Blatchford District Energy Sharing System

Information Report

Executive Summary

In 2009, Edmonton City Council approved the phased closure of the City Centre Airport and initiated the development of a new community for 30,000 people in the heart of the city. With Blatchford, the City of Edmonton embarked on the path to creating a sustainable community unlike any other in Canada or elsewhere in the world. The Vision for Blatchford is a liveable, urban environment that is *carbon neutral* and powered entirely by *renewable energy*. Truly sustainable developments are ambitious and require commitment, creativity and innovation. Achieving the Vision will not only benefit Blatchford's residents, but also inform the development of future communities, establishing the City of Edmonton as an expert in the field of community-based renewable energy.

In June 2014, City Council approved Blatchford's business and implementation plans and directed Administration to investigate the feasibility of an ambient loop district energy system to achieve Council's Vision for a carbon neutral community that uses 100 per cent renewable energy. In response, the Blatchford project team retained Associated Engineering in partnership with DEC Engineering and Sustainable Strategies to complete a detailed feasibility study and preliminary engineering design for Stage 1 of an ambient District Energy Sharing System on the Blatchford site. After reviewing the site-specific characteristics of the development, the consultant team concluded that an ambient District Energy Sharing System, as part of a broader district energy plan, is viable for the Blatchford development and capable of achieving Council's energy objectives for the site.

This report is a summary of the feasibility analysis conducted by the consultant team and forms the basis of the overall plan for district energy in Blatchford. The report also describes three interwoven strategies – energy conservation, energy efficiency and the use of renewable energy sources – to minimize Blatchford's environmental impact and ensure community energy resiliency.

- Conservation: All buildings in Blatchford will be constructed with high performance envelopes that exceed the requirements of existing and future Alberta Building Codes.
- Efficiency: An ambient District Energy Sharing System (DESS) will provide space heating and cooling, and domestic hot water for all buildings in the Blatchford neighbourhood. The DESS is capable of sharing energy between buildings, neighbourhoods, and seasons, significantly reducing overall energy demand. This system will operate as an on-site energy system for the community.
- Renewables: Existing on-site renewable energy sources including geo-exchange and sewer heat exchange will be incorporated into the DESS system.

Together, these three strategies provide a foundation for attaining carbon neutrality and community-based energy sustainability.

The proposed DESS system and the broader Blatchford energy strategy, provides a number of benefits to the City of Edmonton and the Blatchford Development, including:

1. A comprehensive, whole-site solution capable of meeting City Council's Vision for Blatchford.
2. A highly flexible approach to energy system planning, capable of incorporating future emerging energy technologies and adapting to various potential development scenarios. Flexibility is critical for a land development project as large as Blatchford, with a long-term build-out timeline that is subject to market forces.
3. A heightened awareness of the energy systems supporting Blatchford, due to the on-site DESS system, which can encourage the community to adopt additional green actions to contribute to an overall better environmental performance for Blatchford.
4. Tools and levers for Council, through the DESS, to ensure Blatchford is not only capable of meeting its energy objectives, but can monitor and achieve continuous improvement of its environmental performance over time.

The first phase of DESS development will include the installation of a geo-exchange field under the first stormwater management facility in the Stage 1 residential development. A subsequent phase of the DESS will involve the construction of the sewer heat exchange facility as part of the development of the Blatchford Town Centre. As the development proceeds, there will be opportunities to install other potential innovative energy sources into the system.

Proceeding with the proposed plan for Blatchford district energy will start the DESS on the path to achieve the Vision for Blatchford as a carbon neutral and renewable energy community. By choosing a flexible approach, focused on meeting a specific goal, Council can ensure that as renewable energy innovation continues, the Blatchford DESS can adapt and improve. The DESS will be able to incorporate the best ideas of the day, inform future developments and establish the City of Edmonton as leader in community-led renewable energy.

1. Introduction

On July 8, 2009, after extensive discussions, expert analysis and public consultation, Edmonton's City Council voted for the phased closure of the Edmonton City Centre Airport and formally initiated one of the largest redevelopment projects in our City's history. With Blatchford, the City of Edmonton has a once-in-a-lifetime opportunity to redevelop 217 hectares into a world-leading sustainable development that balances social, economic and ecological priorities.

Over the past six years, a series of critical decisions were made to establish the course of Blatchford's redevelopment from now until its projected build-out in 2037. Starting with the original motion to close the airport, Council also positioned the City of Edmonton as the developer of the lands – responsible for ensuring the development of the new community meets the expectations of City Council and ultimately, the citizens of Edmonton.

In March 2010, City Council approved the *City Centre Airport Lands Master Plan Principles*, which serves as the foundation for the Area Redevelopment Plan for the Blatchford site, subsequently approved by Council in May 2012.[1] The principles outline a clear Vision for Blatchford:

> *…home to 30 000 Edmontonians living, working and learning in a sustainable community that uses 100 per cent renewable energy, is carbon neutral, significantly reduces its ecological footprint, and empowers residents to pursue a range of sustainable lifestyle choices.*[2]

The *Master Planning Principles* also mandate that the City, as developer, establish the foundation for environmental sustainability without neglecting social and economic factors. Blatchford will provide residents and businesses located in the community an opportunity to live green affordably.

