

# CLEAN AIR PARTNERSHIP

## Low Carbon DE Series

Development and Implementation of  
a Municipal District Energy  
Strategy

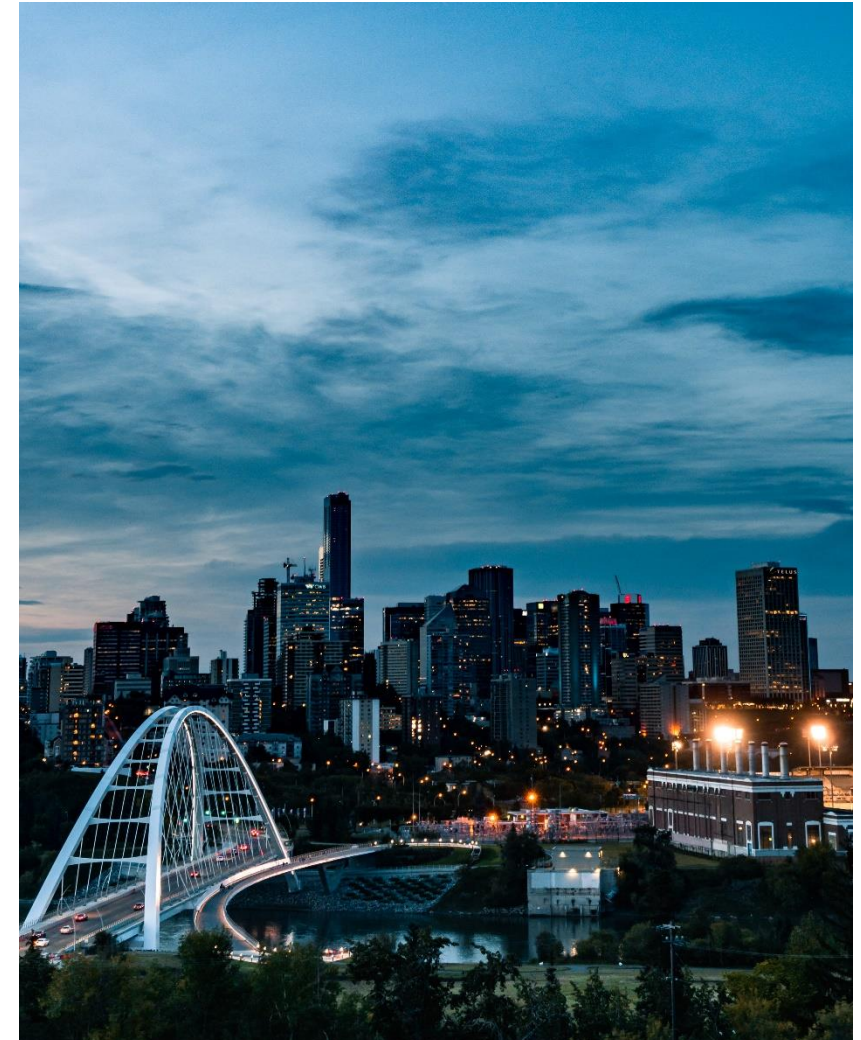
April 3, 2024



# AGENDA



Topic	Speakers	Time
<b>Introduction</b>	Desislava Stefanova, CAP	5 min
<b>DE Primer</b>	Gerard MacDonald, Reshape	5 min
<b>District Energy Opportunity Scan and DE Strategy Development</b>	Sonja Wilson, Reshape	10 min
<b>Implementation of Edmonton's DE Strategy</b>	Lida Fialka & Kelly Fordice, City of Edmonton (AB)	10 min
<b>DE Ownership Models &amp; and Green Building Standards</b>	Gerard MacDonald, Reshape	10 min
<b>DE Partnership Model Case Study: Lulu Island Energy Company</b>	Peter Russel, City of Richmond (BC)	10 min
<b>Q&amp;A</b>		10 min



1

DE PRIMER

# WHY DISTRICT ENERGY (CONVENTIONAL DE BENEFITS)



## Space Savings



## Resiliency



## Efficiency of Maintenance and Operations



# WHY DISTRICT ENERGY (CONTEMPORARY DE BENEFITS)



## Platform for Renewables Technologies and Sources



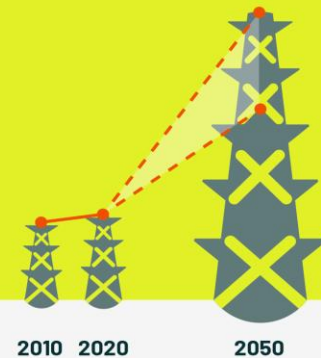
## Electrical Grid Support

### Canada's electricity systems need to get ...



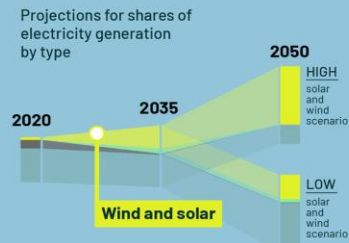
#### BIGGER

Electricity generation capacity needs to grow **2.2 to 3.4 times bigger** than today



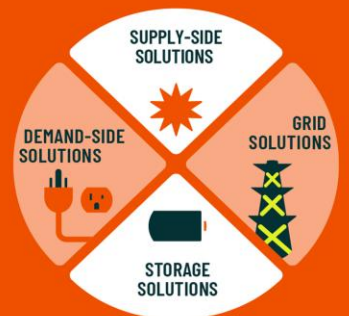
#### CLEANER

By 2050, wind and solar will make up **31-75%** of generation compared to only 6% today

