



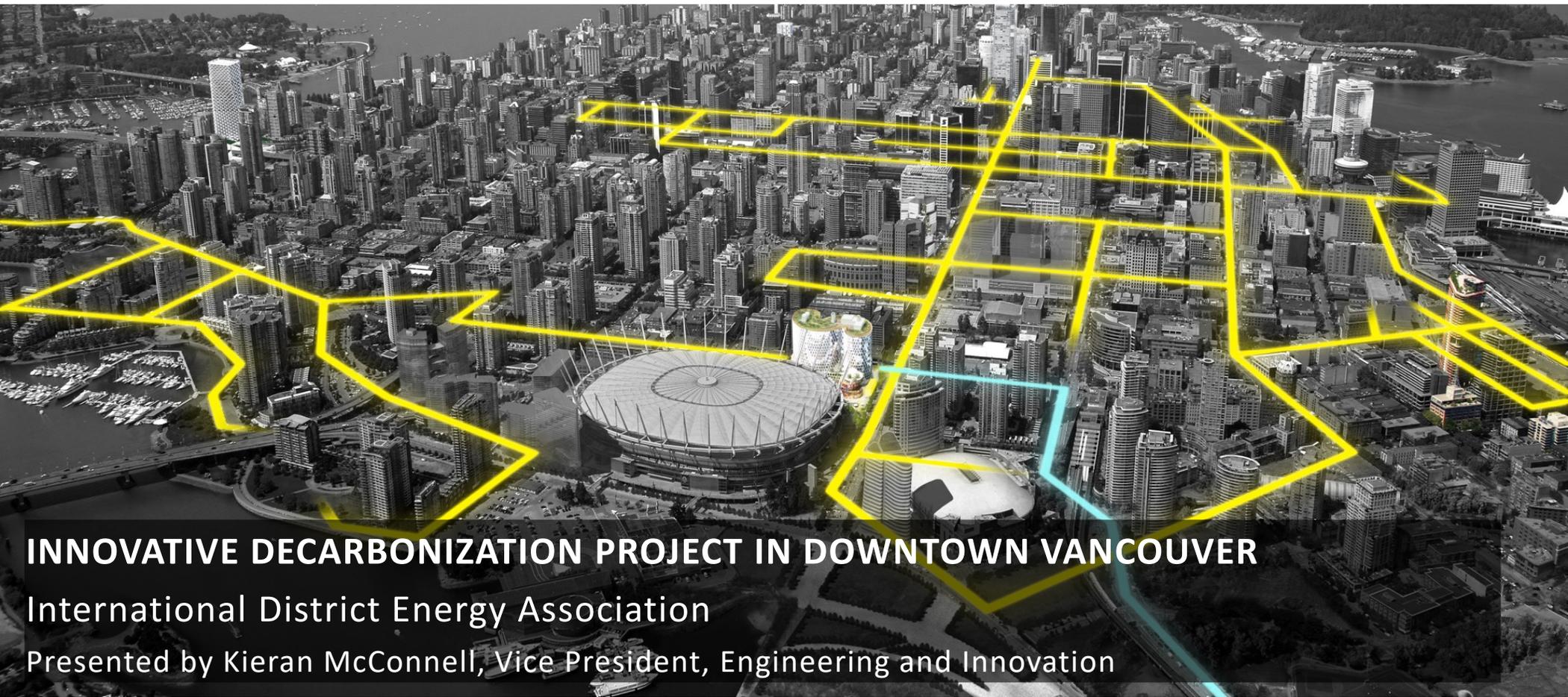
# IDEA 2021

Powering the Future: District Energy/CHP/Microgrids  
Sept. 27-29 | Austin Convention Center | Austin, Texas