The Edmonton City Centre Airport officially closed on November 30, 2013, and the City assumed full control of the site. On June 10, 2014, Council approved the Blatchford Redevelopment Project Implementation Strategy, which outlined a specific approach to guide Blatchford's

[1] Bylaw 16033

[2] 'The Vision', p. 2, *ECCA Lands Master Plan Principles*, 2010PW8753, Attachment 1

development.[3] The motion also indicated Council's preference for an ambient loop district energy system.

One month later, on July 16, 2014, City Council approved the funding model for Blatchford, authorizing a borrowing bylaw required to proceed with development. This model projected net income for the Blatchford project at full build-out to be $229 million, but did not include funding for the district energy system. However, part of that discussion included an acknowledgement that Administration would return to Council with any additional items that could significantly impact the project's pro forma, including the plan for district energy.

Since the formal approvals in mid-2014, considerable work has been completed in preparation for the first stage of development. The Blatchford project team has developed a land sale strategy, undertaken additional public engagement, created and received approval on the Stage 1 Zoning and Tentative Plan of Subdivision, and submitted Stage 1 detailed engineering drawings.

In October 2014, Administration returned to Council with an update report on additional sustainability and liveability features that could be incorporated into Blatchford in the future.[4] The report highlighted several additional items, either raised previously by Council or through subsequent public engagement, including several social and environmental design elements. While each suggestion will be considered for inclusion in Blatchford, two areas were highlighted for immediate follow up: the creation of a recreational lake and the further development of an ambient District Energy Sharing System for Blatchford. Both items were of considerable interest to the public consulted, and had been highlighted by Administration as the remaining outstanding decisions to be addressed by Council before Stage 1 construction begins. The opportunity for a recreational lake in Blatchford is currently being reviewed in greater detail and will be presented to Council in a separate report. The purpose of the following business case is to present Council with a description of the preferred District Energy Sharing System within the Blatchford community.

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[3] The approach (known as Scenario 5a), focuses on the following elements, among others: medium density residential, with high density in direct proximity to LRT station, town centre, institutional lands (NAIT, school sites), major park, urban agriculture, high performance building envelopes, district energy: ambient loop with geo-exchange (preferred) or gas-fired cogeneration (in proforma).

[4] CR_1435, Additional Liveability and Sustainability Features for Blatchford – Update Report, October 28, 2014.

2. What is District Energy?

District energy systems centralize the production of heating or cooling for a geographical area. "Most district energy systems generate heat at a central plant, or extract heat from other sources. The heat is transferred to a fluid and distributed via underground pipes to buildings where it is used for space and water heating. The fluid is then returned to the source to be reheated and recirculated. Some systems also provide space cooling in a similar way."[5]

District energy technologies have been deployed for decades in countries worldwide. There are currently over 112 district energy systems operating in Canada alone.[6]

District energy systems come in different shapes and sizes. They vary according to the temperature of the fluid used for distribution, which could include steam, hot or ambient temperature water, and the type of fuels used to generate thermal energy including traditional fossil fuels (natural gas, diesel, propane), alternative fuels (biomass, biogas), and renewables (geo-exchange, waste heat recovery, solar, etc.).

District energy systems offer communities a number of benefits over traditional approaches to heating and cooling. These benefits are summarized in Figure 1.

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[5] 'District Energy Systems' – BC Climate Toolkit - http://www.toolkit.bc.ca/tool/district-energy-systems

[6] *The New District Energy: Building Blocks for Sustainable Community Development* (2008), Canadian District Energy Association, http://www.ontario-sea.org/Storage/32/2406_The_New_District_Energy_-_Building_Blocks_for_Sustainable_Community_Development.pdf

Figure 1. Benefits of District Energy Systems

- Facilitates community energy planning
- Provides fuel source flexibility
- Reduces dependence on fossil fuels
- Reduces greenhouse gas emissions and improves local air quality
- Potential to decouple from incumbent electricity and gas utilities in the future (providing greater cost certainty and stability for ratepayers)
- Improves resiliency of critical infrastructure (Increases energy security and independence of communities)
- Improves energy efficiency
- Fosters local economic development and skills training
- Serves as a primary vehicle for integrating renewable energy into communities
- Enables the implementation of renewable energy technologies that are not economical or feasible on a building scale.
- Reduces maintenance and improves service for individual building owners/residents
- Motivates builders to construct higher quality (more comfortable) building systems
- Potentially decreases capital costs to individual building owners/residents
- Increases stability of energy costs
- Enables community engagement and pride in sustainable infrastructure

3. Blatchford Approach to District Energy

3.1 Design Considerations

The proposed approach for implementing district energy in Blatchford is based on Council's Vision for the development, which states two goals related to environmentally sustainable energy usage: **carbon neutrality** and the use of **100 percent renewable energy** sources.[7] The requirements for carbon neutrality specifically achieved through the exclusive use of renewable energy sources sets an ambitious objective for any community, but especially one dependent on a provincial electricity grid that's still almost entirely powered by fossil fuel combustion. The ability to achieve this goal will have significant positive reputational benefits for Blatchford and the City of Edmonton.

Blatchford could influence the way the world thinks about sustainable development. However, this will only happen if its approach to energy is ambitious and creative with an ongoing commitment to visionary leadership.

To ensure Council's Vision for Blatchford remains the guiding objective for energy planning, the Blatchford project team has developed a comprehensive, integrated, whole-site strategy, tailor-made for the site. The strategy will provide Council with ongoing control over community energy planning and system performance.