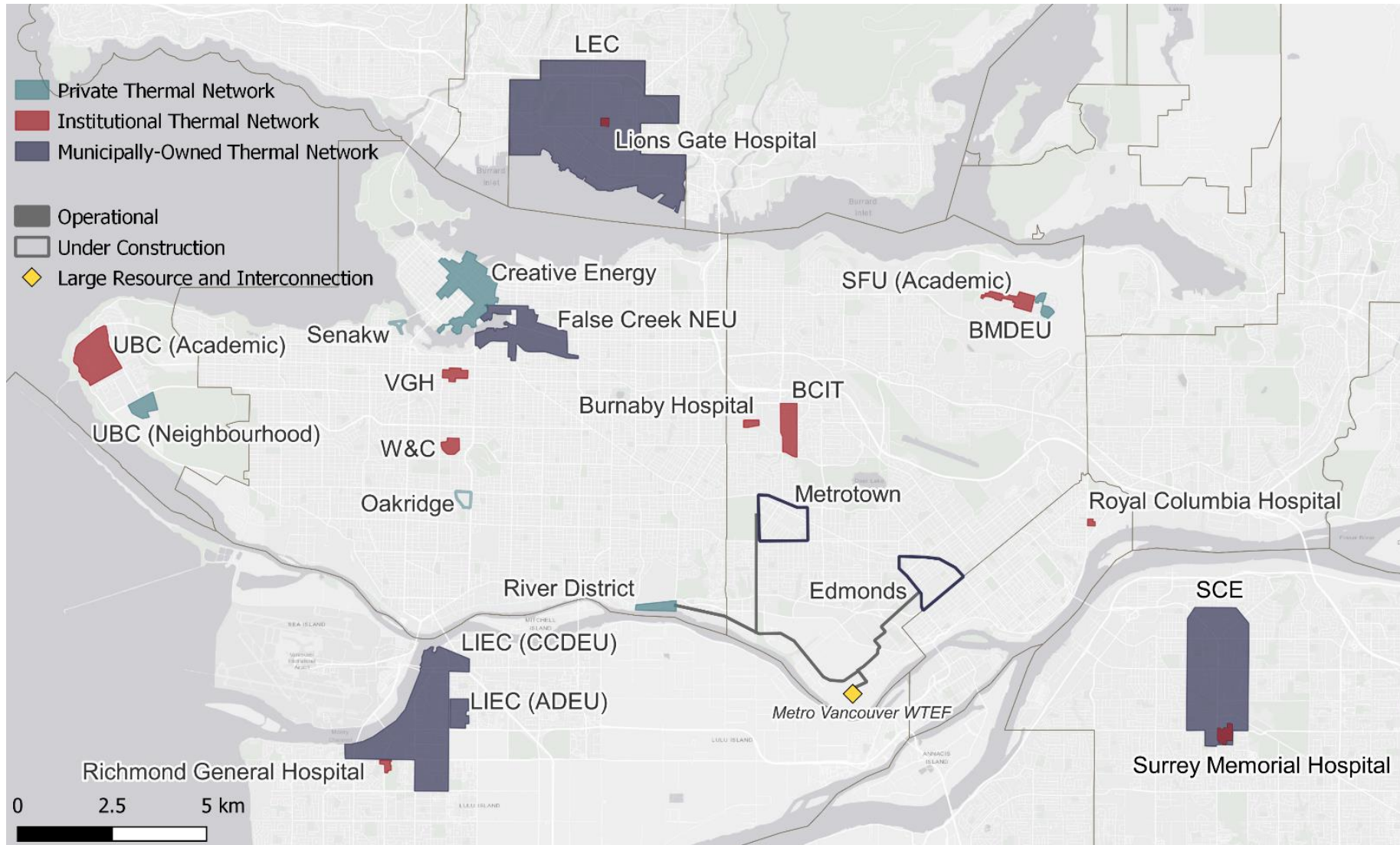


#### SMARTER

Canada needs to deploy a range of solutions to build smarter, more flexible systems



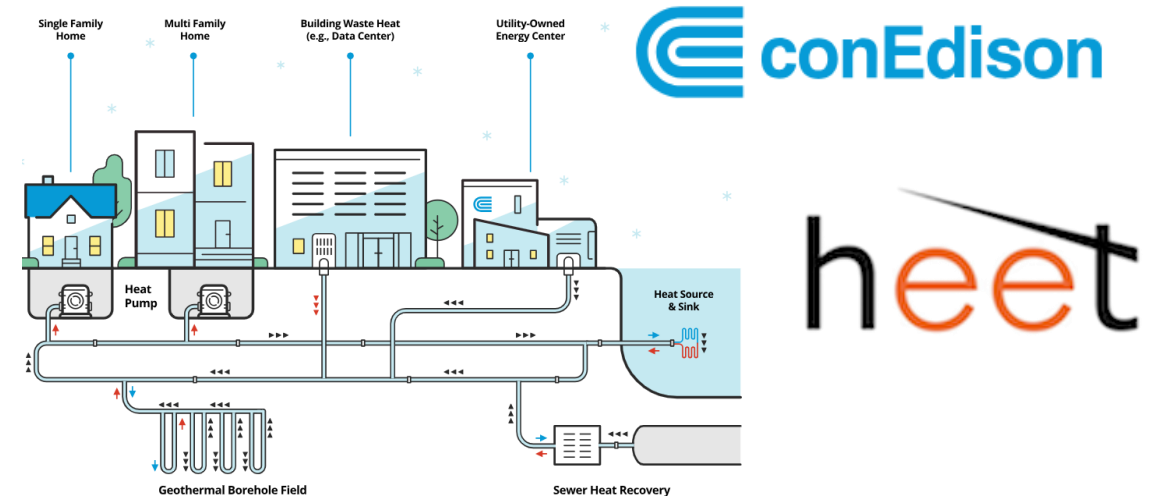
# DE IN THE BC LOWER MAINLAND



# DE IN CANADA AND US



- Cities across Canada and the US are looking at district energy as a means to:
  - **Enable renewable energy sources and technologies**
  - **Ease the burden on the electric grid** as they electrify heating and transportation
- **In Canada**
  - Next to the BC Lower Mainland, the **GTA and Ottawa** are seeing the most activity
  - **Calgary and Edmonton** are developing DE Strategies
  - DE Activity in many other cities from **Halifax to Yellowknife**
- **In the US**
  - Some states are implementing policies / programs (E.g. **NY State Utility Thermal Energy Networks and Jobs Act UTEN-JA**)
  - In **Massachusetts** utilities are implementing networked ge-exchange projects at single family home scale (E.g. Heet)
- Virtually all existing DE systems in North America have begun to consider how to decarbonize their systems in response to policy and market expectations



Top left: Enwave's Thermal Storage tank at 'The Well' (Toronto, ON) Image Credit: Enwave  
Top right: ESAP (Ottawa, ON) Rendering of Cliff Energy Centre. Image Credit Gov of Canada  
Bottom left: Con Edison's UTEN program  
Bottom Right: Home Energy Efficiency Team (Heet)

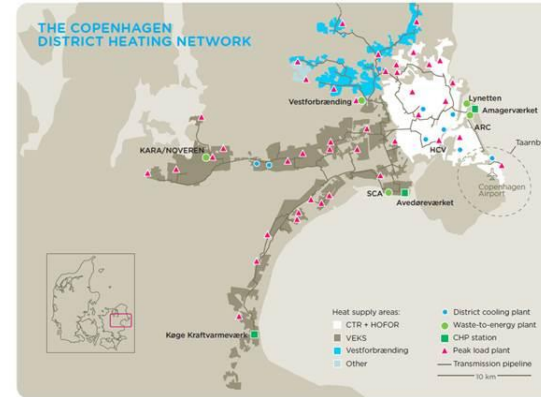
# INTERNATIONAL PRECEDENTS

## MATURE DE MARKETS



### Denmark & Sweden

- Very high share of buildings on district energy in many cities
  - **Copenhagen ~98%**
  - **Stockholm > 90%**
- Systems initiated in response to oil embargos in the 1970s
- Over time system have **shifted fuel mix from fossil to more renewable sources**
- Both Copenhagen and Stockholm have operational carbon capture and storage in their systems with **plans to expand operations to generate more Negative Emissions** (required under all Global Net Zero pathways to address hard to abate sectors)
- Sweden and Denmark have low per capita emissions (**both about 1/3<sup>rd</sup> that of Canada and the US**); Robust district energy programs are part of the reason for this



Top Left: Greater Copenhagen District Heating Network Image Credit: Danish Board of District Heating

Top Right: CopenHill (Copenhagen, DK) Image Credit: BIG

Bottom: Stockholm Exergie BECCS Plant (Stockholm, SE) Image Credit: Stockholm Exergie



# OTHER REGIONS TURNING TO DE



## United Kingdom



- Heat Zoning for all cities in UK
- Government target to increase share of buildings connected to DE **from 2% to 20% by 2030**

## Germany



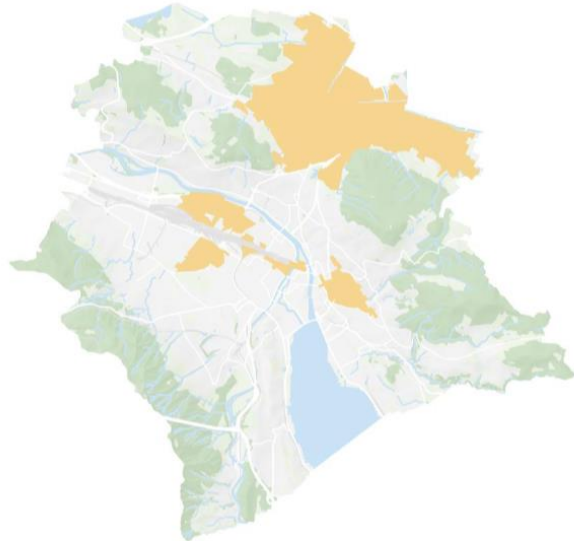
- Legislated required for Municipal Heat Planning
- In **2023 25%** of all new construction in Germany was connected to DE