# CREATIVENERGY

YOUR DISTRICT ENERGY PARTNER



## **INNOVATIVE DECARBONIZATION PROJECT IN DOWNTOWN VANCOUVER**

International District Energy Association

Presented by Kieran McConnell, Vice President, Engineering and Innovation

# CREATIVE ENERGY

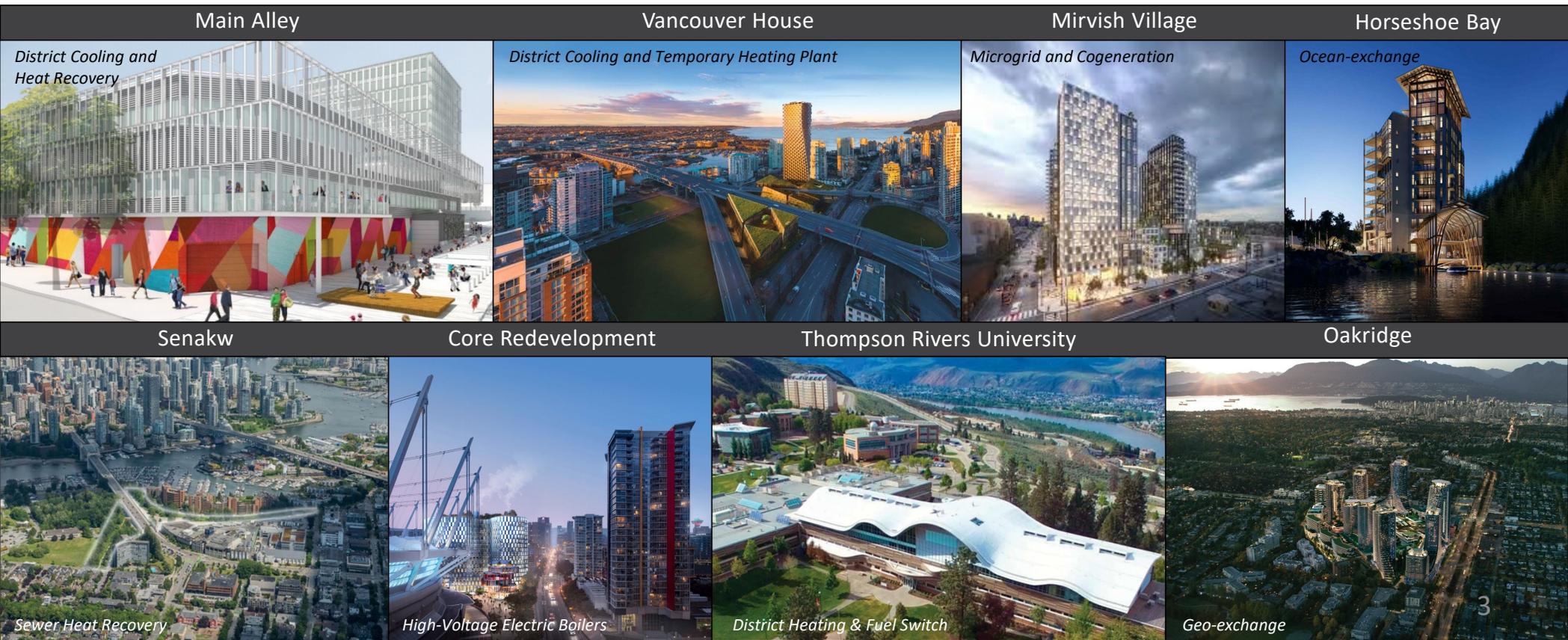
## Major Projects

Owner and operator of one of North America's largest and oldest district energy systems, in downtown Vancouver since 1967

Provides space heating and water heating for over 200 buildings across more than 45 million square feet of connected real estate through 15 km (10 miles) of distribution pipe

Over 52 years of outstanding customer service with a 99.9% reliability record.

New District Energy projects operating and in development in Canada and the US using a wide array of technology



## WHY IS THE CREATIVE ENERGY DECARBONIZATION PROJECT ESSENTIAL?



Help existing and future customers, the City of Vancouver, residents, businesses and developers, meet their emissions reduction goals and increasingly stringent requirements.



**Government of Canada:** net-zero emissions by 2050 and proposed increase in federal carbon tax to \$170 per tonne by 2030 (\$30 today).



**Government of B.C.:** Climate Action Plan and CleanBC encouraging energy-saving improvements in existing homes and workplaces.