Another critical design objective is system flexibility. For a large-scale project with a long development timeline to full build-out, flexibility is crucial because conditions, timelines and plans are subject to change and market pressures. Since the full build-out will occur over a twenty-year-plus time horizon, the system must be designed to accommodate buildings not yet built, whose estimated energy demands can be modelled but may be subject to change. Blatchford's District Energy Sharing System will serve the Blatchford neighbourhood beyond the foreseeable future. Therefore, system flexibility is critical for ensuring future renewable energy

[7] Carbon neutrality, is simply the state in which the net release of carbon emissions to the atmosphere is zero. This does not mean necessarily that no carbon is emitted. Rather, the amount emitted is offset by another positive action that reduces off-site carbon emissions, which would have otherwise occurred by an equal amount. This can be achieved most simply through the purchase of offset credits or by securing renewable energy certificates for renewable energy generated off-site. The relative merit and standards of these methods versus more comprehensive efforts to design sustainable communities is a matter of debate within the literature on sustainability.

sources – not yet proven or cost effective – can be incorporated into the district energy system when and where it makes sense and supports Council's goals and objectives.

A summary of the design considerations for the proposed district energy system is provided in Figure 2 below.

Figure 2. District Energy System Design Considerations

- **Council Vision for Blatchford:** Carbon neutral, 100 per cent renewable energy based, affordable (competitive with other comparative housing options in Edmonton).
- **Council control:** Council leadership with respect to energy planning, policy and performance will be required to meet ambitious goal.
- **Comprehensive**: Provides a solution for all stages of development and all types of buildings.
- **Integrated**: Unites the entire site in a one-system solution, centrally operated and administered, whose performance can be easily optimized, observed, communicated and measured.
- Solution **tailored** to the Blatchford site:
    - Solution for overall **heterogeneity** of Blatchford site (accommodates all kinds of building uses and densities).
    - **Modular** will match the development staging over a 20-year time horizon.
    - **Flexible** to anticipate technologies not yet in existence, buildings not yet built.
    - Leverages unique **on-site resources** (site-specific geology, presence of stormwater lakes and large trunk sewers).

3.2 Process

The Blatchford project team retained FVB Energy Inc., in cooperation with Revolve Engineering, in fall 2013 to complete a preliminary district energy system feasibility study. The study analyzed the energy implications, greenhouse gas (GHG) emissions, costs, and the advantages and disadvantages of six energy delivery options including two 'business-as-usual' options. The study identified two leading options: (1) an ambient loop DESS with geo-exchange, and (2) a traditional system with a natural gas fueled combined heat and power plant. Each system has its advantages, and while the traditional system is more established, only the first option is positioned to deliver on the world-leading Vision for Blatchford as a carbon neutral community fueled by 100 percent renewable energy sources.

The two leading options were discussed at a high level when the Blatchford Concept Plan Implementation Analysis – Project Business Case was before Council on June 10, 2014. Following discussion of the implementation scenarios, Council passed a motion indicating preference for the ambient loop District Energy Sharing System, and directed Administration to conduct further conceptual work and evaluation.

The Blatchford team then retained Associated Engineering, in partnership with DEC Engineering, to complete preliminary engineering for Stage 1 of the DESS and geo-exchange field and review opportunities related to sewer heat exchange, in order to provide a detailed feasibility study to ensure the system is technically and financially viable within the local context. The results of this work are summarized below and form the basis of the recommended approach to district energy in Blatchford.

4. District Energy in Blatchford – Implementing the Vision

The Blatchford approach to district energy provides the foundation for a truly sustainable community. The plan positions City Council as the steward of the Vision, responsible for ensuring the development of an energy system for Blatchford that prioritizes the use of renewable energy and continuously reduces GHG emissions through the addition of new technologies over time, until carbon neutrality and 100 percent renewable energy is achieved. By focusing on achieving the Vision over the full build-out of the project, rather than immediately or in the short term, the plan balances environmental performance with the need to keep Blatchford attractive to investors across all stages of development.

The plan has been broken down into three distinct but inextricably linked strategies: *energy conservation*, *energy efficiency*, and *renewable energy*. Each strategy is outlined in the sections below.

