TO: **Development and Infrastructure Committee**

FROM: **Capital Works**

SUBJECT: **Community Energy Feasibility Study - Phase 1 Results**

Report Number: CW-01-16 Wards Affected: All

File Numbers: 210-09

Date to Committee: February 17, 2016 Date to Council: February 29, 2016

Recommendation:

Direct the Executive Director of Capital Works to proceed with phase two of the Community Energy Feasibility Study and to report back to the Development and Infrastructure Committee with the results by the fourth quarter of 2016.

Purpose:

To provide an update on the phase one results of the Community Energy Feasibility Study (see Appendix A for a copy of the Integrated Community Energy System Feasibility Study by FVB Energy Inc.).

Background:

City Council endorsed the first Community Energy Plan for Burlington in January 2014, a plan developed in partnership with Burlington Hydro along with the support from several community stakeholders. The vision for the plan is the following:

> To achieve a community that is efficient and economically viable in how it uses energy through new development and retrofits, land use and transportation planning, energy generation (including the use of renewables), conservation and industrial processes to reduce its reliance on the use of energy, reduce its carbon footprint, and improve local energy security.

There are five goals in the plan with corresponding objectives and 55 actions. This report relates to the following goal and objective:

Goal: Increase sustainable local energy generation in Burlington and enhance supply security in ways that support Burlington's economic competitiveness.

Objective: Increase capacity for integrated community energy utility infrastructure.

The related actions in the plan include:

- Complete feasibility study for district energy in the downtown core; and,
- Complete long term plan for district energy systems in other locations, such as the Aldershot Mobility Hub and QEW employment corridor.

A Request for Proposals was issued in 2015 to complete phase one of a feasibility study for an Integrated Community Energy System, a high level screening of opportunities to implement a system in Burlington, as well as consideration of conditions and policies to support district energy systems in the future.

Discussion:

Characteristics of a District Energy System

District heating provides heat for multiple buildings from a single heating plant. There are three main components for a district energy system: the energy centre to produce the heat and power; the distribution system of buried piping to circulate the hot water for thermal energy; and the energy transfer station in each building. This is an efficient source of energy as district heating systems operate at higher efficiencies than individual heating systems in buildings. The added benefit is the ability to produce electric power from the engines or turbines (combined heat and power or CHP).

As the system expands and connects new facilities, additional components and sources of energy can be incorporated into the 'integrated' system, including renewables, use of bio-fuels, waste heat from industrial processes, and energy storage.

The technology for district energy systems is mature and has been around for over a century. However, there is always risk associated with building a system. Most district energy systems in Canada are owned by municipalities or large institutions like universities as the public sector in general is in a better position to provide the long-term operational commitments that mitigate the financial risks associated with such systems. However, once a system has expanded and becomes profitable, there is demand by private sector entities to subscribe to and or invest in these systems. Development of a district energy system should be considered a long term investment.

A key criterion for achieving a successful district energy system is the need for an anchor user, such as:

- Hospital
- College or university
- Large hotel(s)
- Large multi-residential housing developments or retirement facilities
- Recreation and Community centres – with indoor swimming facilities
- Certain private-sector commercial or industrial facilities

As noted in the study, these types of facilities are usually stable and long term fixtures in the community and are generally not subject to economic volatility resulting in relocation or closure. These facilities would also have to have a year round need for 'heat' or 'thermal energy' such as hot water and space heating, which would provide a good base demand for a district energy system.

Benefits of a District Energy System

Energy security is an important goal for a city like Burlington. Businesses and residents are vulnerable to the increasing frequency of severe weather events attributed to a changing climate. In addition, conventional energy systems can be inefficient. Heating equipment in individual buildings, such as boilers, are oversized to meet peak demand loads and usually operate at less than optimal loads and, therefore, reduced efficiency. The provincial electricity grid transports power over long distances, losing power through the transmission lines contributing to the inefficiency of the system. In addition, transmission and distribution lines can experience tremendous impacts during severe weather events like strong winds and ice storms. The ice storm of 1998 was a major impetus for Markham to develop their district energy system to ensure they had a secure energy system. During Hurricane Sandy, a local district energy system was able to provide power in one district, providing emergency refuge for many citizens. During the eastern seaboard blackout, the Markham and Hamilton district energy systems were able to provide power in small isolated areas.

District Energy Challenges

Unlike Markham, but not insurmountable, Burlington does not have a large greenfield area to start planning from square one to achieve a good mix of uses with a significant anchor facility that could provide a stable base load for a district energy system. Burlington is also bisected by rail and highways which could be a barrier to piping networks.

Although district energy systems can provide resiliency for a community, the process can be complicated and entails significant planning and coordination with the local distribution companies.

Screening Criteria for a District Energy System

FVB Engineering assessed a number of technologies and locations across the city, using specific screening criteria, including:

- Sizing and intensity of the district energy node
- Availability of space for an energy centre
- Presence of an anchor tenant
- Forecast greenfield development
- Redevelopment with existing nodes
- Presence of barriers of thermal distribution
- Burlington Hydro Grid interconnection capacity
- Timeframe to implement
- Ability of Burlington to influence development
- Ability to showcase for Burlington

The assessment of candidate nodes is contained in Section 7 of the attached report (Appendix A).