**City of Vancouver:** 100% of energy needs from renewable sources before 2050.



## COMPARISON OF LOW-CARBON STEAM OPTIONS

	BIOMASS COMBUSTION	ELECTRIC
FUEL SOURCE	Local urban waste wood – primarily home deconstruction and ICI residuals	<ul style="list-style-type: none"> <li>✓ 98% low carbon hydroelectric power (~6.2c/kWh)</li> <li>✓ Electrical rates transparent and regulated</li> </ul>
EFFICIENCY	<ul style="list-style-type: none"> <li>✗ 65-80% depending on feedstock moisture content</li> </ul>	<ul style="list-style-type: none"> <li>✓ 99%+</li> </ul>
EMISSIONS/LOCAL IMPACT	<ul style="list-style-type: none"> <li>✗ Emits CO<sub>2</sub>, PM, NO<sub>x</sub>, &amp; SO<sub>x</sub></li> <li>✓ Federally recognized as carbon-neutral</li> <li>✗ Continuous fuel deliveries</li> <li>✗ Noise concerns from fuel handling equipment</li> </ul>	<ul style="list-style-type: none"> <li>✓ No emissions</li> <li>✓ No fuel delivery</li> <li>✓ No noise</li> </ul>
MAINTENANCE	<ul style="list-style-type: none"> <li>✗ Complex mechanical fuel handing systems</li> </ul>	<ul style="list-style-type: none"> <li>✓ Simple, minimal moving parts</li> </ul>
SAFETY	<ul style="list-style-type: none"> <li>✗ Biomass and associated dust pose a fire risk</li> </ul>	<ul style="list-style-type: none"> <li>✗ High voltage lines carry elevated shock/electrocution risk</li> </ul>
STAKEHOLDER PROCESS	<ul style="list-style-type: none"> <li>✗ Negative regional public view of biomass</li> <li>✗ Air Quality permit required</li> <li>✗ Extensive stakeholder process required</li> </ul>	<ul style="list-style-type: none"> <li>✓ General support for electrification</li> <li>✓ Less onerous public engagement</li> </ul>
PRECEDENTS	<ul style="list-style-type: none"> <li>✓ UBC – 6 MW hot water plant operating since 2012</li> <li>✓ SFU – 13.5MW hot water plant operating as of 2020</li> <li>✓ St Paul Minnesota – 65MW rail-fed biomass operating since 2003</li> </ul>	<ul style="list-style-type: none"> <li>✓ A number of similar projects in Europe, deployed for district energy and grid regulation since 2010</li> <li>✗ Several institutional electric boiler projects in Quebec with uncertain performance/reliability</li> </ul>

## DECARBONIZATION PROJECT



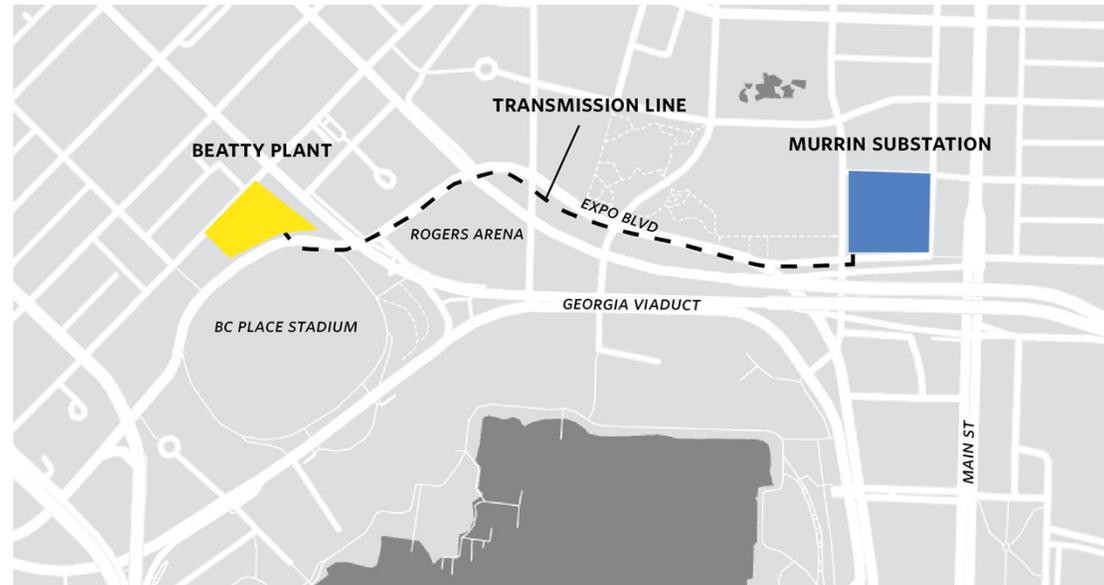
Initial: an on-site substation and two electric steam boilers to supplement existing current natural gas boilers.



Initial 14 MW (41,600PPH) of capacity to our system to transition our existing customers to lower carbon energy. When complete, 28 MW (83,200PPH) of capacity will be online.



BC Hydro will construct a new 1,200 metre underground 60kV transmission line from Murrin Substation (funded by project), giving access to lower rates.



## PROJECT SIZING

### CUSTOMER LOAD PROFILE

- Peak Demand ~200MW
- Base load ~20MW
- Minimum load – 18MW (<15 hrs per year)