Figure 3. Blatchford Energy Strategy

4.1 Energy Conservation – High Performance Building Envelopes

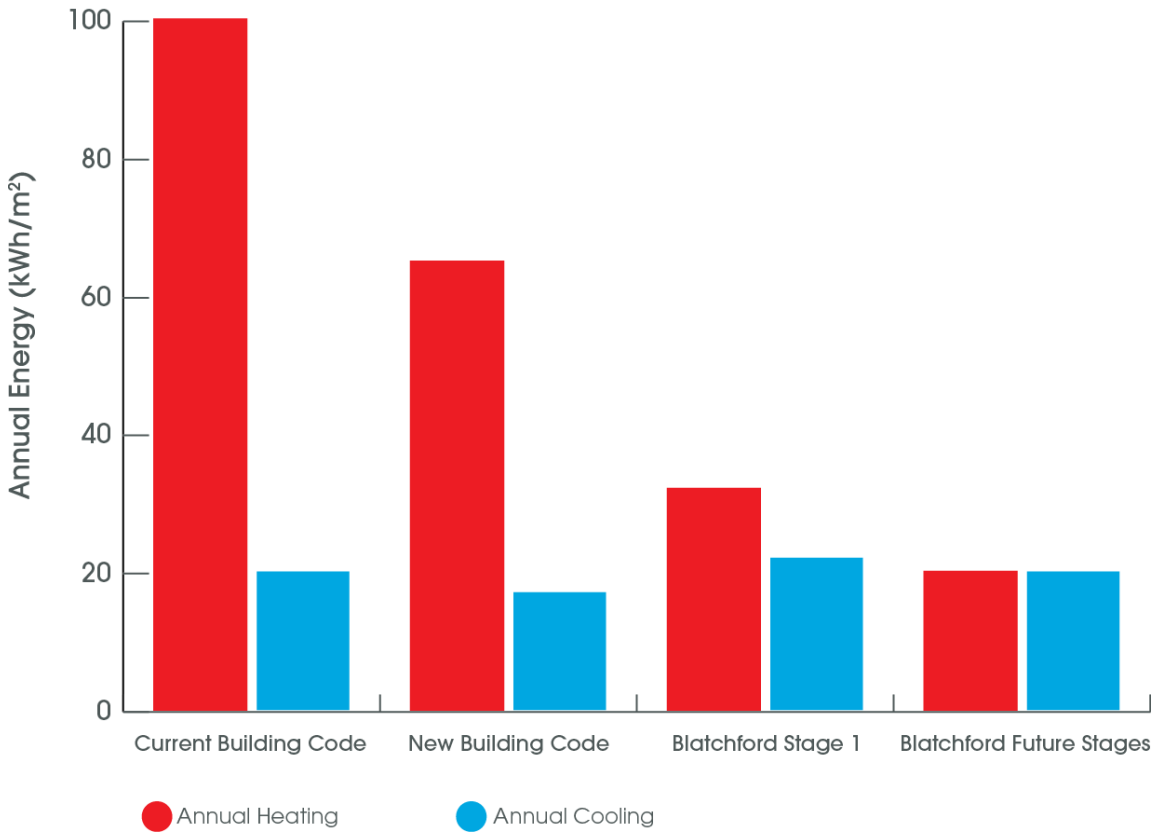
As a new development, Blatchford is well-positioned to leverage an energy conservation strategy by mandating the construction of high performance buildings that results in a reduction in the neighbourhood's thermal energy demand. By requiring higher-performance building envelopes, the required capacity of the district energy system can be minimized, which will better enable the system to reach the goal of 100 percent renewable energy.

Buildings in Blatchford will be required to significantly exceed the performance requirements of the existing Alberta Building Code, as well as exceed the new Code, which comes into effect in November 2015. In the first stage of development, the energy performance target will be set to avoid placing an unnecessary financial/marketability burden on the builders, who are in the process of adapting their practices to meet the heightened standards prescribed by the new Code. In subsequent stages, builders will be required to meet more aggressive targets for building energy usage.

As the developer, the City of Edmonton will use a combination of mechanisms to ensure compliance with these performance standards. These include, but are not limited to, a Blatchford-specific architectural code, sales agreements, and builder selection criteria. The Blatchford energy performance requirements will result in buildings that perform substantially better than business-as-usual (see Figure 4).

Achieving higher performance levels through the implementation of more aggressive building envelope requirements will reduce the overall demand for energy and will help balance the overall heating and cooling loads of the buildings, making Blatchford an ideal candidate for a District Energy Sharing System.

Figure 4. Annual thermal energy demand for a mid-rise residential building based on different building envelope performance requirements.



4.2 Energy Efficiency – District Energy Sharing System

The second component of the Blatchford energy plan is a high efficiency energy delivery system. An ambient (low) temperature District Energy Sharing System (DESS) is recommended to meet the needs of the Blatchford community now and in the future.

A DESS is similar to a traditional district energy system in that energy from a centralized source is distributed to multiple buildings. However, traditional systems deliver high temperature water that can be used directly for heating buildings, whereas a DESS distributes ambient temperature water, which is then upgraded using heat pumps to provide both heating and cooling.

One of the main advantages of a DESS is that it allows for greater flexibility to directly tie-in renewable energy sources. Many renewables, such as geo-exchange, solar thermal and sewer heat exchange, provide low-temperature energy, which can be used directly by the DESS. In contrast, low-temperature sources must be upgraded before they can be incorporated into traditional high-temperature systems, which is less efficient and not always possible. Another key benefit to implementing a DESS in Blatchford is the unique ability to share energy between buildings. For example, office buildings usually generate excess heat (due to high density of lighting, computers, and people). This heat energy is usually rejected to the atmosphere, but a DESS can recover that thermal energy and use it to heat residential buildings. Essentially, the office buildings act as a heat source for the residential buildings. In a neighbourhood the size of Blatchford with a large diversity of building types and occupancies, this sharing of energy can reduce overall energy consumption by 15 to 20 per cent. The more energy sharing that occurs, either on a building or a neighbourhood scale, the less external energy is needed.

Figure 5. Advantages of District Energy Sharing System

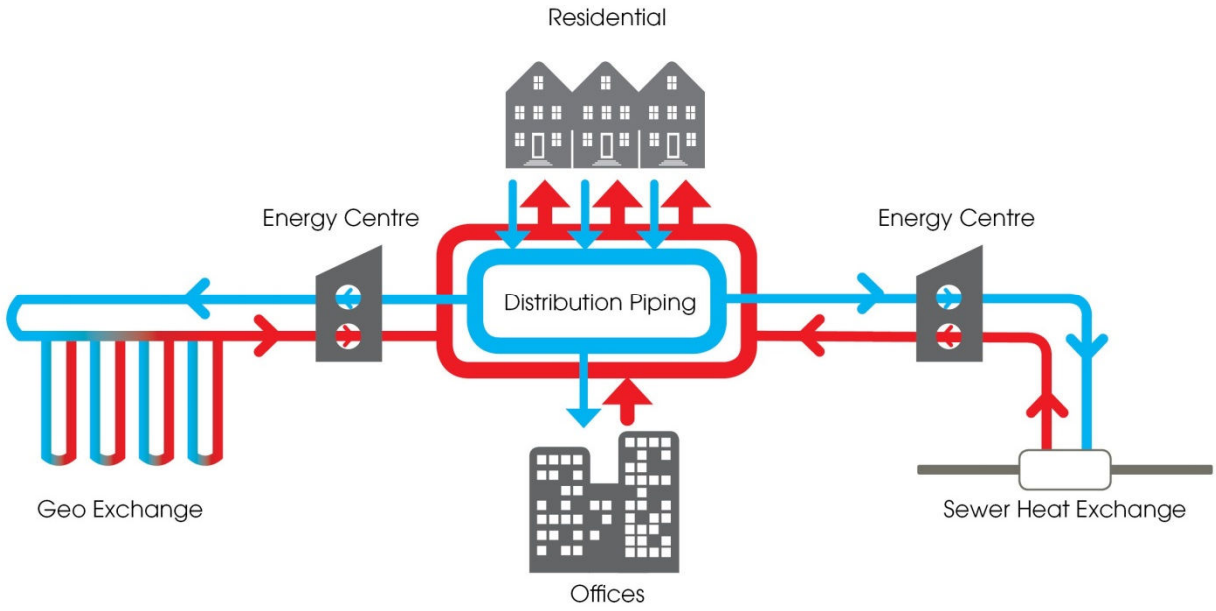
- Provides heating and cooling from a single system
- Allows energy sharing
- Allows tie-in of low-temperature renewables
- Maximizes flexibility of future energy sources and system build-out

4.3 Renewable Energy – Geo-exchange, Sewer Heat Exchange & Solar PV

The third component of the proposed Blatchford district energy plan includes incorporating renewables as the primary source of thermal energy. This approach, if combined with renewable electricity generation, through sources such as solar photovoltaics and the ongoing greening of the Alberta electricity grid, will allow for 100 percent renewable and completely carbon neutral heating, cooling and domestic hot water production at Blatchford.

Two major sources of renewable thermal energy, which leverage existing on-site resources, have been identified: geo-exchange and sewer heat exchange.

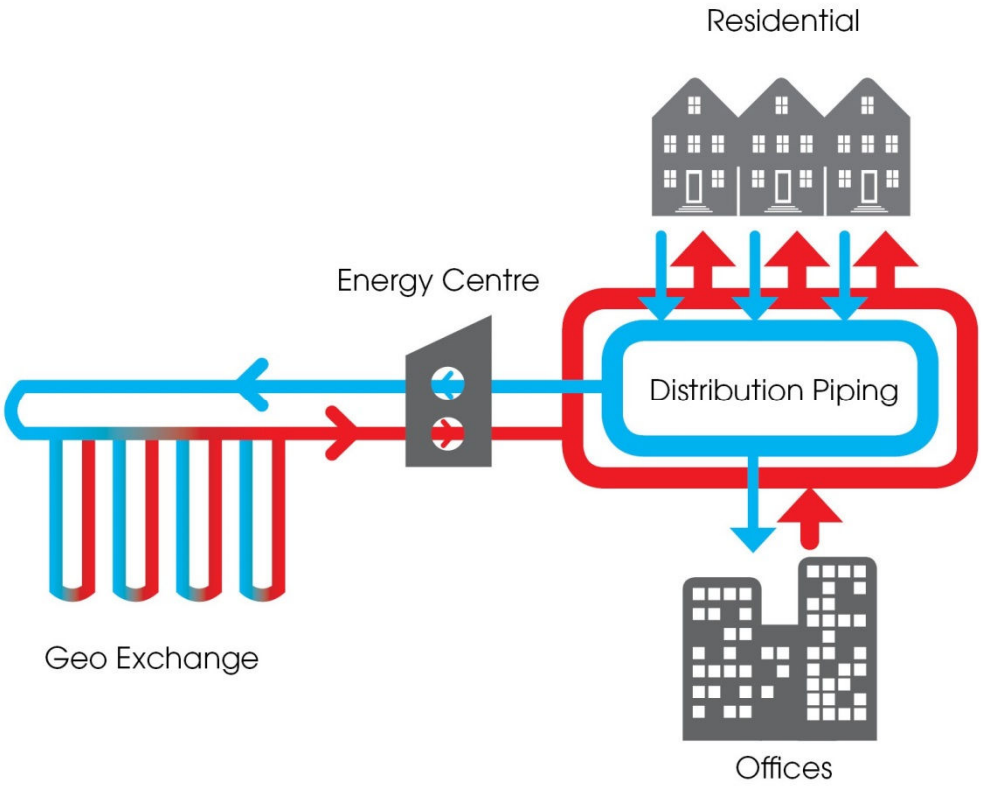
Figure 6. Proposed DESS connected to geo-exchange and sewer heat exchange.



