the expense of higher cooling costs in the summer, unless

"passive" or "natural" cooling systems are included, such as the shading of windows to block high-angle summer sun and the incorporation of cross-ventilation into most units; and

- The cost-effectiveness analysis considers only energy costs and savings. These need to be balanced against other design features that developers and buyers may be seeking, such as increased glazing levels, building orientation to maximize views, etc.

Potential Policy Directions

With the review of the Semiahmoo Town Centre and City Centre Plans underway, it is timely to have completed Phase I of the Integrated Energy Master Plan Study, which examined sustainable energy efficiency and supply options in Surrey's context. Lessons learned can be incorporated in several areas:

- ***Urban Design and Green Buildings***

The success of district energy systems is dependent in large part on reducing the energy load that needs to be serviced. Buildings in the service area need to be energy efficient. In terms of energy used per square metre, high-rise concrete buildings with minimal insulation and high amounts of glazing require significant amounts of energy for heating in winter and cooling in summer. Policies that encourage higher efficiencies in these buildings could be reviewed, potentially in conjunction with development permit area designations, density bonusing for green building practices or other mechanisms.

- ***Infrastructure Planning***

To accommodate district energy, utility plans should consider allocating space within rights-of-way for future energy distribution systems, i.e., water pipes. If district energy is determined to be economically advantageous for all users, utility plans should identify these systems, and cost-effective opportunities for constructing them should be explored, such as during road construction projects. In conjunction with utility planning, alternatives will need to be considered for the financing of the additional infrastructure.

- ***Renewable Energy***

It would appear that the use of geexchange energy and sewer heat recovery, where available, could supply a significant component of the base energy requirements for major development nodes. Other sources of recovered heat are sometimes available, such as the waste heat from refrigeration systems. These energy sources can be augmented with other renewable energy forms, such as biomass and potential waste-to-energy plants in the future, if available and if acceptable technology is identified to reduce environmental impacts to acceptable levels. To take advantage of these energy sources, locations for central or distributed energy plants will need to be identified in town centre plans, along with opportunities for geexchange fields, such as under park land or playing fields.

- **Governance**

In addition to developing a business case for Integrated Energy Master Plans and producing technical studies to ensure the social, economic and environmental sustainability of district energy systems, governance policies would need to be developed to determine which organization(s) are most appropriate to finance, construct, own and operate these systems.

CONCLUSION

The results of Phase I of the Integrated Energy Master Plan Study are consistent with Council direction to promote sustainability and are supportive of the City's commitment to the Province's Climate Action Charter and other legislative requirements to address climate change issues. The complete Study is available at [www.surrey.ca/Energy And Climate Change](http://www.surrey.ca/Energy_And_Climate_Change).

While further analysis and review is required to determine the applicability of these results in the context of the various locations in the City, a number of potential policy directions have been identified that should be considered in the planning processes for the OCP and other town centres within Surrey.

It is recommended that Council direct staff to utilize the findings of the study related to Phase 1 of the Integrated Community Energy Master Plan for the Semiahmoo Town Centre, in the development of policies and plans, including the OCP, the City Centre Plan Update and town centre plans and the design guidelines and utility servicing strategies associated with these plans.

Original signed by

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