## Netherlands

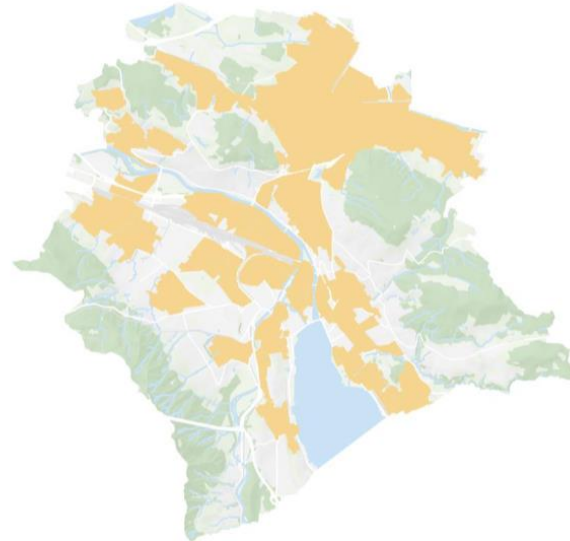


- Heat Transition Visions
- Driven largely by electric grid constraints
- **Gas-free neighborhoods**

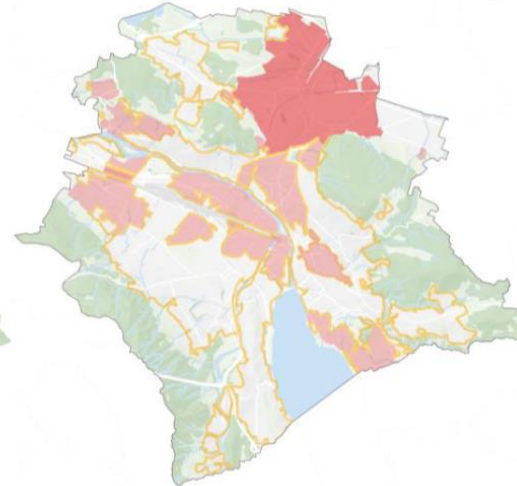
# ZURICH DISTRICT HEAT NETWORK EXPANSION & GAS GRID DECOMMISSIONING



Today:  
District Heating in  
approx. 30 %  
of the city



Future:  
District Heating in  
approx. 60 %  
of the city



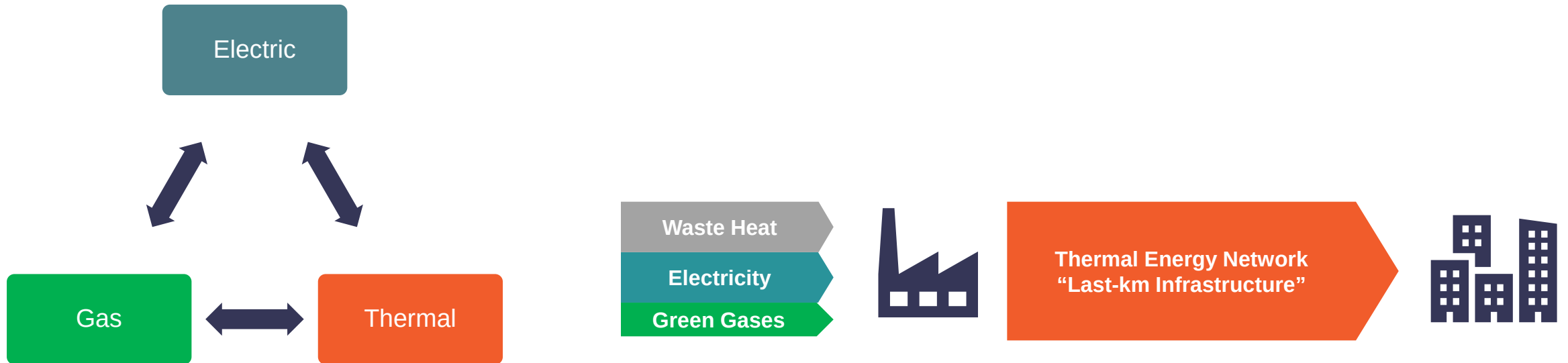
Areas for  
decommissioning  
of the gas grid

- decided and communicated
- not yet decided

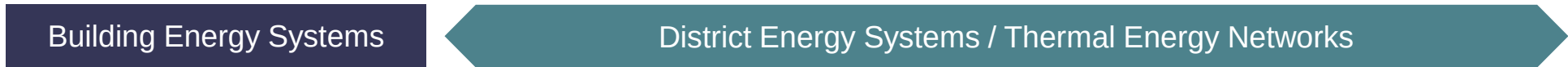


**Image Credit:** Decarb City Pipes 2050 from, "Legislative Barriers And Solutions To Unlock Cities' Heating And Cooling Strategies" (July 2023)

# DE (TEN) AS 'LAST - KM INFRASTRUCTURE'



# DE/UTEN VALUE PROP BY SCALE



**Building-scale**  
*Single Building*  
*One developer/owner*  
*(or one consortium)*

**Block-scale**  
*2-3 buildings*  
*Typically single*  
*developer/owner*

**Neighbourhood-scale**

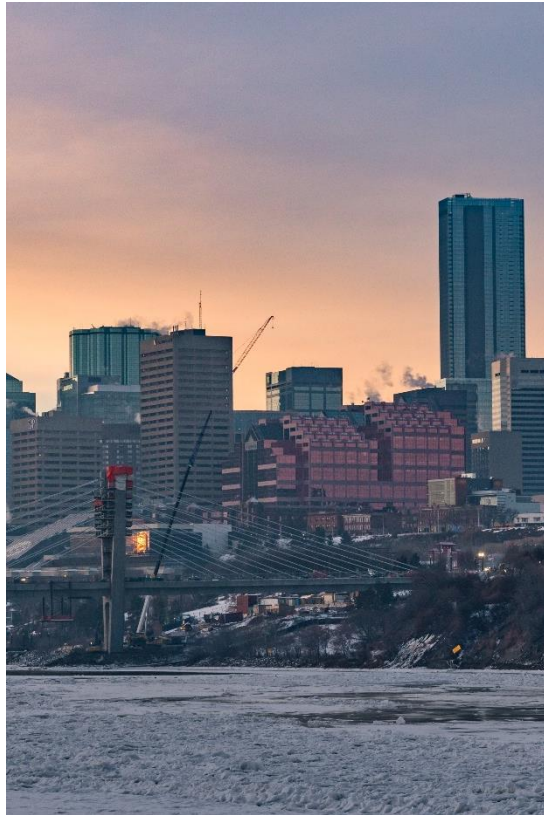
**City-scale**  
*(50-100+ buildings)*  
*Multiple developer/owners*

	Building-scale	Block-Scale	Neighbourhood-Scale	City-Scale
<b>DE/UTEN Value Prop</b>				
• Space, Resiliency, O&M	-	★	★★★	★★★★★
• Access to Renewables & Grid Relief	-	★	★★★	★★★★★