Recommended Sites for Further Investigation

The list of possible locations was screened using the criteria, resulting in the first three recommended sites to complete further investigation in phase two:

1. **The Downtown Core** – the City Hall/Burlington Centre for Performing Arts node features a high content of municipal assets, highest density, and no physical barriers to implementation. With the ability of the City to influence district energy, a showcase installation in the core of the City will be well positioned to readily interconnect to existing facilities as well as future infill development. The John Street corridor could be an area where district energy could be supported where infill redevelopment is anticipated. The potential for a hotel development or redevelopment in the downtown could also provide a stable anchor for the system. In addition, Burlington owns parking lots which could provide a location to site an energy plant.
2. **Existing electric heating multi-residential buildings** – these represent an opportunity to utilize existing electrically heated facilities to establish combined heat and power (CHP) with thermal energy to be distributed to nearby hydronically heated buildings. This offsets the high cost of electricity to these

buildings. There may be a couple opportunities close to the downtown core that could be assessed, in consultation with the property owners.

3. **Mobility Hubs** - it is strongly recommended that the future development of the three mobility hubs be district energy ready with CHP (combined heat & power). Phase two should also inform the master planning process for the priority mobility hub (still to be identified), recommending policies for future land use development with a mix of uses and sufficient density, and include a key anchor facility, that can support a district energy system. It is anticipated that the recommended policies would be applicable to all three mobility hubs.

In addition, the following sites may be considered in phase two:

4. **Recreation Facilities and Community Centres** - City owned facilities may be readily able to immediately establish smaller district energy systems and enable them to be established as emergency centres during electrical outage events and enhance the resiliency of the community. Tansley Woods Community Centre with the pool and close proximity to a seniors' residence might be a facility to consider.
5. **Economic Prosperity Corridor** - The McMaster DeGroote node in the Economic Prosperity Corridor may warrant consideration when the adjacent greenfield area is considered for development.
6. **Potential sites with high electrical loads** – that are in proximity to one or more schools. Schools offer an excellent opportunity to showcase the technology to the students so that the district energy system concept may be included in the curriculum and become the 'default business as usual' for the upcoming generation. Hamilton provides a good example for this where the plant is adjacent to a high school.

Next Steps

Staff have reviewed the report in consultation with staff from Burlington Hydro and the McMaster Institute for Energy. It is recommended that the City proceed with phase two of the Community Energy Feasibility study by issuing a Request for Proposals to further investigate the preferred sites and complete business cases. In summary, phase two will entail the following steps:

- Coordinate the process with Burlington Hydro, as a key partner in the study, using its experience with the implementation of their pilot micro turbine CHP system;
- Consult with and arrange tours of other municipal district energy systems;
- Engage property owners in the key nodes where applicable in the opportunity of connecting to a secure and efficient supply of energy;
- Review potential sites for an energy plant;

- Review nodes to determine ability to develop a distribution system and coordinate with planned roadwork projects;
- Undertake site inspections and detailed reviews of the necessary energy attributes and mechanical systems for key facilities and anchor tenants who may interconnect;
- Assess energy loads (thermal/heat) and complete cost benefit analysis;
- Consider and recommend ownership and funding models for the city to proceed with the implementation of a district energy system, consulting with key city staff; and,
- Provide recommendations related to land use legislative and policy tools to enable implementation, including policy recommendations for future master planning/area planning processes.

Financial Matters:

A key component of phase two will be to establish a business case for the recommended site including a financial feasibility study.

In 2015, staff were successful at obtaining a grant from the Green Municipal Fund administered by the Federation of Canadian Municipalities to support the study, providing matching funding for both phases one and two of the study.

Funding for phase one of the study is budgeted for in the Community Energy Plan capital budget with matching funding from the FCM Green Municipal Fund (GMF). Phase two funding will be covered by BESI (Burlington Electricity Services Inc.) with matching funding from the GMF. The city will be required to cashflow phase two pending receipt of funds from FCM Green Municipal Fund.

Environmental Matters:

District energy systems are more efficient and can reduce community greenhouse gas emissions. They will displace individual building heating systems with a centralized plant and they can also act as a ‘bridge’ to renewables like solar and biomass that have zero carbon impact.

With respect to power generation, the system will not displace electricity that is produced by nuclear, hydro or wind but will reduce the production of electricity from the gas/oil fleet of generation in the province.

Markham’s district energy system has been audited and has reduced their ‘status quo’ emissions by 50% by utilizing combined heat and power.

Public Engagement Matters:

A presentation on the draft results of the Community Energy Feasibility Study was provided to the Community Stakeholder Advisory Committee on November 6th, 2015. A representative of the Sustainable Development Committee is one of the stakeholders, along with a number of other community groups and organizations. A media release regarding the Green Municipal Funding for the study was issued by the Federation of Canadian Municipalities and City of Burlington in December 2015. Information about the study was covered by the Burlington Post, the Novae Res Urbis, and social media (Facebook, Twitter and the Take Action Burlington blog).

Conclusion:

The implementation of an integrated community energy system can help Burlington achieve its goal to 'increase sustainable local energy generation and enhance supply security, in ways that support Burlington's economic competitiveness.' It is recommended that the City proceed with phase two of the community energy feasibility study to complete a detailed business case for implementation.

Respectfully submitted,

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Appendices:

a. Integrated Community Energy System Feasibility Study (under separate cover)

Notifications: (after Council decision)

Name:	Mailing or E-mail Address:

Approved by:

Reviewed by: