DISTRICT ENERGY STRATEGY

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Edmonton

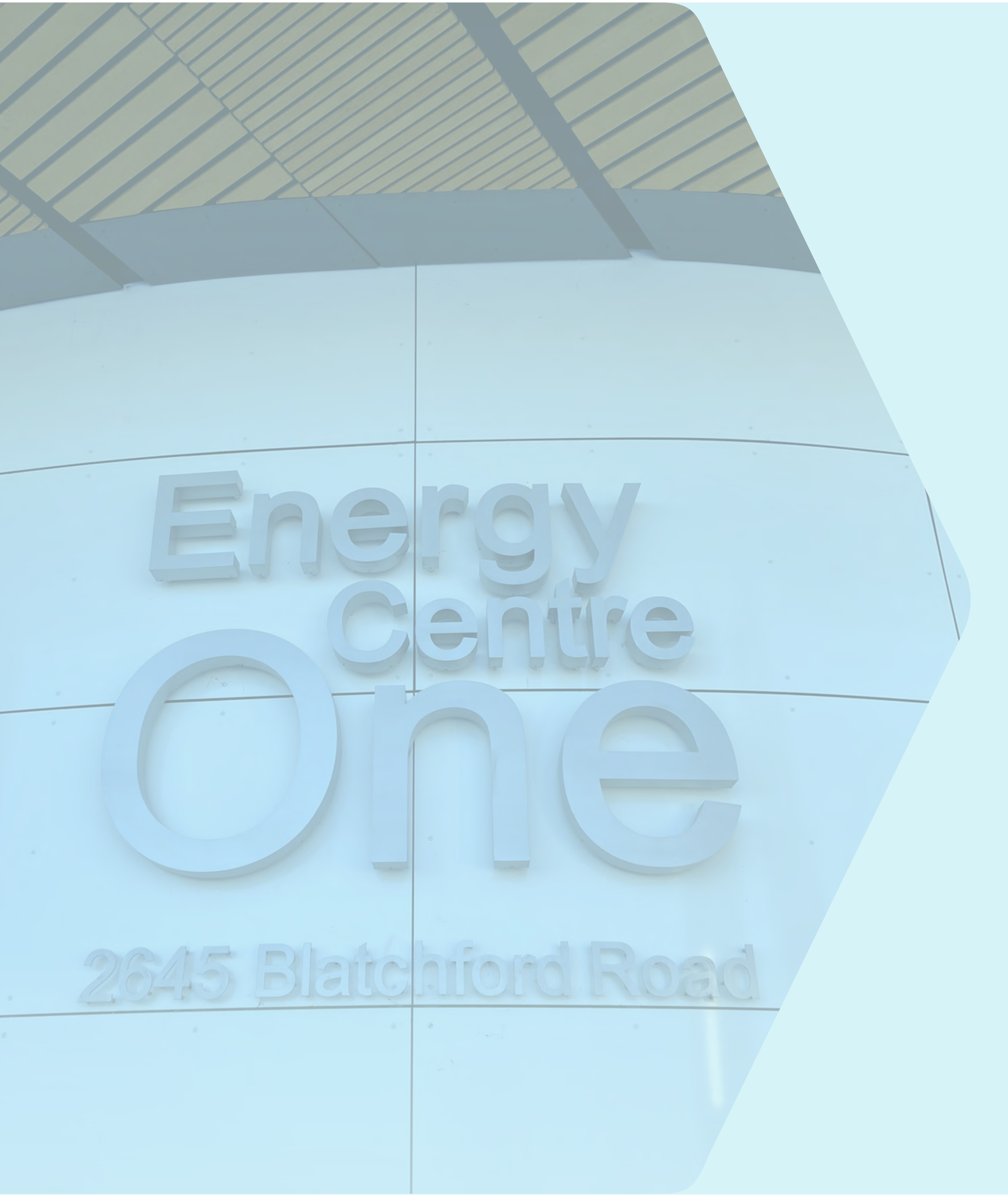
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TABLE OF CONTENTS

DISTRICT ENERGY STRATEGY GOALS AND OBJECTIVES

In 2021, Edmonton City Council adopted the revised Community Energy Transition Strategy, designed to ensure the City's climate targets are aligned with meeting the Paris Agreement commitment of limiting global temperature rise to 1.5 °C. The revised Strategy is targeting a 35% reduction in greenhouse gas (GHG) emissions (relative to 2005 levels) by 2025, a 50% reduction by 2030, and net-zero emissions by 2050.

Reducing emissions from heating and cooling buildings will be a key part of achieving Edmonton's climate targets. Commercial, residential and institutional buildings together account for 38% of the City's GHG emissions (from space heating, cooling and electricity use). The City is targeting a 19% reduction in building emissions through deep energy retrofits of existing buildings and a further 36% reduction in City-wide emissions through "Energy Systems Transformation", which includes both low-carbon electricity supply and low-carbon district energy systems for thermal energy supply.

The "Energy Systems Transformation" pathway identified in the Community Energy Transition Strategy includes a "City-wide decarbonized district energy network" to provide emissions-free thermal energy to connected buildings.

This District Energy Strategy was developed to support this objective. The findings are based on a geospatial analysis of housing density to identify which Edmonton neighbourhoods are likely to have sufficient thermal demand density to support a District Energy System, coupled with regulatory and economic conditions that support successful District Energy implementation.

The key results and recommendations in this document were provided in the February 2022 report "City of Edmonton District Energy Strategy" from Reshape Infrastructure Strategies, Kerr Wood Leidal and Torchlight Bioresources on behalf of the City of Edmonton.

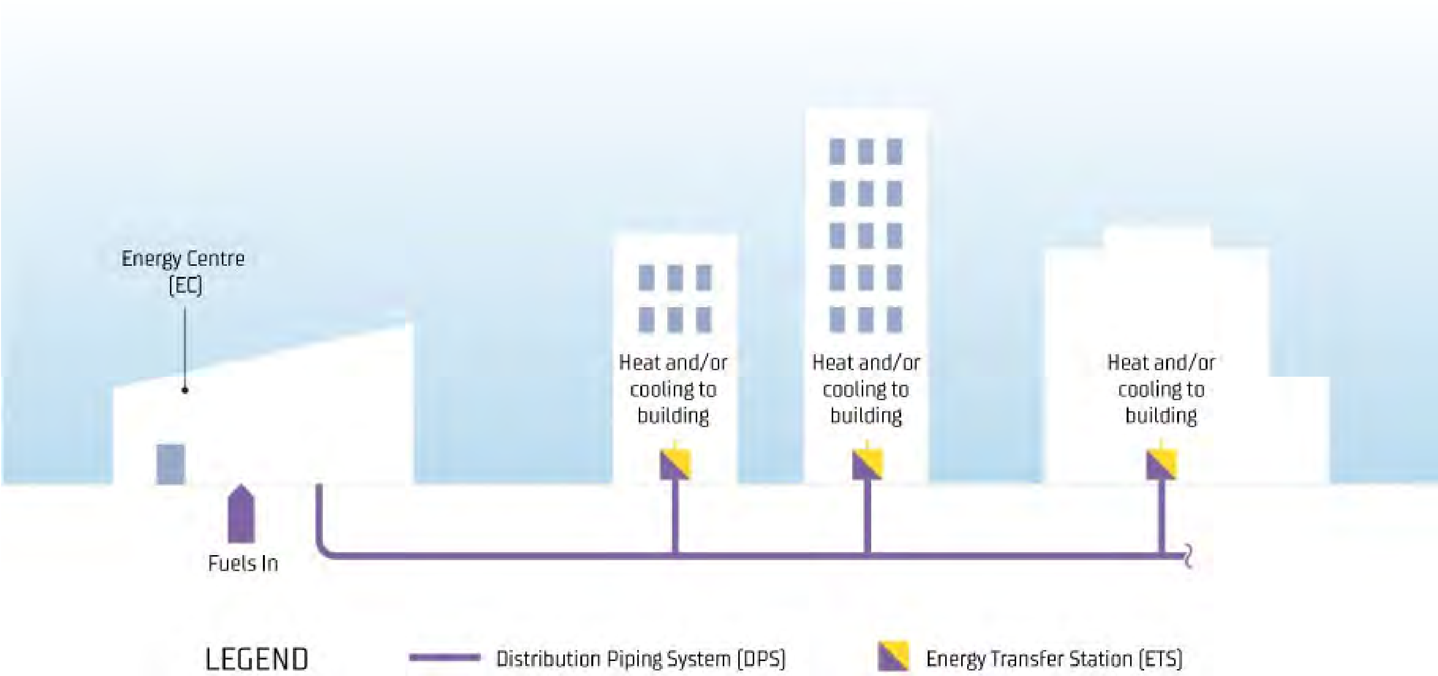
WHAT IS DISTRICT ENERGY?