Geo-exchange

Geo-exchange harnesses the readily renewable shallow geothermal energy in the soil and ground water below the earth's surface. In the winter, a geo-exchange system draws heat from the ground for heating, and in the summer, it uses the ground to store excess heat and provide cooling to buildings. Shallow geothermal energy is a low-grade energy source and is not warm enough on its own as a direct source of space heating. To use this energy as a source for heating or cooling, a heat pump is required to move and upgrade the thermal energy from the ground to the buildings.

Figure 7. Basic Components of a Geo-exchange System



A geo-exchange system consists of three main components: a ground heat exchanger (GHX), a heat pump and a distribution system. Heat energy is extracted from the ground by pumping a heat transfer fluid through a horizontal or vertical circuit of underground piping in a closed loop. The fluid absorbs the heat in the ground and transfers it to a heat pump. The heat pump upgrades (concentrates) the heat and moves it to the distribution system, which delivers it to buildings. While the heat pump uses some electricity, it is only a fraction of the total useful energy moved from the earth to the building. Geo-exchange systems have been in operation around the world for decades.

The Blatchford development plan includes a central park district with two stormwater management facilities that provide optimal locations for extensive geo-exchange fields. The fields will consist of vertically drilled boreholes with closed loops of piping containing a heat transfer fluid . The first geo-exchange field will be installed under the Stage 1 stormwater lake and will consist of approximately 570 vertical boreholes drilled at a depth ranging from approximately 100 to 145 metres.

Installing a geo-exchange field beneath a stormwater management body is a non-typical, innovative approach. Using this area increases the total space available for the geo-exchange. Installing the GHX loops below the lake will also minimize the potential for damage due to other excavations occurring on other parts of the site. The GHX field itself is a passive piece of equipment and once correctly installed requires no direct maintenance.

Sewer Heat Exchange

A second major source of renewable energy identified within the Blatchford site is sewer heat exchange. There are two major existing combined sewers, which run under the Blatchford site and converge under the future Town Centre. These sewers provide a high volume of ambient temperature wastewater, which through sewer heat exchange (SHX) can be used as a substantial source of renewable energy for the DESS.

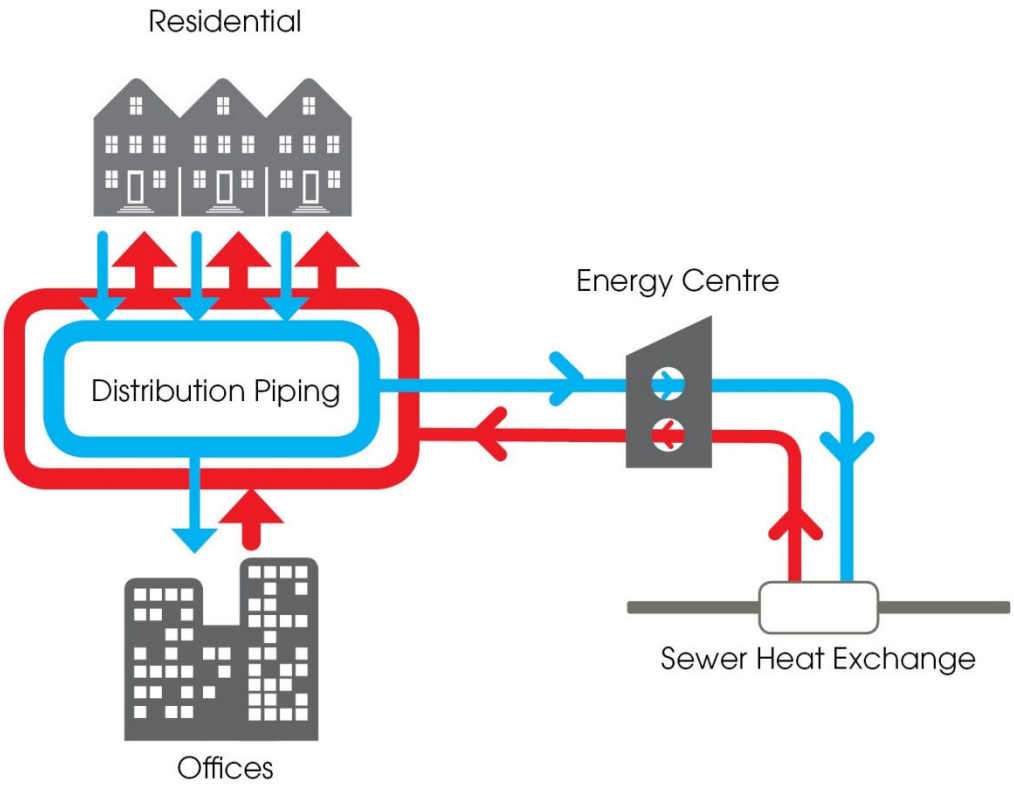
In a SHX system, wastewater is diverted from the sewer, screened and sent through a heat exchanger. In the winter, heat is transferred from the wastewater to the DESS, and in the summer excess heat is transferred from the DESS to the wastewater. The wastewater is then returned to a downstream point in the sewer.

SHX makes an excellent energy resource for both heating and cooling when paired with an ambient temperature District Energy Sharing System. Generally, wastewater is of a similar temperature to an ambient DESS and contains a substantial amount of recoverable energy. Figure 8 illustrates the basic components of a sewer heat exchange system connected to a DESS.

Sewer heat exchange provides several benefits when compared to other renewable energy sources, including its:

- *Cost-effectiveness* – wastewater heat recovery systems generally have the lowest capital cost relative to almost every other renewable thermal energy source and the source energy is free.
- *Thermal energy capacity* – since wastewater is almost entirely water, it has an excellent ability to hold thermal energy.
- *Ability to provide heating and cooling* – wastewater can be used as both a source of heat and as a sink for excess thermal energy (cooling).

Figure 8. Basic Components of a Sewer Heat Exchange System.



Progressive Inclusion of Solar PV

The geo-exchange and sewer heat exchange systems are two sources of renewable thermal energy. Taken together, both technologies have the capacity to meet the projected thermal energy demand of the Blatchford site at full build-out, which is important for meeting the Vision for Blatchford as a sustainable community that is carbon neutral and uses 100 percent renewable energy. However, while these renewable sources of energy are sufficient for meeting the thermal energy demand for Blatchford, the mechanical equipment within the systems relies on electricity to operate. In Alberta, where the carbon intensity of our electrical grid is relatively high, this poses a significant challenge to ensuring the carbon neutrality and fossil-fuel independence of the Blatchford DESS.

One proposed solution to address this issue is the installation of on-site solar photovoltaic panels (solar PV). These panels could be used to offset the GHG emissions associated with the electricity used by the DESS.

Due to the current high capital costs associated with solar, the purchase of solar PV has not been factored into this district energy plan at this time. However, while constrained by high

capital costs in the past, the cost of solar PV units has been decreasing steadily. Although it may be difficult to justify financially at present, future pricing, coupled with rising electricity costs makes this option promising and worthy of further investigation. The decision to install solar PV can be made incrementally in the future as the DESS develops.

Addressing the GHG emissions from the DESS system (and additional electrical plug loads within development) remains critical to achieving the Vision of a carbon neutral and 100 percent renewable community, and warrants a separate strategy to best take advantage of trends in the cost of renewable technologies and the natural reduction in grid carbon intensities.

4.4 DESS Phasing

The construction of the DESS will be phased to match the Blatchford development staging, which in turn is dependent on market conditions. As with any large land development project, a preliminary phasing schedule exists, however, it is subject to change depending on the rate at which the market absorbs different types of serviced land (residential, commercial, etc.) as they become available. The following DESS phasing outline is highly context-dependant because it has been designed to leverage the specific characteristics of Blatchford's site while tailoring its development schedule to align with the project's development activity assumptions. This approach will allow the DESS to optimize its investment in additional DESS infrastructure over time.

The first geo-exchange field will be installed as part of the Stage 1 residential development in Blatchford. The first stage of development requires constructing the south stormwater management facility as part of the infrastructure needed to service the first lots. Excavation of the lake started in August 2015. Once the lake is excavated, and the DESS proposal approved, geo-exchange boreholes will be drilled and the geo-exchange field will be installed in the bottom of the facility. Drilling within the stormwater management facility will be a one-time event since it is impractical to drain the lake to allow for a second phase of drilling. Accordingly, the number of boreholes in the Stage 1 geo-exchange field will be maximized to make best use of the underlying space. Excess geo-exchange capacity will service future stages of development. Open space within the Stage 1 park area and park spaces in subsequent stages would be drilled at a later date when additional geo-exchange capacity is required.

There are two existing, large-diameter combined sewers under Blatchford, which meet at the southeast corner of the site along Princess Elizabeth Avenue under the future Town Centre. This provides as ideal location for a sewer heat exchange facility . The sewer heat exchange facility will be constructed as part of the Town Centre development servicing.

The construction of the DESS infrastructure represents a substantial investment decision, which will be spread out over time and will require ongoing review and approval by City Council. To begin construction of the DESS system, City Council must approve a business case for the DESS to meet the future thermal energy needs of the Blatchford neighbourhood. Council must also authorize the funding required for the initial stages of the DESS including the first geo-exchange field under the Stage 1 stormwater facility, which will be used as the initial heat source for the

DESS. As residential development continues and additional thermal capacity is required, future Council approval will be required to authorize the construction of additional renewable energy infrastructure to expand the capacity of the DESS system. Along the path of developing the DESS system, other opportunities may arise to further advance the DESS system. These opportunities include:

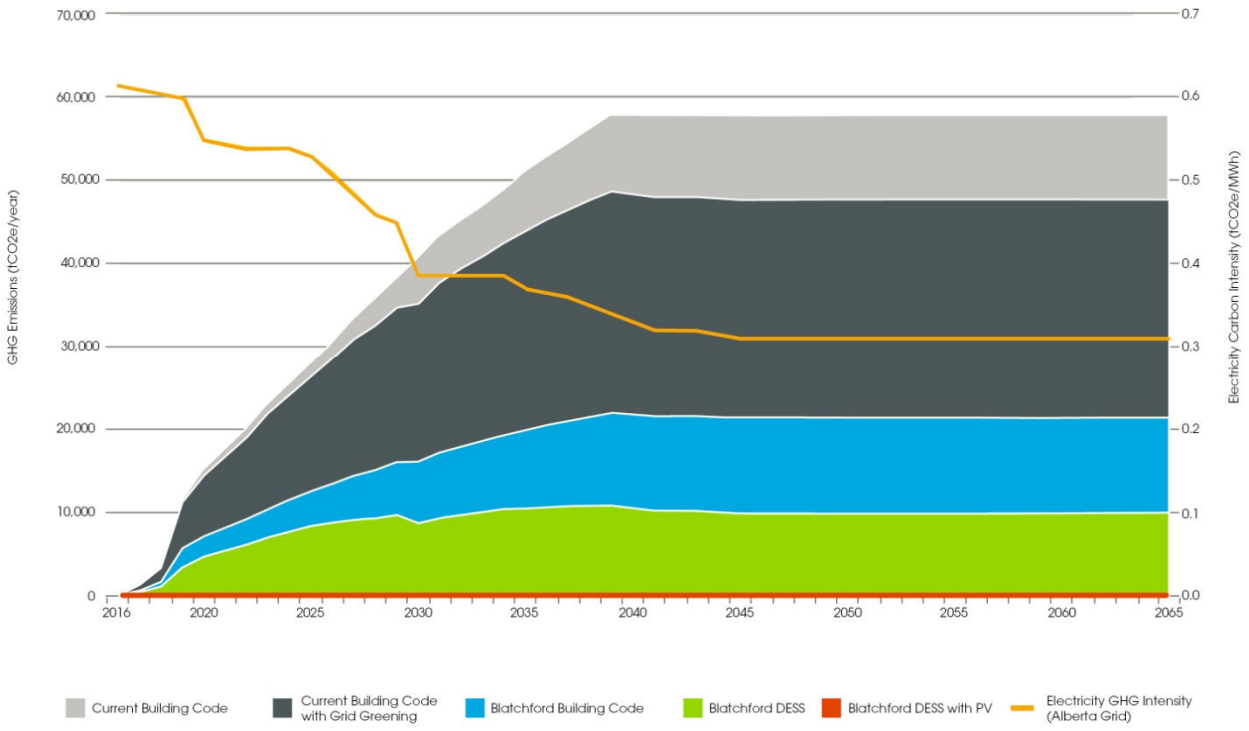
- expanding the loads serviced by the DESS;
- implementing new thermal energy sources and technologies to improve efficiency; and
- incorporating traditional heating or cooling infrastructure to offset or delay the cost of additional renewable energy infrastructure investment.

As a City-led project, regular status updates, check-ins and reports prepared for Council's review and approval will be critical to ensuring DESS decision-making aligns with Council's Vision for Blatchford and the City of Edmonton's financial priorities and capacity.

4.5 Greenhouse Gas Reductions

Implementing the comprehensive Blatchford energy strategy will significantly reduce the neighbourhood's greenhouse gas emissions, as illustrated in Figure 9.

Figure 9. Greenhouse Gas Emissions



The Blatchford high performance building envelope will reduce GHGs by approximately 55 per cent. The DESS with geo-exchange and sewer heat exchange will reduce emissions by a further 23 per cent, for a total projected reduction of GHG emissions of 78 per cent compared to business-as-usual. As solar PV is implemented, or as future renewable energy sources become viable, Blatchford has the potential reduce its GHG emissions associated with heating, cooling and domestic hot water by 100 percent.

5. Conclusion

City Council's ambitious Vision to create a carbon neutral community that uses 100 percent renewable energy is achievable in Blatchford. However, prior to advancing the District Energy Sharing System for Blatchford, critical information regarding the development of utility operations, required financial investments and associated risks need to be discussed by Council.

This report outlines a practical approach to district energy in the Blatchford community based on three primary strategies: energy conservation, energy efficiency and renewable energy. The Blatchford approach to DESS will reduce the demand for energy within Blatchford by implementing increasingly stringent standards for high performance building envelopes. It will focus on energy efficiency by implementing an ambient temperature District Energy Sharing System capable of sharing energy between buildings. Most importantly, it will optimize the use of multiple renewable thermal energy sources, including geo-exchange and sewer heat exchange, which leverage the unique assets of the site.

The preferred system is tailored to meet the challenges associated with developing a district energy system over the long-term. The DESS maximizes the ability to incorporate future technologies while maintaining flexibility to meet the needs of buildings not yet designed. Working together, these three strategies will deliver a district energy system that reduces the greenhouse gas emissions associated with the production of heating, cooling and domestic hot water by approximately 78 percent compared to business as usual. The development of additional strategies (such as installation of solar PV) to offset the emissions associated with electricity required by the DESS has the potential to achieve further reductions in this area and maintain the goal of delivering a fully renewable and carbon neutral energy system.

Facilitating sustainable development is a challenge faced by municipalities worldwide. Bold action is required to identify new methods to develop communities that preserve the environment for future generations. There is no silver bullet or one-size-fits-all approach. However, communities worldwide are using district energy to adopt a community-led approach to solving local and global sustainability challenges. The preferred approach to district energy provides the City of Edmonton with the ability to achieve carbon neutrality and the use of 100 percent renewable energy in Blatchford. Achieving this Vision at the scale of a mixed-use neighbourhood with 30,000 residents, within the energy context of the province of Alberta, has the potential to put Blatchford at the forefront of sustainable development efforts not only in Canada, but worldwide.