DE 4.0 - Expansion of the False Creek Neighbourhood Energy Utility ("NEU")
Renewable City Strategy – Approved in 2015

100% of energy used is renewable by 2050

New buildings required to achieve zero emissions by 2030 or earlier
Zero Emissions Building Plan – Approved in 2016

High Performance Building
- GHG limit achieved by minimizing heat loss
- Enables simple heating system design

Low Carbon Energy System
- GHG limit achieved by combining efficiency with low carbon energy supply
- Uses advanced technologies
Zero Emissions Building Plan – Stepped Approach

- **Zero Emissions Building Plan** is a stepped approach to heat loss and energy use.
- **Thermal energy demand intensity (TEDI) relaxation** for buildings connected to a City-recognized low carbon energy system.

**ZEBP Targets for a Mid-to-High Rise MURB**

<table>
<thead>
<tr>
<th>Year</th>
<th>TEDI Low Carbon Energy System</th>
<th>TEDI High Performance Bldg</th>
<th>GHGI (kgCO2/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014 Rezoning</td>
<td>46</td>
<td>46</td>
<td>46</td>
</tr>
<tr>
<td>2016 Limits</td>
<td>40</td>
<td>32</td>
<td>18</td>
</tr>
<tr>
<td>2020 Limits</td>
<td>40</td>
<td>18</td>
<td>TBD</td>
</tr>
<tr>
<td>2025 Limits</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
</tbody>
</table>
Vancouver – District Energy Priorities

**Downtown Priorities:**
- Low carbon conversion of Downtown Steam System
- New hot water networks in high growth areas
- Retrofit existing gas-heated buildings to renewable energy

**Cambie Corridor Priorities:**
- Conversion of hospital steam systems to renewable energy
- Low-carbon systems at major development sites

**False Creek NEU:**
- Now serves ~5M sq ft of buildings, including the Great Northern Way Campus lands

**River District:**
- Ongoing expansion
False Creek NEU Overview

- Supplies thermal energy for space heat & hot water
- Owned & operated by the City, with independent oversight by Expert Panel
- 70% of energy from renewable sources (waste heat recovered from sewage + bio-methane)
- Operating under a commercial utility model, delivering cost-effective renewable energy
NEU Development Timeline

2006: City Council decision to establish NEU

2010: NEU started operations

2014: Expansion to Great Northern Way Campus lands

2018: City Council approved major expansion plan
Environmental Benefits

• NEU provides City with direct control to achieve 100% renewable energy outcomes for pre-2030 buildings

• Enables recycling of waste heat and increases local supply of renewable energy

• Provides long-term flexibility to adapt to new technologies
Developer Implications

- NEU provides simple approach to achieving green building policy GHG limits
- Construction cost and space savings, and increased architectural design flexibility
- Connecting to system is mandatory within designated area
End-User Benefits

• NEU connection helps to maximize roof-top amenity space

• Customers do not need to maintain and replace costly heat generation equipment

• Some buildings can sell waste heat back to the NEU
NEU Customer Base

- 32 buildings
- 9 buildings in development
- Customer base has grown 300% since 2010
- 5.2M sqft of connected floor space
1. Sewage is filtered to remove solids
2. Filtered sewage passes through heat pump evaporators (shell & tube heat exchangers)
3. Two heat pumps – sewage flows in series & district heat water flows in series or parallel (output 65-80° C)
4. Sewage flow reversed periodically to prevent heat exchanger fouling
5. Effluent mixed with filtered solids and sent to treatment plant
6. Boilers used for peaking & backup
Distribution Pipe Network

- Two-pipe closed loop delivers thermal energy to customer buildings
- Supply: 65°C (95°C max), Return: 50°C
- Majority of pipe is steel, with PEX used on trial basis
Each building has an Energy Transfer Station, which houses two heat exchangers.

The heat exchangers transfer heat to the building’s heating and hot water mechanical systems.

Automated controls and remote monitoring to ensure reliability.

Transitioning away from custom designed units for cost saving.
Sewage Heat Recovery Expansion

- Preliminary engineering underway to increase sewage heat recovery capacity by 5 MW

- Challenges:
  - Securing adequate sewage
  - Plant space constraints

- Opportunities:
  - Alternative sewage filtration
  - Lower temp heat pumps
  - Thermal storage
In Feb 2018, City Council approved expansion plans to secure 100% renewable energy outcomes for ~22 million ft\(^2\) of buildings.
Role of the City

- Expansion plan is based on City ownership of the distribution network, and existing False Creek Energy Centre
- This maintains direct control to achieve GHG performance targets, without provincial regulation
- Flexibility for private sector investment in energy production
2019-2022 Capital Plan Forecast

NEU pipes to be timed with NE False Creek road works

New Customers
New Distribution Pipes

Expansion to Innovation Hub

Planned 5 MW Heat Pump Expansion
Lower Main Expansion
Forecast Growth Beyond 2026

NOTE: Sites that fall within expansion boundaries but not have not been included in phasing projections due to timing uncertainty will be assessed for connection on a case-by-case basis.
Energy Source Options for Expansions

- Business case evaluated expanded use of sewage heat
- Other potential energy sources:
  - Downtown Fuel Switch Project
  - Waste heat from data centres and customer buildings
  - Renewable natural gas
  - Small-scale technology demonstration projects
Waste Heat Opportunities

- 27MW of low carbon capacity needed at buildout (including all study areas)

Metro Columbia Sewage Force Main (5 MW)

False Creek Energy Centre

MEC Heat Recovery

Tech cooling (0.5 MW)

Existing Data Centre (1-2 MW)

Metro 8th Ave Interceptor (15-30 MW)

Innovation Hub (0.2 MW)

Existing Data Centre (1 MW)
Exploring Opportunities for Optimization

KEY PRINCIPLES:

• Maximize energy efficiency and recovery of waste heat
• Preserve 100% renewable energy outcomes
• Achieve economic efficiency
• Maintain long-term technology flexibility
• Balance innovation and risk
• Maximize design flexibility and co-benefits for connected buildings
Key Optimization Areas

1. NEU Technology & System Design
   - Explore lower temperature approaches for expansion areas to maximize efficiency & waste heat recovery potential

2. Design Requirements for Buildings
   - Explore opportunities for increased flexibility in building-side mechanical design requirements

3. Sharing of Economic Benefits
   - Connection fee to share economic benefits of connection between developers and utility customers
Priority on maximizing use of local resources and unlocking waste heat recycling opportunities in the community

• **Example:** New MEC Store Waste Heat Recovery
  
  ➢ Benefits include increased renewable energy generation, freeing valuable rooftop space for developer, and revenue stream for building owner

• **Study Underway:** Exploring potential for low temperature NEU zones to increase the amount of waste heat being recovered
  
  ➢ Evaluate technical, cost, and servicing risks and benefits associated with discrete low temperature NEU zones
  
  ➢ Includes consultation with development industry
Operating temperature scenarios to be evaluated:

<table>
<thead>
<tr>
<th>System Operating Temp</th>
<th>NEU Supply Temp (°C)</th>
<th>NEU Return Temp (°C)</th>
<th>Heating Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Temp (Current NEU)</td>
<td>65 (max 95)</td>
<td>50</td>
<td>Centralized</td>
</tr>
<tr>
<td>Low Temp</td>
<td>50 (max 60)</td>
<td>35</td>
<td>Centralized with some boosting required in buildings</td>
</tr>
<tr>
<td>Ambient Temp</td>
<td>25</td>
<td>20</td>
<td>Decentralized</td>
</tr>
</tbody>
</table>
Current customer building design requirements:

• **Restrictions:**
  
  - 100% of heat and hot water demand to be supplied by NEU with no building-side heat production equipment
  
  - Restrictions are in place to secure GHG outcomes and ensure cost-effective low carbon service

• **Exceptions allowed:**

  - Solar thermal panels
  
  - Equipment that recovers waste heat from refrigeration or cooling of the building
What we’ve been hearing from developers – a desire for more flexibility on:

- requirement for 100% energy supply by NEU
  - examples include exceptions for isolated or unoccupied spaces, hot water loads in office buildings, etc.

- the use of certain technologies that facilitate some on-site heat recovery
  - examples include distributed water-to-water heat pumps, and Variable Refrigerant Flow (VRF) systems which generate some heat from electricity

- Critical to maintain cost effectiveness and not jeopardize 100% renewable energy outcomes
3. Sharing of Economic Benefits

- Use of utility connection fees is a common practice (including district energy, other energy, water and sewer services)

- NEU provides construction cost savings through:
  - Eliminating the need for on-site renewable energy heat production
  - Flexibility on the building envelope through relaxed TEDI requirements

- Recovering a portion of this savings would result in lower rates for utility customers

- Different connection fee structures being explored – price per KW capacity appears to be the preferred approach for stakeholders
SUMMARY

The Zero Emissions Building Plan significantly lowers GHG emissions in new buildings. The NEU provides unique opportunities:

1. High level of City control to achieve Renewable City Strategy objectives for pre-2030 buildings
2. Ability to leverage resource recovery opportunities, including sewage heat and other local waste sources
3. A highly adaptable and resilient energy solution for buildings
NEXT STEPS

• **Sewage Heat Expansion:**
  - **Q4, 2018:** initiate procurements (pending status of other low carbon options)
  - **2019 – 2020:** detailed design and construction

• **Distribution System Expansion:**
  - **2019:** Mt Pleasant
  - **2020 - 2021:** NE False Creek and Innovation Hub

• **Technical Optimization Review:**
  - complete Q3 2018
QUESTIONS