District Energy Systems consists of three main components: One or more energy centres to produce thermal energy; a distribution piping system to connect the energy centres to individual buildings; and energy transfer stations at each building to supply space heating, domestic hot water heating and/or cooling (Figure 1).

In Edmonton's vision for a zero-emissions District Energy System, the energy centres must produce zero-emissions heat for distribution to connected buildings. This emission-free heat could come from a wide variety of low-carbon sources that may include waste heat recovery, geoexchange, bioenergy, deep geothermal energy, or fossil fuel combustion or waste-to-energy technologies coupled with carbon capture and storage.

Since cooling is primarily provided by electrically driven chillers or heat pumps, decarbonizing the electricity supply will be key to providing low-carbon cooling. With a decarbonized electricity grid, cooling generated by individual building chillers or chillers located in an energy centre would both be low-carbon. However, district cooling may facilitate access to other low-carbon cooling resources, such as geoexchange and river water heat exchange (if permitted), enable waste heat recovery, and produce chilled water at a higher efficiency than individual building systems.

Figure 1: Components of a District Energy System



Drivers for District Energy

Historically, the main drivers of District Energy were typically efficiency, energy security, cost and convenience. District Energy was also instrumental in improving air quality in many cities by displacing coal, biomass, or fuel oil use in individual buildings. With the development of natural gas grids and rapid progress in gas boiler technology, some of the original value propositions have waned, although older (legacy) District Energy systems continue to operate in many cities.

As cities have begun to develop climate action plans, there has been increasing recognition that existing and new District Energy Systems can be the most cost-effective path to low-carbon heating within dense urban areas, and one of the principal advantages is that it can facilitate economies of scale and/or access to low-carbon energy resources that are not technically or financially feasible at the scale of a single building. In addition, as transportation and heating are electrified, District Energy can help reduce the impact of increased load on electrical grids for cooling.

District Energy enables access to low-carbon thermal resources that would not be feasible at the building scale, including:

- Sewage heat recovery
- Treated effluent heat recovery (from a wastewater treatment plant)
- Industrial waste heat
- Process waste heat (data centres, for example)
- Geoexchange
- Deep geothermal
- Biomass boilers with/without carbon capture
- Biomass combined heat and power
- Waste to Energy: Combined heat and power with carbon capture

Conditions for District Energy

District Energy is not necessarily the optimal pathway to zero-emissions buildings for all neighbourhoods in Edmonton. Factors to consider include existing and planned development density, anticipated seasonal load profiles and proximity to local energy resources. Where conditions are not optimal, on-site low-carbon energy systems coupled with high-efficiency building envelopes and ventilation systems (or deep energy retrofits for existing buildings) may be preferred.

In the relatively recent past, compact, high-rise communities have traditionally offered the most compelling case for new District Energy development. However, as regulation (and/or) taxation of carbon emissions increase, the case for District Energy may become compelling even at lower densities.

The following criteria were considered for the purposes of identifying and evaluating District Energy opportunity areas in Edmonton in this study:

- High-density, new development (clusters of large buildings):
  - A node and corridor aligned with the City Plan.
  - A new neighbourhood developing under an official community plan designed to encourage density.
  - A master planned development/redevelopment of a large site.
- Areas where the City has increased control over the development process through rezoning, development permits and building permits to ensure connection to a District Energy System, or development of City-owned land.
- Presence of a potential "anchor" load for a new District Energy System (particularly municipally-owned buildings).
- Presence of a District Energy-scale low-carbon thermal resource.
- Voluntary or mandatory GHG emissions regulations for buildings (such as C627 the City's Climate Resilience Policy for City-owned buildings).
- Presence of existing high-density buildings that may connect in the future.
- Close proximity to an existing (or planned/developing) District Energy System.

District Energy and Existing Buildings

Developing District Energy solely for existing buildings and neighbourhoods can present financial and technical challenges. These include:

- Diffuse ownership of buildings, as well as shared ownership structures (e.g., condominium corporations in residential buildings).
- Lack of funding or financial incentive for connecting existing buildings to District Energy (particularly in the absence of GHG regulations).
- Long remaining service life of existing equipment and diverse timing of replacement schedules.
- Existing equipment (boilers/air handling units) located in penthouses, making tie-in difficult.
- Building heating systems/loads incompatible with District Energy (e.g., a low-temperature District Energy System cannot serve buildings with steam boilers without major mechanical retrofits).

While existing buildings alone are not usually sufficient to support development of a new District Energy system, it's still possible to connect existing buildings to existing or newly established systems that are anchored by new development. Areas with future plans for significant densification through infill or redevelopment provide good opportunity to establish or expand a District Energy System.

Edmonton is already in the process of developing a District Energy System in the downtown core, which will provide an opportunity to connect some of the largest existing and new buildings in the city. However, for the most part, outside of the City Centre areas, existing building height and density is relatively low.

Co-benefits of District Energy

In addition to the direct climate benefits realized by displacing natural gas use in existing buildings and avoiding additional emissions from new construction, District Energy can offer many co-benefits for municipalities, utilities, developers, community members and the environment.

Decarbonization of the Electricity Supply: Combined heat and power (CHP) fueled by biomass or solid waste with carbon capture and storage would provide stable, base-load, low-carbon electricity to support the Community Energy Transition Strategy 's "Energy Systems Transformation" objective of a fully decarbonized electricity grid. As the capacity of intermittent renewables such as solar and wind increases, and coal and gas fired power plants are phased out, the importance of having firm low-carbon power to stabilize the electricity grid will increase. Local low carbon electricity generation can also be used directly in a District Energy System, and hot or chilled water storage can be a lower-cost alternative to batteries when it comes to storing excess renewable power.

Electrical Distribution System Support: With electrification of transportation and heating, existing electricity distribution infrastructure will experience increased demands and capacity constraints. District Energy can relieve some of the strain on the electrical distribution system by enabling access to other forms of low-carbon heat; by centralizing electrical heating and cooling loads in energy centres so that they can be more easily managed through thermal storage; and by using electricity for heat efficiently with industrial scale heat pumps and large scale low-grade waste heat sources.

Solid Waste Diversion: A waste-to-energy facility including carbon capture could provide value to the City of Edmonton by enabling the City to achieve its goal of diverting 90% of solid waste from landfills. By using solid waste as fuel, the City would reduce the ongoing cost of tipping fees charged by landfills for waste disposal (resulting in a 'negative' fuel cost). A state-of-the-art waste-to-energy facility would include stringent air emission requirements and treatment and control technologies.

Forest Fire Mitigation: A large-scale biomass energy facility (either thermal only or CHP) could create a market for forestry residues and thinnings that have been removed to reduce the incidence and severity of forest fires. By creating a market for these low-value wood residues, District Energy can support job creation and economic development in rural areas and support adaptation to the warming climate that is driving increasingly severe forest fires across Canada. A proper fuel availability study would need to be conducted to provide more information.

Negative Emissions for Hard-to-Abate Sectors: Bioenergy carbon capture and storage using waste wood from forestry operations or wildfire management has the potential to generate "negative emissions" which can be used to offset sectors that are harder to abate, such as private transportation or heavy industry.

Enabling a Circular Economy: In addition to utilizing waste wood and municipal solid waste as fuel, District Energy can also facilitate waste heat recovery from sources such as data centres, refrigerated warehouses, ice arenas and air conditioning.

Resilience: District Energy facilities are designed to have redundant generating capacity and typically utilize more than one fuel source for heat generation. This dual-fuel (or multi-fuel) capability can provide greater resilience in the face of disruptions to the electrical grid or natural gas supply.

Job Creation: The District Energy sector generates employment through all phases of project development and operation, from planning and detailed design, through to manufacturing, construction, operation and maintenance and administration. Employment in the sector varies by system type, location, size, and corporate structure. A strong District Energy sector in Edmonton would provide good jobs in an emerging low-carbon economy for Alberta's large workforce of skilled tradespeople and engineers.

DISTRICT ENERGY OPPORTUNITY AREAS

The final prioritization of the District Energy opportunity areas in Edmonton shown in Table 1 is based on a combination of expected demand density, timing of development and other key success factors such as presence of anchor loads or low-carbon energy sources. They have been aligned with the 15 minute major or district nodes outlined in the City Plan.

Table 1: Prioritized District Energy Opportunity Areas

Opportunity Area	Priority Level for District Energy Development / Study	15 Minute District (Centre City/ Major/District Node)
Rossdale/River Crossing	*Ongoing feasibility study*	Centre City
City Centre	*Ongoing system development*	Centre City
Blatchford / Royal Alex / Kingsway	*Ongoing system construction and operation*	Major
Bonnie Doon	**1**	**District**
Heritage Valley	**1**	**Major**
City Centre: Oliver	**1**	**Centre City**
The Quarters	**1**	**Centre City**
Exhibition Lands	**1**	**District**
Mill Woods Town Centre	2	Major
City Centre: Chinatown	3	Major
West Edmonton Mall / Misericordia	3	Major
Stadium	3	District
University: Garneau	3	Major
Clareview Station	3	Major
Century Park	3	District

These opportunity areas account for approximately 25% of new housing that will be developed in Edmonton between now and when the population reaches 2.0 million in accordance with the City Plan. These neighbourhoods represent an opportunity to ensure that at least 25% of all new housing in Edmonton has zero emissions heating through low-carbon District Energy. Furthermore, by catalyzing District Energy at these new development nodes, nearby existing buildings can be connected to the systems and decarbonized without the need for extensive building retrofits.

The top priority areas should be the focus of near-term efforts to foster the development of District Energy, as once buildings have reached the building permit stage, it is usually too late to connect them to District Energy. Missing these opportunity areas would mean that some of the largest new developments in the city will likely be heated with conventional natural gas heating systems, resulting in technology lock-in that could endure for decades.

Recommended next steps for District Energy development in top priority areas are provided in this report. However, the potential for District Energy in the lower priority opportunity areas should not be dismissed. Development of District Energy in the lower priority areas (lower density and longer term) should be the focus of City-wide policies and strategies to ensure that District Energy is part of the planning and permitting processes for the areas identified.

Policy recommendations to support District Energy development in Edmonton are also provided in this report.

First Priority Areas

Bonnie Doon – District Node

- The redeveloped Bonnie Doon Mall site will have some of the highest new residential density in the city, surpassed only by The Quarters.
- Rezoning for the site is already completed, and based on the City Plan, this will be one of the first areas of the city to densify. It is crucial to begin planning for District Energy on the site as soon as possible to ensure all new buildings are connected to the system.
- The City is planning a new twin ice rink arena at the Dermott District Park site, close to the development. This City-owned facility could be an excellent source of waste heat for a District Energy System, and it could potentially house an energy centre.

Heritage Valley – Major Node

- This major node consists of Heritage Valley Town Centre, a new District Park and Recreation Centre, and a new hospital precinct. It will be served by the Capital Line LRT.
- Heritage Valley Town Centre is expected to have similar residential density to Bonnie Doon as well as non-residential development in the town centre.
- The hospital precinct will be served by a hospital-only District Energy System however, it may be possible to connect the hospital as an anchor load for low-carbon energy supply from a neighbourhood District Energy System.
- The City is planning to construct a new recreation centre west of the Town Centre which could be a key anchor load on a neighbourhood District Energy System and could potentially house an energy centre.
- Heritage Valley is expected to densify in the mid-term, however the hospital is currently being designed and is expected to be completed in 2030.

City Centre: Oliver – Centre City

- City Centre: Oliver is expected to have similar residential density to Bonnie Doon.
- Oliver also has some of the largest existing buildings outside of the City Centre, with high existing building density.
- Oliver is adjacent to the Downtown District Energy System, currently under development, and this system could potentially expand to connect buildings in Oliver or interconnect with an Oliver District Energy node.
- Oliver is expected to densify in the mid-term.

The Quarters – Centre City

- The Quarters is expected to have the highest new residential density in the entire city.
- The Quarters is expected to densify in the mid-term.
- The Quarters is adjacent to Downtown and the Downtown District Energy Initiative could potentially expand to connect buildings in the Quarters or interconnect with a Chinatown District Energy System node.

Exhibition Lands – District Node

- The Exhibition Lands are significantly lower in new residential density than the other top priority areas, however the Neighbourhood Plan for the Exhibition Land also includes substantial non-residential development.
- The Exhibition Lands are redeveloping in the near term, and it is important for the City to study the potential for District Energy on the site and develop a strategy before much of the development is complete.
- The City-owned Expo Centre could be an anchor load on a District Energy System.
- The City owns much of the land in the neighbourhood.

Second Priority Areas

Mill Woods Town Centre – Major Node

- Mill Woods Town Centre is expected to have significantly lower residential density than the top priority areas, however the Neighbourhood Plan for the Mill Woods Town Centre includes significant non-residential development, including the expansion of the Grey Nuns Hospital.
- Mill Woods Town Centre is redeveloping in the medium term, and it is important for the City to study the potential for District Energy on the site and develop a strategy before much of the development is complete.
- The expanded Grey Nuns Hospital could potentially house an energy centre, it is an ideal anchor load for District Energy, and the existing hospital's energy centre could be leveraged as part of the District Energy System.

Third Priority Areas

City Centre: Chinatown – Centre City

- Chinatown is expected to have very high residential density, but it is not expected to develop until much later than the first and second priority areas.
- Chinatown is home to the Downtown Division of the Edmonton Police Services, which includes several buildings that could be potential anchor loads for the system.
- Chinatown is adjacent to the City Centre and the Downtown District Energy System could potentially expand to connect buildings in Chinatown.

West Edmonton Mall / Misericordia – Major Node

- The West Edmonton Mall/ Misericordia area is not expected to have high new residential density in the near or medium term.
- However, the Misericordia hospital is expected to undergo renewal and there could be potential to establish a District Energy System as part of the renewal project. The hospital's energy centre could be leveraged as part of a District Energy System serving new and existing non-residential buildings.

Stadium – District Node

- The Stadium neighbourhood will have high new residential density, but not in the near or medium term.
- The City-owned Commonwealth Recreation Centre could be a potential anchor load on a District Energy System (DES) in the neighbourhood.

University: Garneau – Major Node

- The University-Garneau area is expected to have high density residential development in the very long term, in addition to significant existing density, adjacent to the University of Alberta campus.
- Waste heat from the University of Alberta district cooling system could be an excellent source of low-carbon heat for a District Energy System serving the surrounding neighbourhood.
- Decarbonization of the University of Alberta's district steam heating system has potential to reduce GHG emissions from existing buildings on campus.

Clareview Station and Fort Road – Major Node

- The Clareview neighbourhood will have high new residential density, but not in the near or medium term.
- The City-owned Clareview Recreation Centre could be a potential anchor load on a District Energy System in the neighbourhood.

Century Park (111 to 114 Street) – District Node

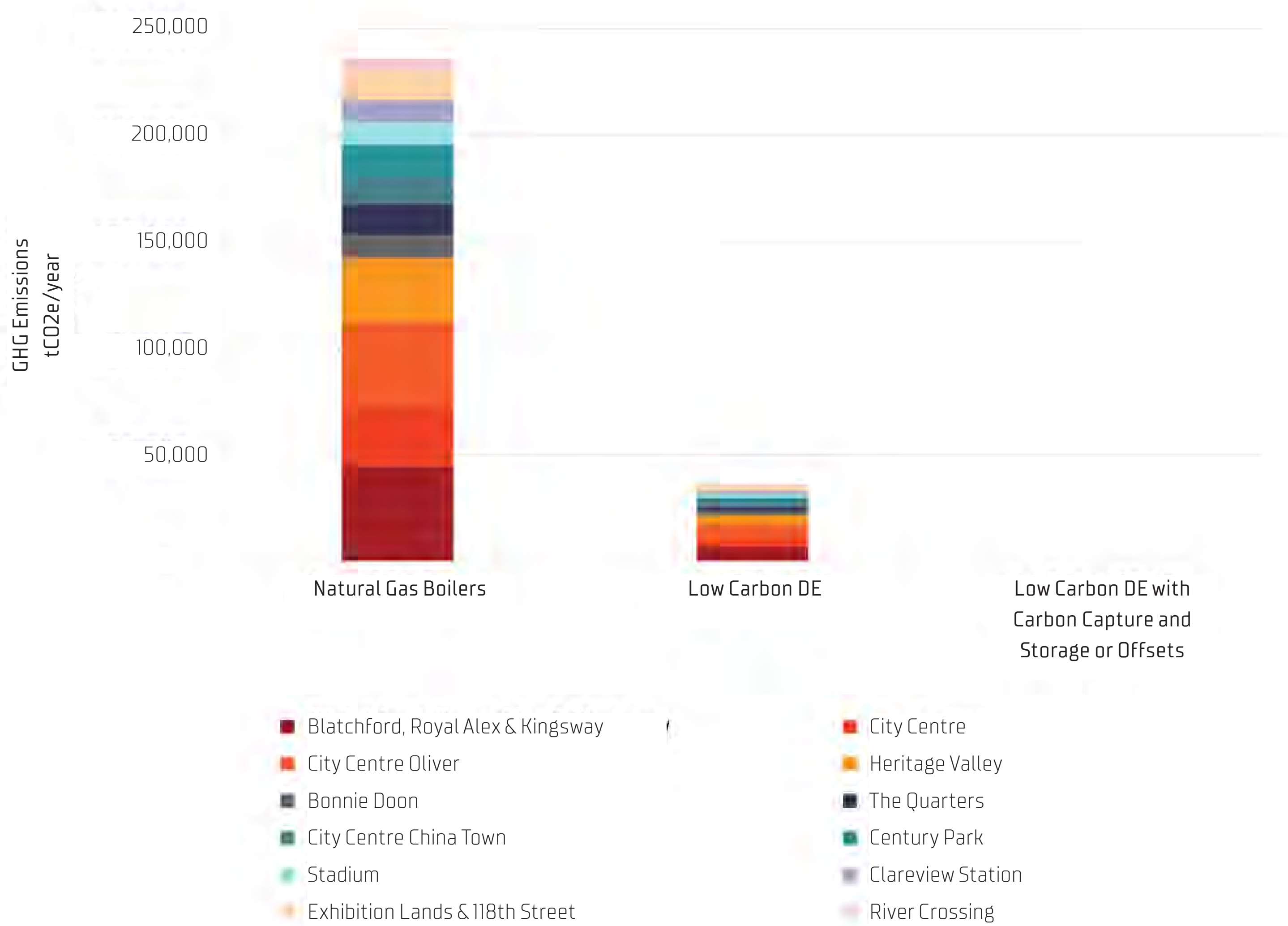
- The Century Park neighbourhood will have high new residential density, but not in the near or medium term.
- Century Park has several clusters of existing mid to high-rise buildings that could potentially connect to a District Energy System in the future.

Potential Impact on GHG Emissions

Based on certain energy use assumptions, the total annual emissions from new housing in District Energy priority areas identified would be in the order of 230 ktCO2e/yr (at build-out) if all the new development was heated by natural gas.

If the buildings in these densifying neighbourhoods were connected to low-carbon District Energy (DE) instead, the annual emissions at build-out could be significantly reduced or even entirely eliminated, depending on the energy supply mix of the District Energy System. Figure 2 shows the relative GHG impact of low-carbon DE in the areas identified above.

Figure 2: Potential Avoided Emissions from Low-Carbon District Energy in Edmonton



EDMONTON'S DISTRICT ENERGY STRATEGY

An effective District Energy policy framework in Edmonton must help to overcome the following key barriers to District Energy development:

- In the absence of emissions regulations or higher carbon prices, the low cost of gas-fired energy in new and existing buildings provides limited incentives to lower GHG emissions from buildings.
- While District Energy can reduce the long-term cost of low-carbon energy in denser neighbourhoods (and provide many other societal benefits), first costs and load risk can be barriers for getting new systems off the ground. Load risk can encompass both uncertainty in future development as well as uncertainty of connection.
- Development of a District Energy System requires coordination among many stakeholders, including multiple developers, building owners, district energy utilities and the City.

Municipally-Owned District Energy Systems

The most straightforward approach to overcoming the barriers noted above is one that has been employed by the City of Edmonton at Blatchford, following examples from the Cities of Vancouver, North Vancouver, Richmond and Surrey in British Columbia: A municipally-owned District Energy System with a mandatory connection bylaw within a defined service area.

While this approach has proven effective in multiple jurisdictions, the principal drawback is that it requires the municipality to take on most of the financial risk and responsibility associated with developing, owning, operating and governing a District Energy utility – although different ownership models and contracting arrangements could help to mitigate these risks.

There are several compelling advantages for municipally-owned District Energy Systems

- Municipal ownership could make it easier to establish mandatory connection requirements, to provide strong connection incentives to reduce load risk[1], and to set and control carbon intensity of Systems.
- Municipally-owned utilities are exempt from economic regulation by the Alberta Utilities Commission (AUC). While AUC regulation has enhanced transparency and credibility, some uncertainty over the form and level of regulation remain, which may be a perceived barrier to new privately-owned District Energy Systems.
- Municipalities have more flexibility to establish a level and form of regulation commensurate with the size and policy objectives for District Energy.

1 Municipalities can establish connection incentives or mandates for private systems, but there may be political or legal barriers to doing so, this depends on the jurisdiction.

Table 2: Summary of Different District Energy Ownership Models

	100% City	100% City ownership with Private Financing & Operations	Split Ownership		100% Private
Owner of Distribution	City	City	City	Private	Private
Ownership of Generation	City	City	Private	Shared / Split	Private
Financing & Operations	City	Private	Shared / Split	Private	Private
Example	*Blatchford*	*City of Richmond*	*District Energy Windsor*	*Metro Vancouver Regional District / River District Energy (pending)*	*Enwave Toronto*

Legend

City	Private	Shared / Split

- Municipalities may have a lower cost of capital or longer time horizon than private utilities (although municipalities may also have limited capital or competing requirements for capital).
- Municipal ownership can facilitate access to low-cost financing or grants from senior levels of government that may not be available to the private sector.

Municipal ownership does not necessarily mean that all District Energy Systems assets are financed, owned and operated by the municipality. Table 2 illustrates the range of ownership models possible for public and private ownership. In addition, municipal ownership can also be viewed as a transitional strategy to initiate and de-risk a new District Energy System. Once adequately established, the City could divest the system to the private sector. The City of Toronto is a good example of this. The now privately-owned DES in downtown Toronto was previously owned by the City of Toronto and the Ontario Municipal Employees Retirement System until it was acquired by Brookfield asset management in 2012.

Divestment can also be staged, with the municipality divesting of generation assets while retaining the distribution system. The proceeds from divestment could then be deployed in initiating other District Energy Systems, as illustrated in Figure 3.

Figure 3: Example of an Evolutionary Approach to District Energy Ownership

1 100% City Ownership & Financing

- Strong City leadership and policy tools to establish systems, de-risk initial investments and achieve scale
- No AUC regulation

2 City Divests of Generation

- City divests of generation functions but retains distribution to drive connections and network expansion
- Strong City control over system development and supply planning
- City leverages private sector to finance and operate existing generation assets and expand / develop new assets
- Load risk borne by City (which can be managed through distribution ownership and policy tools)
- Generation capital cost and performance risks partially transferred to private sector
- Partial AUC regulation (to be confirmed)

3 City Divests of Distribution

- City divests of distribution function once critical scale and GHG performance established
- Private sector finances and operates existing assets and expansion
- Full AUC regulation
- Ongoing policy role for City

Privately-Owned District Energy Systems

A policy framework that encourages private sector development of District Energy must do the following:

- De-risk private sector investment in District Energy by incentivizing buildings to connect to District Energy and/or introducing other mechanisms to lower initial costs or risks for new District Energy systems.
- Provide a coordinating framework for identifying and developing District Energy opportunities with the private sector.

De-risking Investment

Load risk is one of the biggest challenges facing new private District Energy Systems. Unlike electricity, sewer and water utility connections, buildings do not necessarily need District Energy Service, and in the absence of a mandatory connection bylaw or strong incentives, connection of privately-owned buildings to a District Energy System is uncertain.

Without adequate load certainty, private sector utilities are unlikely to invest the capital required to establish and expand a District Energy System. The lack of load certainty can also hinder the optimal sizing and expansion of networks (e.g., private District Energy providers may be hesitant to extend to buildings at the periphery if there is uncertainty over the future connection of other developments along the way).

In lieu of mandating connection, municipalities could incentivize buildings to connect to District Energy by making District Energy connection the simplest and lowest cost pathway for buildings to comply with City bylaws that:

- Put limits on GHG emissions from buildings; and/or
- Eliminate heating system alternatives (such as banning new gas grid connections or the installation of gas burning appliances).

It is critical that City policies also recognize connection to District Energy as a compliance pathway for meeting the GHG requirements of building emissions bylaws, similar to the City of Vancouver's Low-carbon Energy System compliance pathway in the City's Zero Emissions Building Plan. A key nuance of this is the timing of District Energy System decarbonization; a new District Energy System may need to reach a certain scale before it can be decarbonized, however buildings should be able to meet the GHG requirement by connecting to the District Energy System, with the understanding that the system will be decarbonized in the future, enabling buildings to comply with the GHG requirements in the interim.

The City can also help to de-risk new District Energy System development by committing to connect new and existing City-owned buildings to the system as anchor loads (as is the case with Edmonton's Downtown District Energy Initiative, connecting to Chancery Hall and Century Place). The presence of an anchor load may be enough to initiate District Energy development in a neighbourhood which can then be expanded to connect buildings that are incentivized to connect through green building policies.

Additional policies that could be studied to further encourage District Energy connection, based on experiences from other jurisdictions, include:

- Property tax rebates for connecting to District Energy System;
- Infrastructure fees: all buildings pay a neighbourhood-wide levy for District Energy, the fee is less if they don't connect than if they do (connection includes connection fee), but all buildings contribute.
- Accelerated rezoning and permit approvals for buildings that connect to the District Energy System.

In areas where a District Energy System is established and the system only needs to be expanded to serve additional buildings, the infrastructure fee or accelerated permitting process may be all that is required to incentivize building connection.

However, even once low-carbon building bylaws are in force, without City leadership to coordinate among stakeholders and facilitate District Energy development, buildings may simply resort back to individual building improvements. Therefore, the City District Energy policy must also provide a coordinating framework for developing new District Energy Systems in opportunity areas, which will be presented in the following.

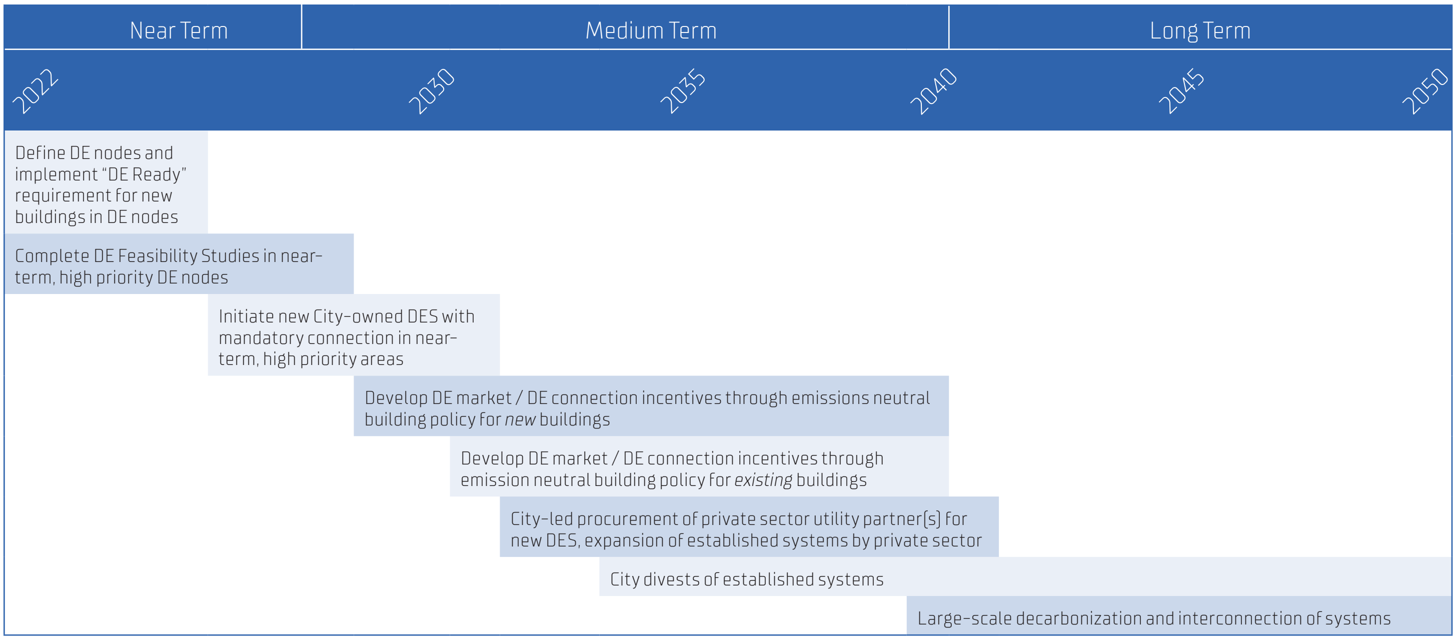
Providing a Coordinating Framework for District Energy

It is recommended that the City include District Energy as part of the infrastructure planning process in these prioritized neighbourhoods or "District Energy Nodes".

Within District Energy nodes, whether owned by the City or privately, the following policies and processes are recommended to support District Energy development:

- All buildings over a specific size threshold shall be designed to be "District Energy Ready" with hydronic (water) heating distribution systems and mechanical rooms located either at grade or in the parkade of buildings on the perimeter of the building. This will

Figure 4: Proposed Evolving District Energy Policy Framework



ensure that even if a District Energy System is not established in time to serve a particular building, buildings can more easily be connected to District Energy in the future.

- Requirement for all buildings over a specific size threshold to submit an Energy Modeling Report as part of the development application which will contain information that can be used to prepare or update District Energy System feasibility studies and business cases.
- City-funded District Energy feasibility studies in District Energy nodes (by order of priority and timing of neighbourhood development).
- After a City-led feasibility study indicates favourable conditions for District Energy in a node, the City may lead a competitive process to select a private sector utility to design, build, own and operate the District Energy System.
  - City awards a "franchise" to the selected utility to be the exclusive District Energy provider in the node (note: this would need to be approved by the AUC).
  - City backstops the cost of further District Energy feasibility studies by the private utility.
  - In District Energy nodes, the building carbon requirement is part of the District Energy System utility agreement (buildings automatically meet the GHG intensity requirement by connecting to the District Energy System).

An Evolutionary Policy Framework for District Energy Development

As noted in previous sections, the barriers and policy needs for District Energy will vary through the lifecycle of systems – from initiation to preliminary build out of networks, to implementation of low-carbon energy sources, to expansion and eventual renewal.

District Energy policies can, and should, vary across the lifecycle of individual systems with more City involvement required during system initiation. This could take the form of City ownership, or City leadership in selecting a private sector District Energy partner and establishing policy support for the private sector utility.

Project initiation requires strong connection requirements or incentives, however, once a system is established, more flexibility may be allowed and competition with District Energy may be introduced. An evolving framework is proposed so that near term District Energy opportunities are not missed while the City works to develop and implement policies that will encourage more private sector participation in the District Energy market in the future.

Swift action is required to address the climate emergency, and it is critical to work within the limitations of the existing City climate-energy policy and AUC regulatory context to prevent decades-long fossil fuel technology lock-in within densifying areas of the City. Since the City is not currently planning to enforce compulsory GHG emission limits for new and existing non-city buildings, a policy of initiating municipally-owned District Energy System with mandatory connection bylaws in priority areas is the primary means of ensuring that District Energy will develop in the near term.[1] The City can also support District Energy development by committing to connect new and existing City-owned buildings as anchor loads on City-owned or privately-owned systems.

It is recommended that the City take an evolutionary approach to District Energy ownership and development by initiating and de-risking new systems, and divesting once the system is established, only to re-invest the capital in another new system, or system expansion. This approach would be transitional as the City works to lay the policy and regulatory groundwork for more private sector investment in the longer term. In parallel with developing municipally-owned systems in the near-term opportunity areas, the City should take action to build the future market for District Energy by ensuring new large buildings in District Energy nodes are "District Energy Ready", and by developing a database of building heat load information that can be used to develop District Energy feasibility studies and business cases in the future.

Over the near and medium term, the City should make proposals to the AUC and seek decisions to ensure appropriate economic regulation of privately-owned District Energy systems, and clarify the AUC's approval criteria/process for franchise agreements. This will help to reduce the regulatory risk that private utility operators would face when developing or acquiring District Energy System in Edmonton in the future.

Over the longer term, the City should implement policies with compulsory GHG emissions limits for new buildings and eventually existing buildings. Alternatively, the City could consider the "gas ban" approach, preventing new buildings from connecting to the gas grid and prohibiting the installation of new natural gas-burning equipment in existing buildings. These policies will push buildings towards connecting to District Energy as the lowest cost and easiest compliance pathway, enabling established District Energy systems to expand, and de-risking the initiation of new systems by the private sector.

1 In neighbourhoods such as River Crossing where the City owns the land, the City may be able to require connection to a privately owned DES as a condition of the land sale.

INITIAL WORKPLAN

To realize the long-term City-wide District Energy vision, the City must lead feasibility studies for near-term District Energy opportunities and implement policies that will ensure that buildings connect to District Energy when systems are initiated. The following near-term actions are recommended to support District Energy development in Edmonton:

Ensure Buildings are Ready to Connect

- Define the City's District Energy nodes and implement a "District Energy Ready" bylaw requirement for large buildings in District Energy nodes.
- Commit to connecting new and existing City-owned buildings in District Energy nodes as anchor loads and leveraging City buildings to initiate new systems.
- Approach master developers or developers of large sites in District Energy nodes to coordinate on anchor load opportunities.

Lead District Energy Development

- Complete City-led District Energy feasibility studies in near term, high-priority areas.
- Initiate new City-owned District Energy system(s) in priority District Energy nodes with mandatory connection requirements; or
- Seek a private sector utility partner to develop District Energy in nodes where the City is the primary land or building owner and can require connection.

Build a District Energy Database

- Continue and actively expand existing building energy benchmarking opportunities, particularly for large buildings in District Energy nodes.
- Implement an energy modeling report requirement for large buildings as part of permitting to collect energy data for future District Energy feasibility studies and review "District Energy readiness" in District Energy nodes.

Develop Supporting Policies and Advocate for Appropriate Regulation

- Follow AUC decision on the newly privatized Calgary District Energy System that supports appropriate economic regulation of privately-owned District Energy in Alberta.
- Initiate work to determine regulatory and legislative changes required to implement mandatory emissions limits for existing buildings.
- Develop off-site infrastructure levy policy to fund District Energy (and incentivize connection).
- Develop accelerated permitting policy for District Energy connection (in non-mandatory connection zones).

APPENDIX A: CITY-WIDE DISTRICT ENERGY VISION

To achieve the Community Energy Transition Strategy goal of a City-wide decarbonized District Energy network, the City will need to initiate and expand discreet District Energy nodes throughout the City, with a long-term plan to interconnect and decarbonize the system at scale via a low-carbon energy transmission system that supplies low-carbon energy from a city-scale low-carbon energy centre to the local District Energy distribution systems established in each of the District Energy nodes.

This strategy is articulated in the five phases described below and illustrated in the following figures with the ultimate goal of an interconnected, decarbonized District Energy System by 2050. It is envisioned that these phases would unfold over the next 30 years, with the timing determined by the pace of population growth in Edmonton and the rate of densification in the District Energy nodes identified.

Phase 1 – Present

- Expand established District Energy node in Blatchford.
- Initiate new District Energy node in Downtown.
- Implement a "DE Ready" requirement for large[1] buildings throughout the City's DE nodes to ensure new buildings in District Energy nodes are ready to connect to District Energy when a system is initiated.

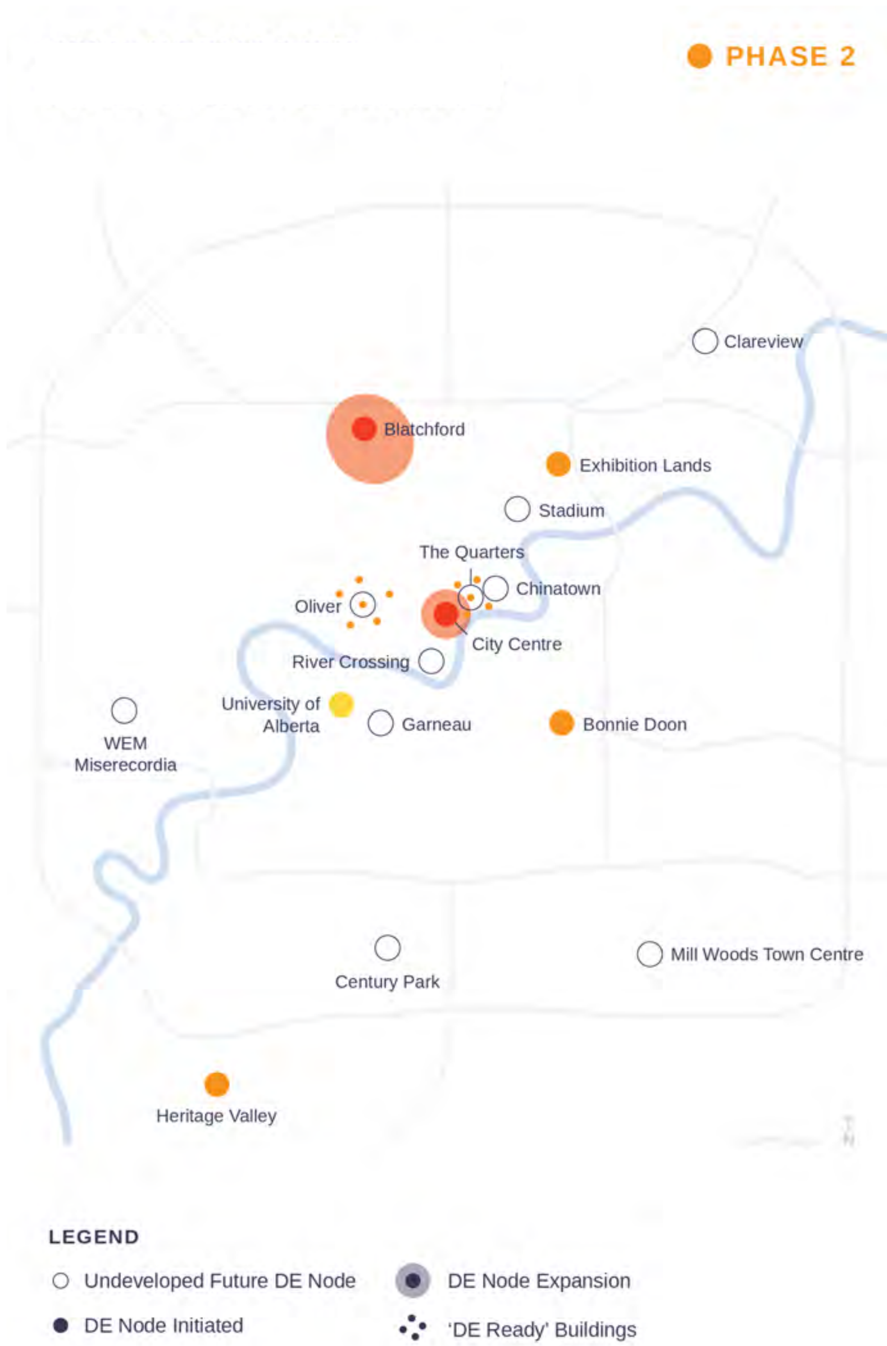
1 Size threshold for "DE Ready" requirement to be determined.

Phase 2 – Initiate New DE Nodes in High Priority Areas

» Initiate new District Energy nodes in Bonnie Doon, Heritage Valley and the Exhibition Lands starting with City-owned buildings as anchor loads (and potentially energy centres).

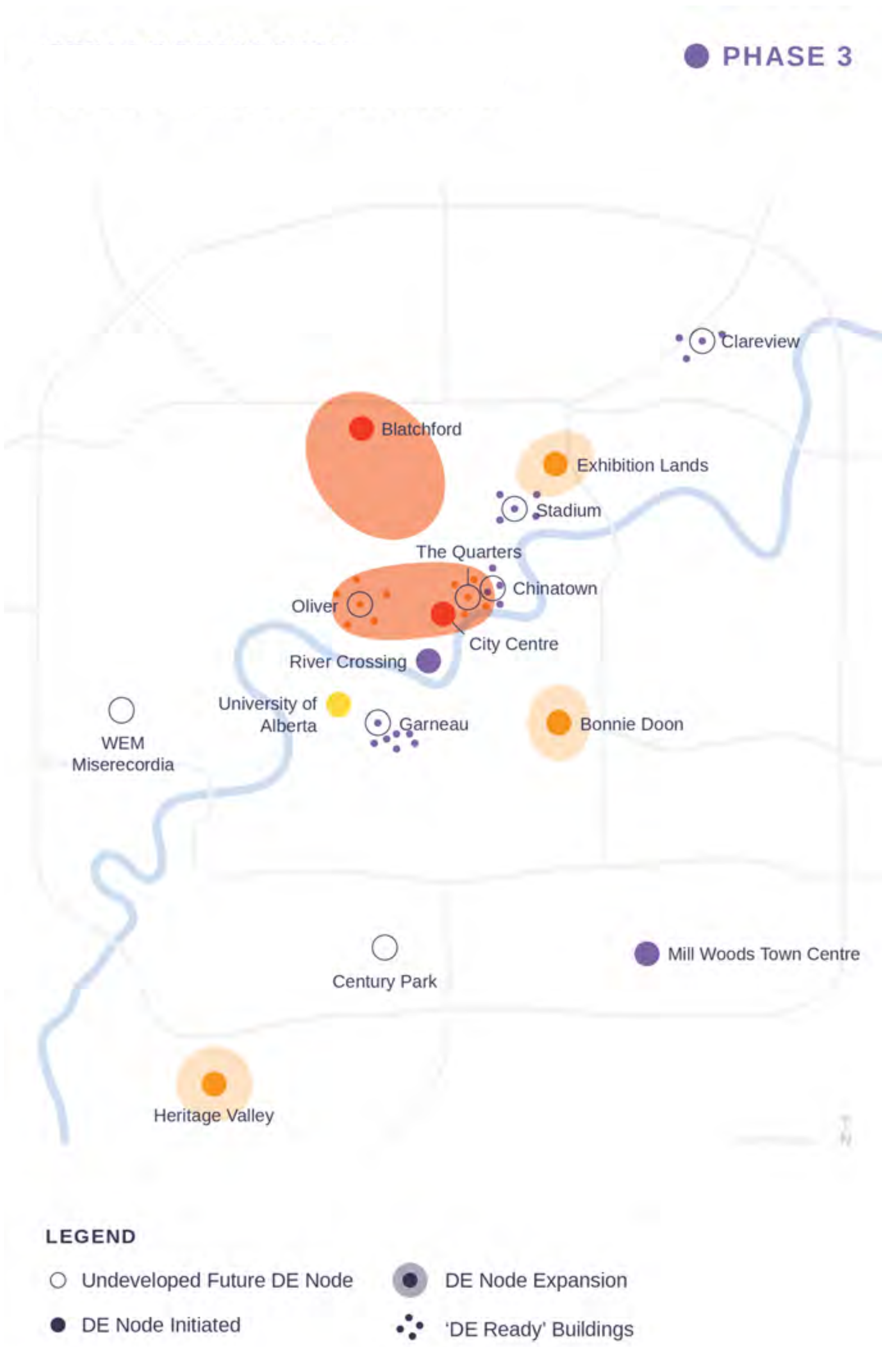
» The District Energy System in Blatchford continues to expand, connecting new development.

» The District Energy System in Downtown expands, connecting new and existing buildings.



Phase 3 – Expand Established Systems, Initiate New Systems

- Initiate a District Energy node in River Crossing, connecting City-owned buildings as anchor loads.
- Initiate District Energy node in Mill Woods Town Centre.
- Blatchford, Bonnie Doon, Exhibition Lands and Heritage Valley District Energy System expand to connect more buildings as neighbourhoods grow.
- Downtown District Energy System expands to connect "DE Ready" buildings in Oliver and The Quarters.



Phase 4 – City Scale Low-Carbon Energy Centre and Transmission Piping

- Construct City-scale low-carbon energy centre north of Downtown.
- Extend low-carbon energy transmission piping from City-scale low-carbon energy centre to established District Energy System in the Exhibition Lands, Blatchford, and Downtown.
- Construct District Energy distribution piping in the neighbourhoods of Clareview, Stadium and Chinatown to connect "DE Ready" buildings to low-carbon energy transmission systems.
- Existing buildings in District Energy System service areas connect to a decarbonized District Energy System.
- Connect "DE Ready" buildings in University Garneau to District Energy System (potentially heated by cooling waste heat recovery from the University of Alberta district cooling system).
- Established District Energy nodes in Heritage Valley and Mill Woods Town Centre continue to expand.

Phase 5 – Extend Low-carbon Energy Transmission System South

- Extend low-carbon energy transmission piping south to River Crossing and across North Saskatchewan River to the University-Garneau District Energy System and connecting other existing buildings within the expanded service area.
- Extend City-wide District Energy piping east along south Saskatchewan Drive to connect existing and redeveloping high-rise buildings north of 82nd Ave.

Phase 5.1 – University of Alberta District Energy System

- The University of Alberta heating District Energy System is currently a steam distribution system. If the University System were to undergo a steam-to-hot water conversion, the University could be supplied with low-carbon energy from the City-wide low-carbon District Energy System.

Phase 5.2 – Initiate New District Energy Nodes

- Initiate District Energy nodes in Century Park and West Edmonton Mall/Misericordia.

Phase 6 – Interconnection of Nodes in South and West of City (Conditional)

If the independent District Energy nodes in Bonnie Doon, Heritage Valley, Century Park, West Edmonton Mall and Mill Woods Town Centre require more low-carbon energy than can be supplied through local low-carbon resources, extension of the low-carbon energy transmission system may be justified to facilitate full decarbonization. However, the distances to these nodes from the core of the system near the city centre are very large, and the case for extending the transmission system may not be strong compared to other low-carbon energy supply options.

APPENDIX B : NEXT STEPS FOR HIGH-PRIORITY DISTRICT ENERGY OPPORTUNITIES

Bonnie Doon – District Node

Since the site rezoning of the Bonnie Doon shopping centre has been approved by City Council and the land is owned by a private developer, the City's opportunity to require low-carbon development or mandatory District Energy connection as a condition of the site rezoning or land sale is limited. However, the developer may still be convinced of the value of connecting to a City-owned District Energy System if the system can provide value to the developer, such as reducing the space required for heating and cooling equipment within individual buildings and "future proofing" their assets against the rising cost of the carbon tax and potential GHG regulation.

The recommended next steps for advancing the District Energy opportunity in Bonnie Doon are:

- Meet with the owner of the Bonnie Doon shopping centre to introduce the concept of District Energy and the value proposition for developers.
- Complete a District Energy feasibility study for the Bonnie Doon node. The study should include:
  - A commitment to connect new and existing City-owned buildings (such as the new twin ice rink arena).
  - Consideration of co-locating the energy centre within the new City-owned recreation facility.

Exhibition Lands – District Node

The City is the primary land-owner in the Exhibition Lands, and the owner of the Expo Centre (an existing building that is currently undergoing an integrated design process for facility renewal). Although the City does not plan to act as the property developer for the Exhibition Lands, the City does have considerable leverage to require connection to a District Energy System as the condition of the land sale to a private developer.

The recommended next steps for advancing the District Energy opportunity in the Exhibition Lands are:

- Ensure that the renovated Expo Centre's heating and cooling system is compatible with future connection to District Energy.
- Complete a District Energy feasibility study for the Exhibition lands with the Expo Centre as the anchor load on the system.

Heritage Valley – Major Node

The developing neighbourhood of Heritage Valley will be anchored by the new Heritage Valley Hospital campus with its own District Energy System, delivered by Alberta Infrastructure. The hospital is currently in the design intent definition stage, and the project is expected to begin construction in 2023 or 2024 with completion in 2030. The facility plan includes a provision to expand both the hospital and energy centre by 50% in the future. The design intent for the hospital is to be a LEED Silver facility with provisions in place to achieve net-zero emissions eventually.

The Heritage Valley Hospital District Energy System (HDES) concept is a medium temperature hot water and chilled water distribution system, and the hospital energy centre will be designed to house condensing boilers, heat recovery chillers and peaking chillers. While the design process and construction schedule for the hospital is too advanced to accommodate major changes, the HDES as planned could be compatible with an off-site low-carbon energy supply from a Heritage Valley Neighbourhood District Energy Systems (NDES) that could facilitate the hospital's net-zero transition.

The HDES design intent coupled with the intended transition to net-zero in the future provides a compelling opportunity for a low-carbon NDES to provide low-carbon energy to the hospital. Connecting the Heritage Valley Hospital could provide the scale of demand for low-carbon energy that could catalyze the NDES development.

To preserve the option for future interconnection of the HDES and NDES, the hospital's energy centre design will need to allow for a "tie-in" point with the NDES. This tie-in would likely take the form of an Energy Transfer Station (ETS) that would allow the NDES to supply energy to the hospital, in the same way it would supply energy to other buildings in the neighbourhood (but at a larger scale). The hospital ETS would maintain hydraulic separation of the HDES and NDES, and the hospital's energy centre would continue to house the heating and cooling equipment required to meet the needs of the hospital (full peaking and backup).

To advance the District Energy opportunity in Heritage Valley it is recommended that the City take the following next steps:

- Sign a memorandum of understanding with Alberta Infrastructure to further investigate the opportunity.
- Complete a feasibility study for the Heritage Valley NDES that includes determining the space and technical requirements for a hospital ETS.
- Determine what provisions may be required in the Heritage Valley Hospital procurement documents and project delivery contract to preserve the opportunity to connect the HDES to the NDES in the future.

For more information please visit: **edmonton.ca/energytransition**