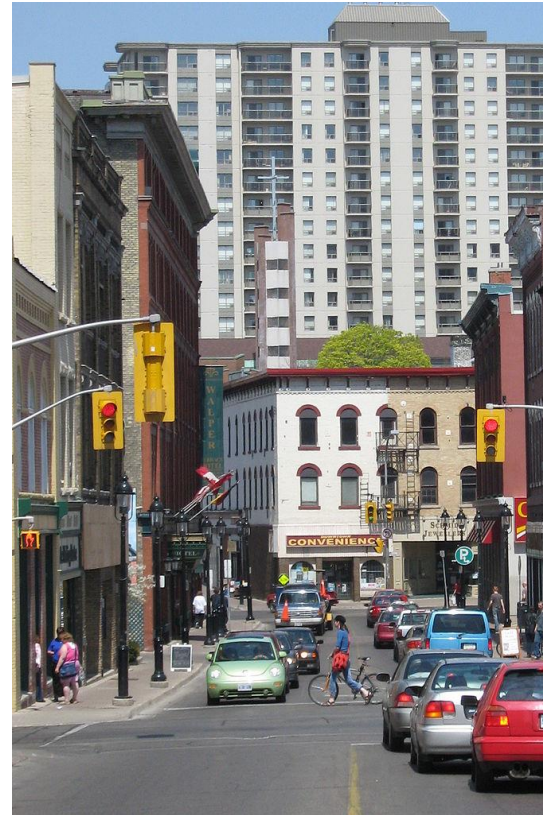
# 2

## DISTRICT ENERGY OPPORTUNITY SCAN & STRATEGY DEVELOPMENT

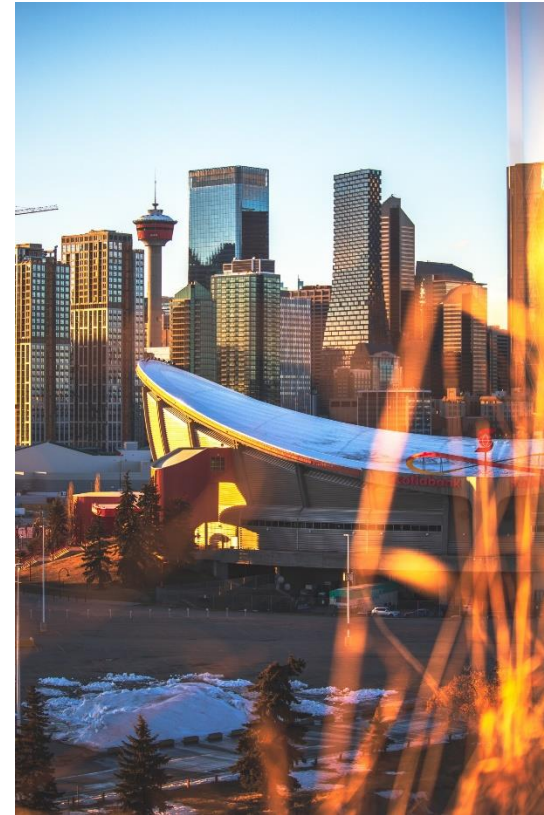
# DISTRICT ENERGY OPPORTUNITY SCAN & STRATEGY DEVELOPMENT



**City of Edmonton**



**Waterloo Region**

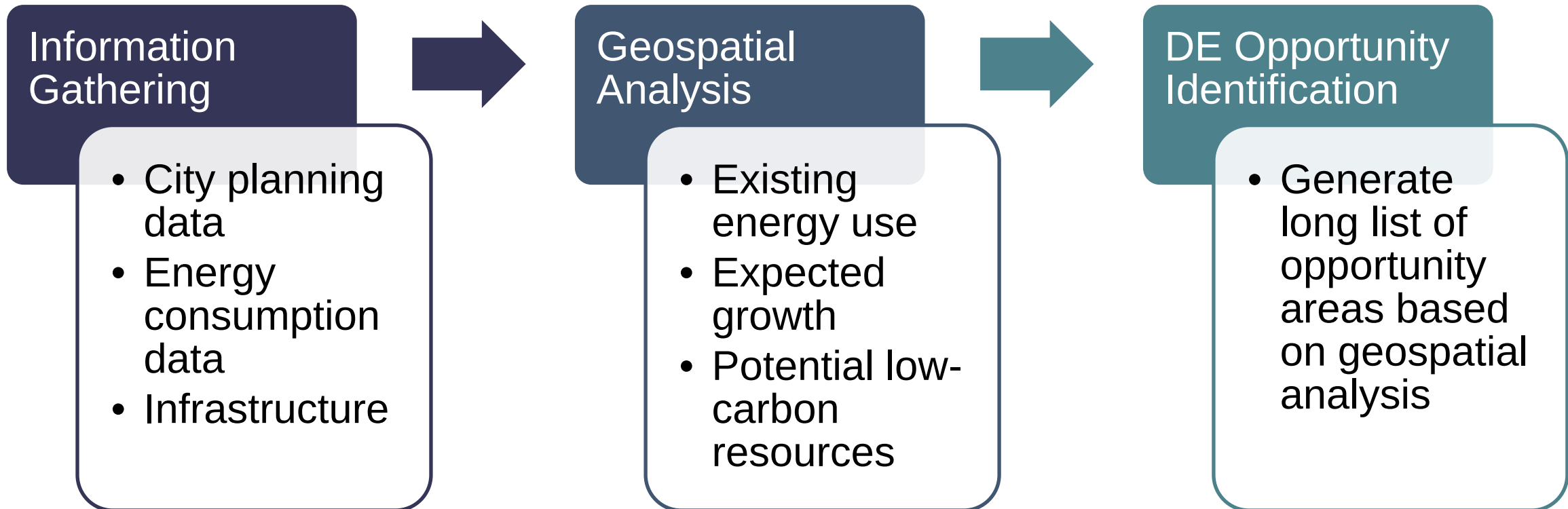


**City of Calgary**



**City of Coquitlam**

# DISTRICT ENERGY OPPORTUNITY SCAN



# DE OPPORTUNITY FILTERING AND PRIORITIZATION



## Screening & Prioritization Criteria

- Expected thermal energy demand density of area
- Timing of growth
- Presence of low-carbon resources
- Presence of potential anchor loads
- Municipal authority to implement DE policies in area





# CITY OF EDMONTON DISTRICT ENERGY STRATEGY



**Table 1: Prioritized District Energy Opportunity Areas**

Opportunity Area	Priority Level for District Energy Development / Study	15 Minute District (Centre City/ Major/District Node)
<i>Rossdale/River Crossing</i>	<i>Ongoing feasibility study</i>	Centre City
<i>City Centre</i>	<i>Ongoing system development</i>	Centre City
<i>Blatchford / Royal Alex / Kingsway</i>	<i>Ongoing system construction and operation</i>	Major
<b>Bonnie Doon</b>	<b>1</b>	<b>District</b>
<b>Heritage Valley</b>	<b>1</b>	<b>Major</b>
<b>City Centre: Oliver</b>	<b>1</b>	<b>Centre City</b>
<b>The Quarters</b>	<b>1</b>	<b>Centre City</b>
<b>Exhibition Lands</b>	<b>1</b>	<b>District</b>
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

Source: [City of Edmonton DE Strategy](#)

# CITY OF EDMONTON DE STRATEGY



CITY OF EDMONTON DISTRICT ENERGY STRATEGY

● PHASE 1

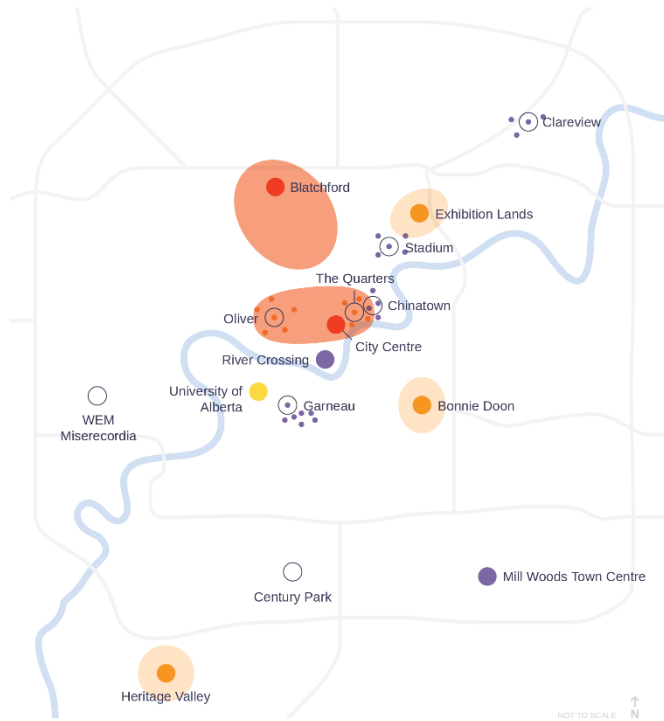


**LEGEND**

- Undeveloped Future DE Node
- DE Node Initiated
- DE Node Expansion
- ⋯ 'DE Ready' Buildings

CITY OF EDMONTON DISTRICT ENERGY STRATEGY

● PHASE 3

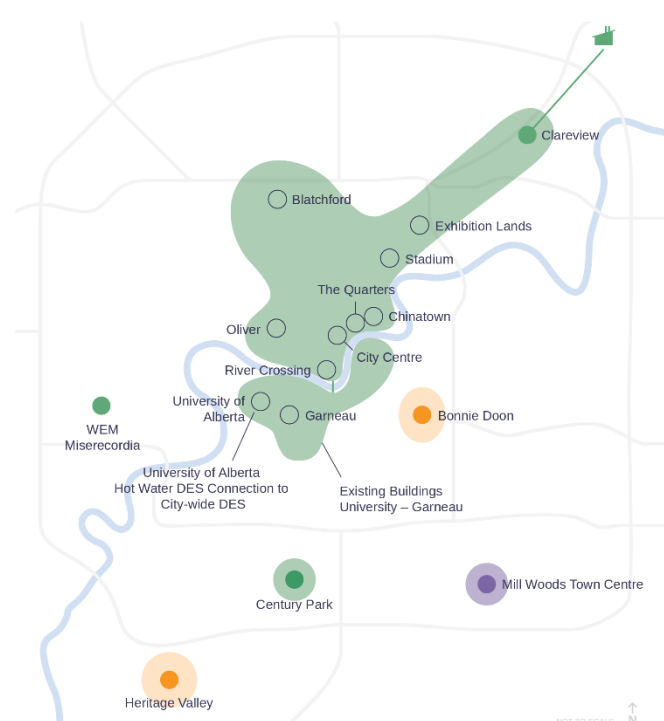


**LEGEND**

- Undeveloped Future DE Node
- DE Node Initiated
- DE Node Expansion
- ⋯ 'DE Ready' Buildings

CITY OF EDMONTON DISTRICT ENERGY STRATEGY

● PHASE 5



**LEGEND**

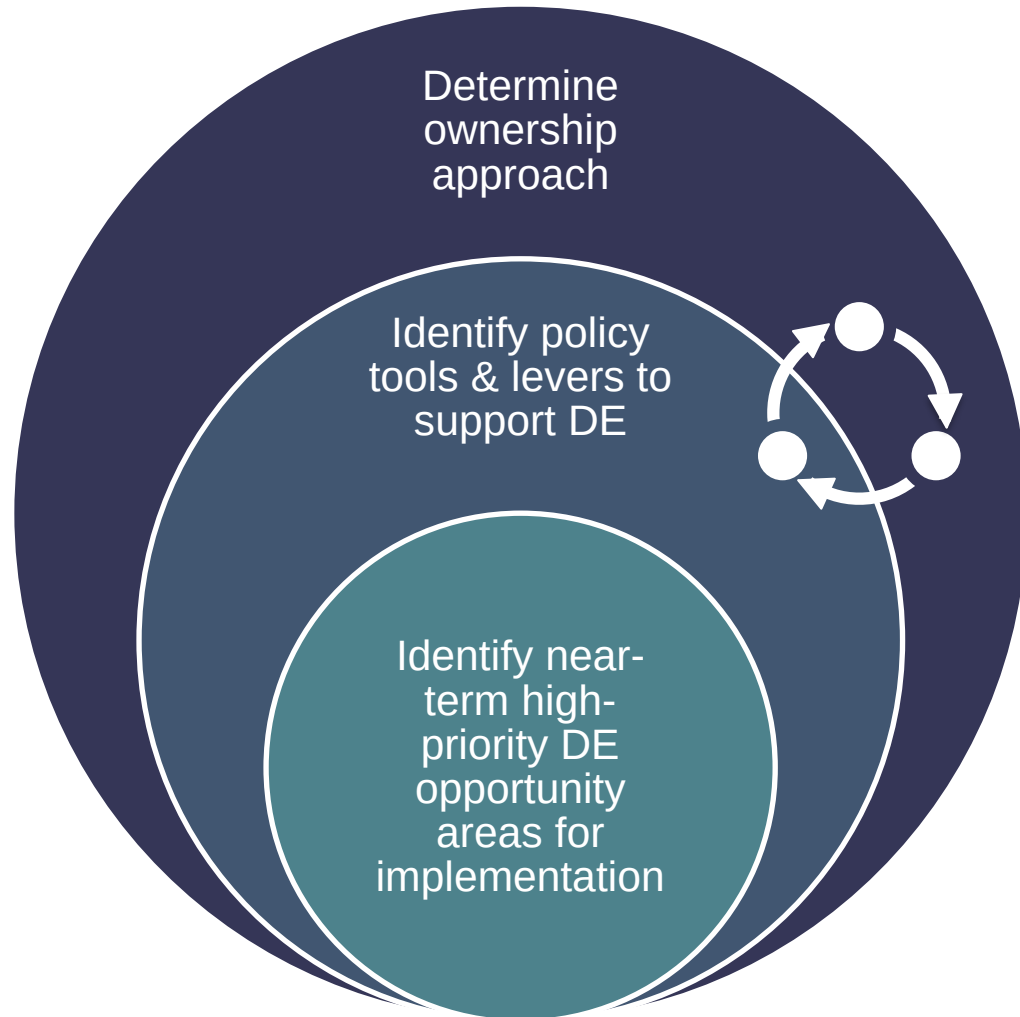
- Undeveloped Future DE Node
- DE Node Initiated
- DE Node Expansion
- ⋯ 'DE Ready' Buildings



# 3

## DE STRATEGY IMPLEMENTATION

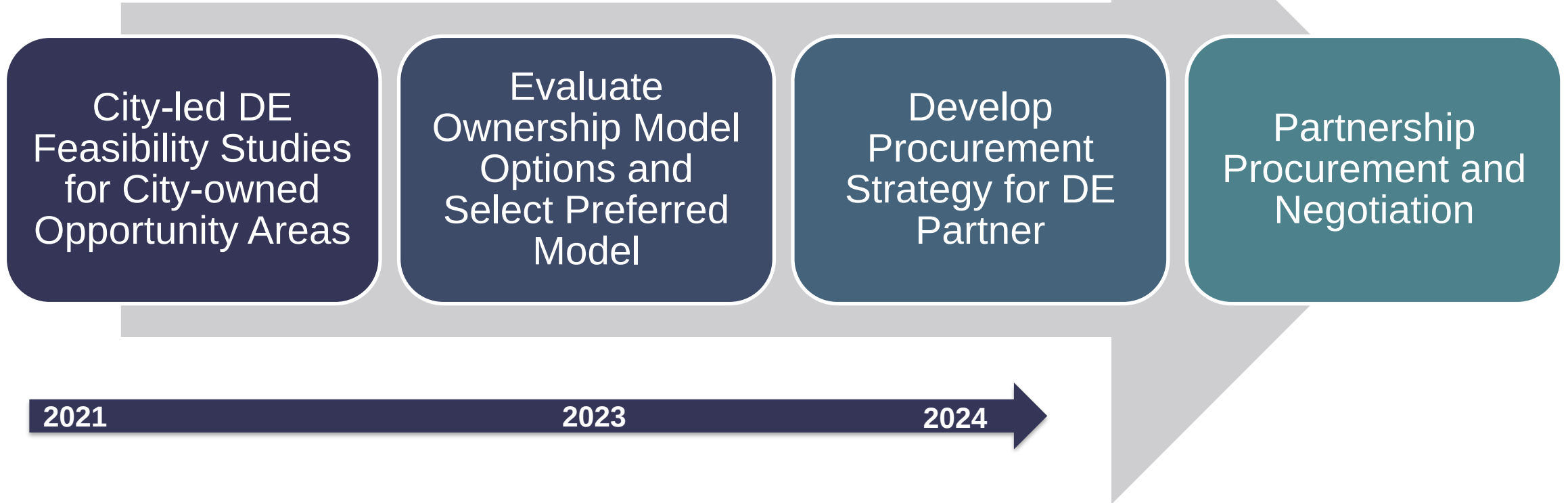
# DISTRICT ENERGY STRATEGY IMPLEMENTATION



## Influenced by...

- Jurisdictional Authority
- Regulation of DE
- Land Ownership in DE Nodes
- Local Culture

# EDMONTON DISTRICT ENERGY STRATEGY IMPLEMENTATION



# APPROACHES TO DISTRICT ENERGY POLICY



## Compulsory

- Mandatory Connection bylaws in service area
- DE connection required as condition of municipal land sale
- Provision of or connection to DE required as a condition of rezoning approval process

- Municipal franchise agreements with 3<sup>rd</sup> party providers that govern
  - GHG Intensity of supply
  - Obligation to serve
- Pro-active connection of City-owned facilities
- Green building policies with greenhouse gas intensity requirements

## Non-Compulsory

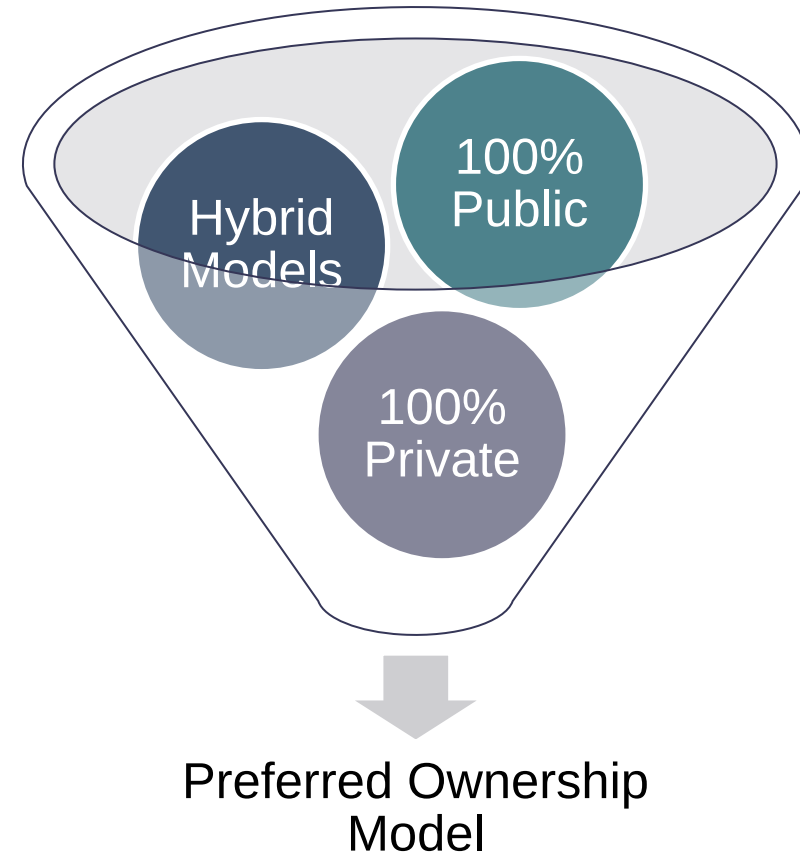
- Incentives
  - Density bonuses
  - Accelerated permitting
- Connection encouraged in planning process
- Access to land / rights of way
- Access to resources
- Access to information
- Access to City resources
- Requirement to study DE

# SELECTION OF A PREFERRED DE OWNERSHIP MODEL



## Ownership Model Evaluation Criteria

- Capital requirements
- Ability to mitigate connection risk through policy
- Control over GHG outcomes
- Control over rates / affordability / equity
- Regulatory complexity



# 4

## OVERVIEW OF DE OWNERSHIP MODELS



# DISTRICT ENERGY (DE) OWNERSHIP AND GOVERNANCE MODELS



## The range of DE Ownership Models include:

- 100% Public
- Hybrids
- 100% Private

## Elements of models include:

- Ownership & Governance
- Development
- Operations

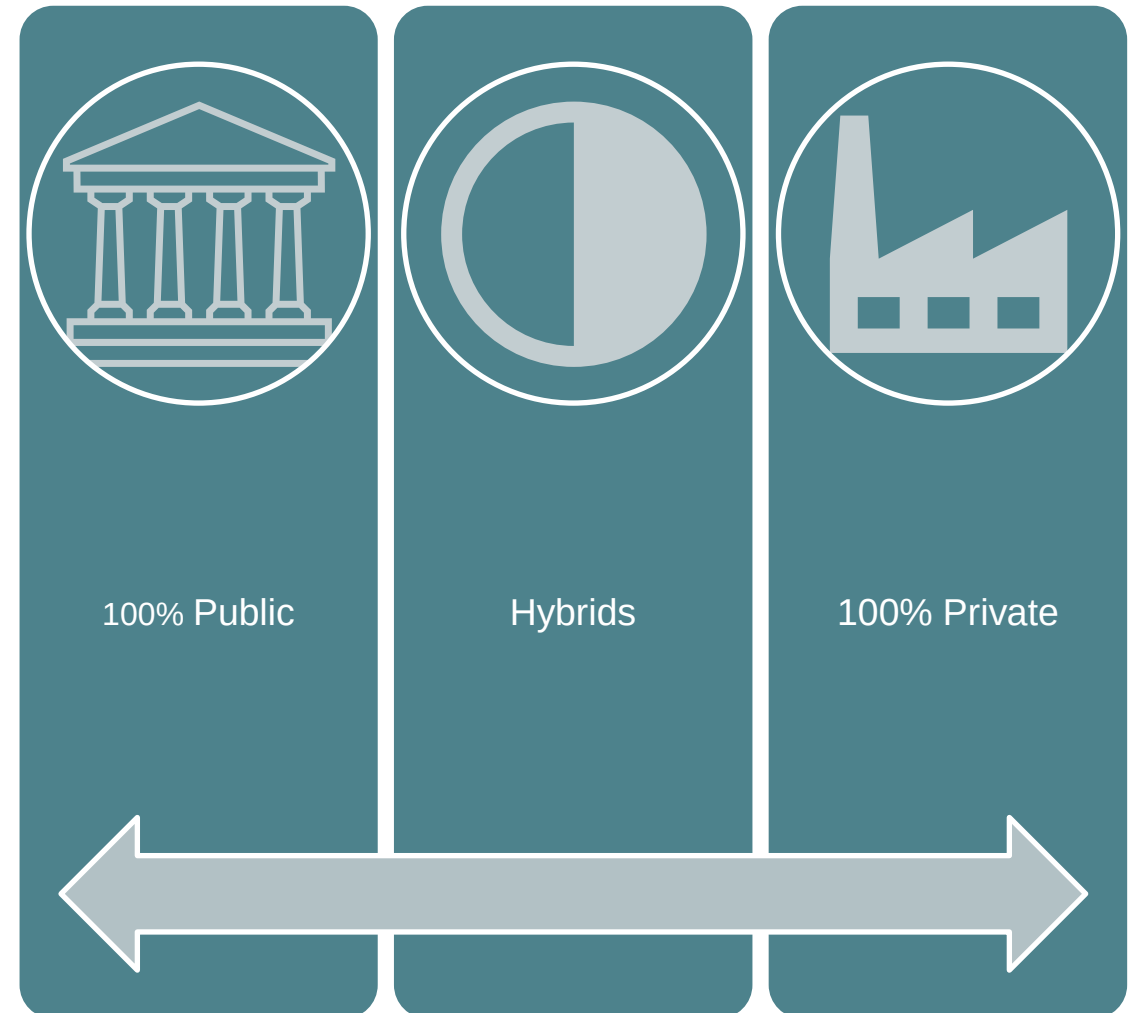
## DE Regulation

- Depends on region (regulated and un-regulated markets)
- In some markets (like BC) municipally owned systems are exempt from Utilities Commission regulation

**Policy** plays a large role in the development of DE systems and various forms of policy can be applied across the range of ownership models.

## DE Ownership model can transition over time

A DE system may start as 100% Public and certain roles can transition over time.



# DE MODEL SUB-TYPES AND EXAMPLES



Model	Sub-Types	Examples
<b>100% Public</b>	<ul style="list-style-type: none"> <li>Part of public administration</li> <li>Wholly-owned subsidiaries</li> </ul>	<ul style="list-style-type: none"> <li>Markham District Energy</li> <li>Vancouver Neighbourhood Energy Utility</li> <li>Surrey City Energy</li> <li>Lonsdale Energy Corporation</li> </ul>
<b>Hybrids</b>	<ul style="list-style-type: none"> <li>Joint ventures (various legal structures)</li> <li>Split assets (separate ownership of assets / functions with contractual relationships)</li> <li>Strategic partnerships (private ownership with public cooperation)</li> <li>Concessions (permanent or temporary private ownership with public mandate and oversight)</li> </ul>	<ul style="list-style-type: none"> <li>Richmond City Centre (Richmond/Corix)</li> <li>Burnaby Mountain (SFU / Corix)</li> <li>Sen'ákw (Creative/Squamish Nation)</li> <li>Zibi (Ottawa Hydro/Theia Partners/Dream)</li> </ul>
<b>100% Private</b>	<ul style="list-style-type: none"> <li>For profit</li> <li>Not for profit</li> <li>Cooperatives (customer ownership)</li> </ul>	<ul style="list-style-type: none"> <li>Downtown Toronto (Enwave)</li> <li>Downtown Vancouver (Creative Energy)</li> <li>Oakridge (Creative Energy / Corix)</li> <li>River District Energy (Wesgroup)</li> </ul>

# DE GOVERNANCE MATRIX



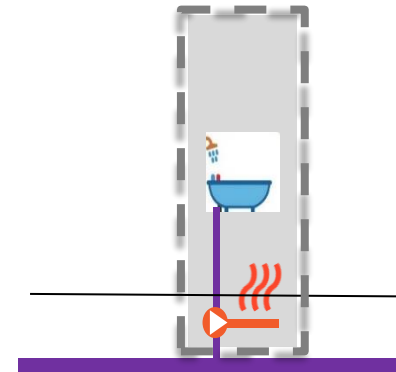
Role/Activity	Subcategory	Description	100% Public	<--- Hybrids --->	Fully Private
Ownership & Governance	Ownership	Maintains ownership rights to DE assets	Public Entity for all roles	<p>Hybrids include various <b>combinations of entities leading different governance roles/activity.</b></p> <p>Each role may include multiple entities.</p> <p>Entities may include:</p> <ul style="list-style-type: none"> <li>• Municipalities</li> <li>• Thermal Energy Utilities</li> <li>• Electric Utilities</li> <li>• Gas Utilities</li> <li>• Energy System Developers</li> <li>• Building Developers</li> <li>• Community Groups</li> <li>• Public Sector Financing</li> <li>• Private Capital</li> </ul>	Private Sector Entity for all roles
	Governance	Directs DE			
Development	Planning	Originates and leads early-stage development activities			
	Financing	Provides debt and equity to develop system			
	Construction	Design and construction of DE assets			
Operations		Operations and maintenance of DE assets			
Policy	Applied across DE Models	Energy-climate policies from municipal, provincial, and federal government play a large role in the development of low carbon district energy. Carbon taxes, green building standards, and DE Policies (like mandatory connection and franchise agreements) can apply across DE models.			

# ALIGNING MUNICIPAL DE STRATEGY AND GREEN BUILDING STANDARDS

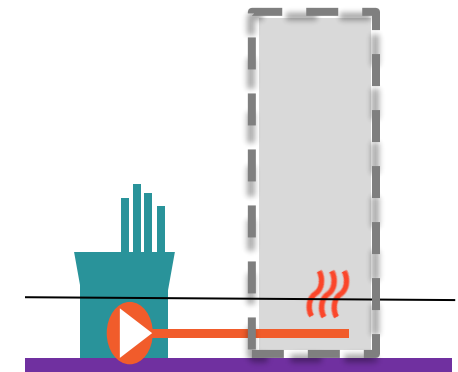
- There are two key elements to ensuring alignment of green building standards and a DE Strategy
  - 1) **Ensuring a level playing field** for on-site and off-site (i.e. District energy) sources
  - 2) Recognizing the **balance** between building envelope and energy system trade-offs
- Many modern green building standards address the first item by focusing on GHG emissions, and primary energy sources. However, even with some of these modern codes, unlevel playing fields are created when upstream efficiencies and/or renewable supply is not recognized. Cities should recognize efficiency and renewables the same way the atmosphere does – i.e. it should not differentiate between the two.
- With respect to balancing between envelope and energy systems, several municipalities in the BC Lower Mainland have taken the following approach to ensure alignment:
  - Requiring buildings **outside** DE Service Areas to comply with **Step X requirements**
  - Requiring buildings **inside** DE Service Areas to comply with **Step X-1 requirements**
- This ensures that all buildings see a base level of advanced envelope measures, while striking a balance and not going beyond the point of diminishing returns



SWHR On-site



SWHR Off-site



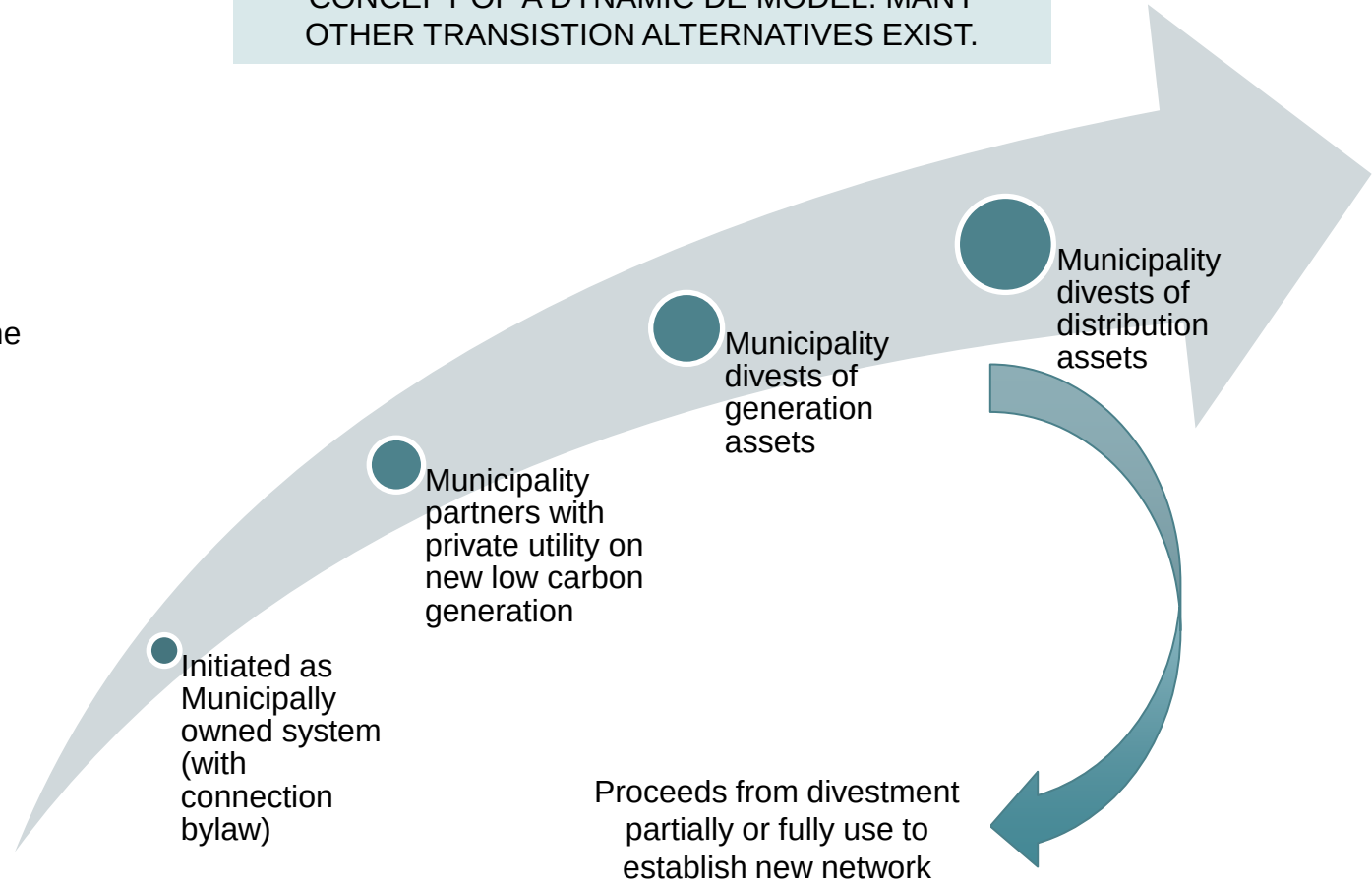
# EVOLUTION OF DE MODEL OVER TIME



- The governance model does not need to remain static for the project lifecycle.
- Systems may begin as 100% Public ownership initially, then the public sector owner may choose to partially or fully divest.
  - Proceeds from divestment could be used to initiate new networks
- Another model is for the public sector to acquire private systems so that they can have more control over the environmental performance outcomes of the system.

ONE EXAMPLE ONLY TO ILLUSTRATE THE CONCEPT OF A DYNAMIC DE MODEL. MANY OTHER TRANSITION ALTERNATIVES EXIST.

● Size of DE System



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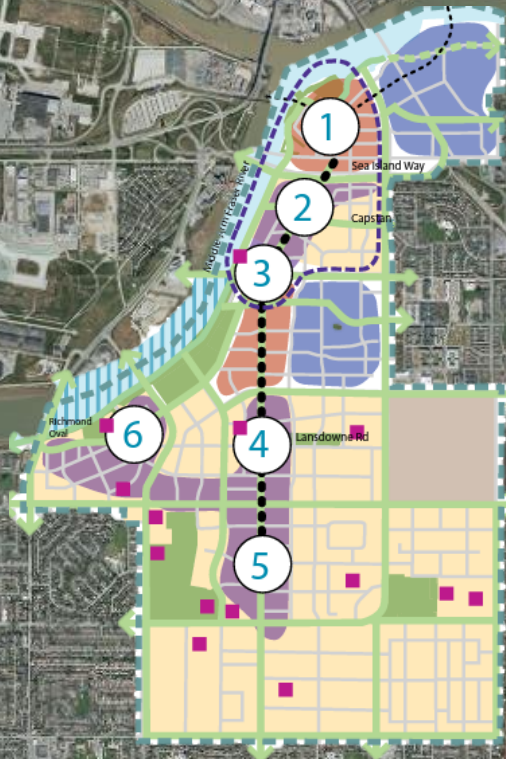
**CASE STUDY:  
LULU ISLAND ENERGY COMPANY**







YVR



~80,000 new residents by 2050, ~70% of residential growth occurring in City centre

# LULU ISLAND ENERGY COMPANY (LIEC) RICHMOND, BC

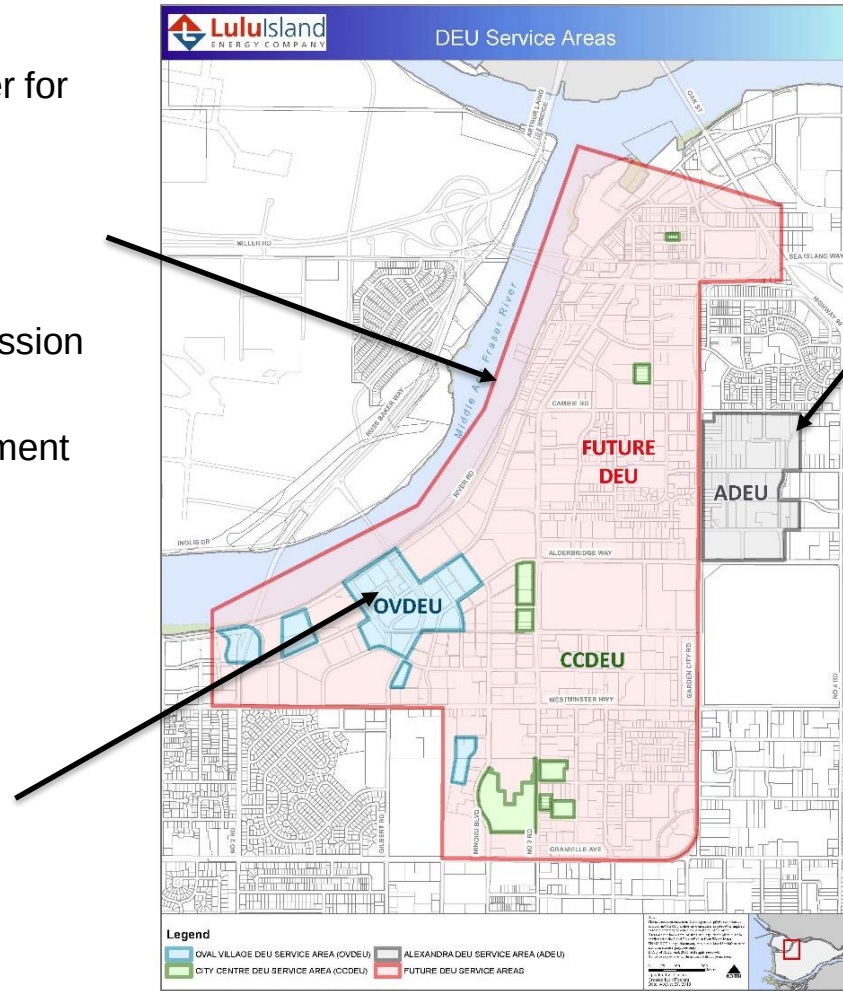


## 2022: City Centre DEU (CCDEU)

- RFEOI process to secure partner for larger service area
- 30-year DBOFM concession agreement with Corix
- OVDEU absorbed into CCDEU service area and OVDEU concession agreement superseded
- CIB/LIEC/Corix financing agreement

## 2014: Oval Village DEU (OVDEU)

- City-led feasibility study in partnership with developer prior to rezoning
- Public process to procure DEU delivery partner
- 30-year concession agreement with Corix (superseded by new DBOFM agreement for CCDEU)



Lulu Island Energy Company Service Area

## 2012: Alexandra DEU (ADEU)

- Developed and financed by LIEC with a separate contract for O&M services only with Corix

## Servicing Strategies:

- DEU-Ready Rezoning
- Nodal Pattern of Development
- Focus is on building distribution network
- Interim Energy Centres to make way for Permanent Energy Centres (SHR)

**RFEOI** – Request for Expressions of Interest  
**DBOFM** – Design, Build, Operate, Finance and Maintain

# LULU ISLAND ENERGY COMPANY (LIEC) RICHMOND, BC



Lulu Island Energy Company	
<b>Year Established:</b>	2013
<b>System Size:</b>	<b>Current:</b> 600,000 m2 in two service areas <b>Future:</b> 4.4 million m2
<b>Service:</b>	Heating and Cooling*
<b>Energy Supply and Decarbonization:</b>	<b>Current:</b> Geoexchange, ASHP, peaking boilers <b>Future:</b> Sewer heat recovery, decarbonization
<b>Funding/ Financing:</b>	CIB financing for CCDEU, \$175M
<b>Drivers of System Initiation:</b>	Means for achieving the City's climate targets  Strong support from City Council



## Ownership & Governance

- LIEC is a wholly-owned municipal corporation.
- LIEC governed by a board of directors composed of Staff, (1) Council Liaison.
- 30-year DBFOM agreement with Corix Utilities for delivery of City Centre DEU.
- Debt financing for City Centre DEU provided by CIB.

## Connection Incentives and Rates

- City Council determines and enforces connection requirements via service area bylaws.
- Council establishes LIEC rates.
- Rates indexed at a 'Business as Usual'; e.g. customers not paying a premium LIEC services.
- Rates for end users are also managed through the use of developer contributions (capital or assets).

## Decarbonization

- 24MW of potential energy are available in regional sewer main = 75% zero carbon.
- 1,000,000 tonnes CO<sub>2</sub>e reduction by 2050.
- LIEC approves Corix's annual capital and operating plans to achieve decarbonization goals.
- Current: Peak heating provided by gas boilers
- Future: Decarbonization Strategy

6

Q & A

# SUPPORTING YOUR LOW-CARBON TRANSITION

How to contact Reshape:  
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