### ELECTRICAL CAPACITY

- Tariff minimum 10MW
- Upstream transformer capacity limit ~30MW

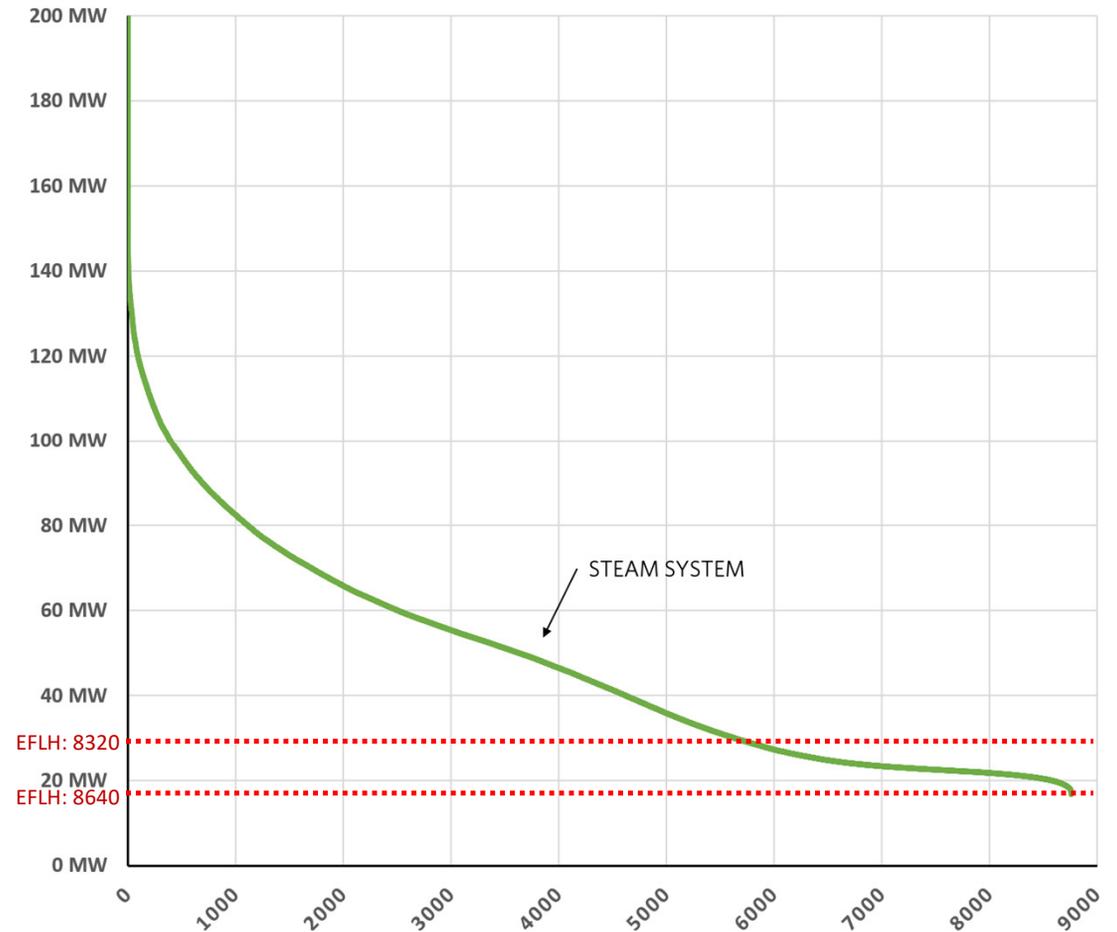
### ECONOMIC CONSIDERATIONS

- EFLH ~8500 when deployed for base load
- Electrical demand charges (\$/kW) minimized

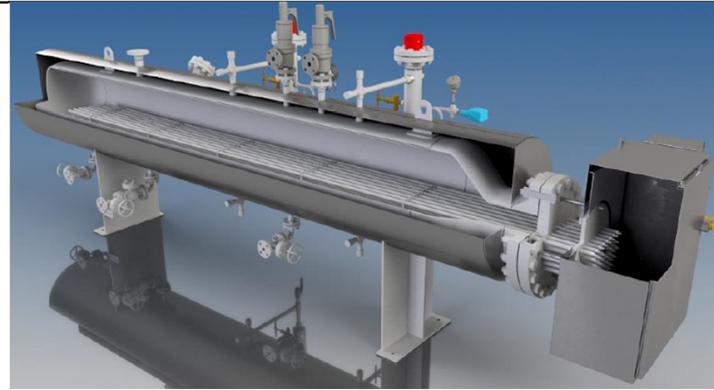
### PRODUCTION

- 14MW (7% of peak) produces **26%** of annual generation
- 28MW (15% of peak) produces **50%** of annual generation

### HISTORICAL LOAD CURVES



## ELECTRIC STEAM TECHNOLOGY OPTIONS

	<b>ELECTRODE</b>	<b>RESISTIVE</b>
		
Function	High voltage electricity passed through a waterjet from anode to cathode	Medium voltage electricity heats an array of immersed resistive elements
Voltage	4.16kV – 25kV	4.16kV – 6.9kV
Capacity	3,300PPH - 188,000PPH (1 – 56MW)	3,500PPH – 33,000PPH
Water treatment	Reverse Osmosis (RO)	No additional treatment (softened)
Conductivity Control	Precise conductivity control required to maintain steady state ( $V=IR$ )	None required

## COOLING HEAT RECOVERY



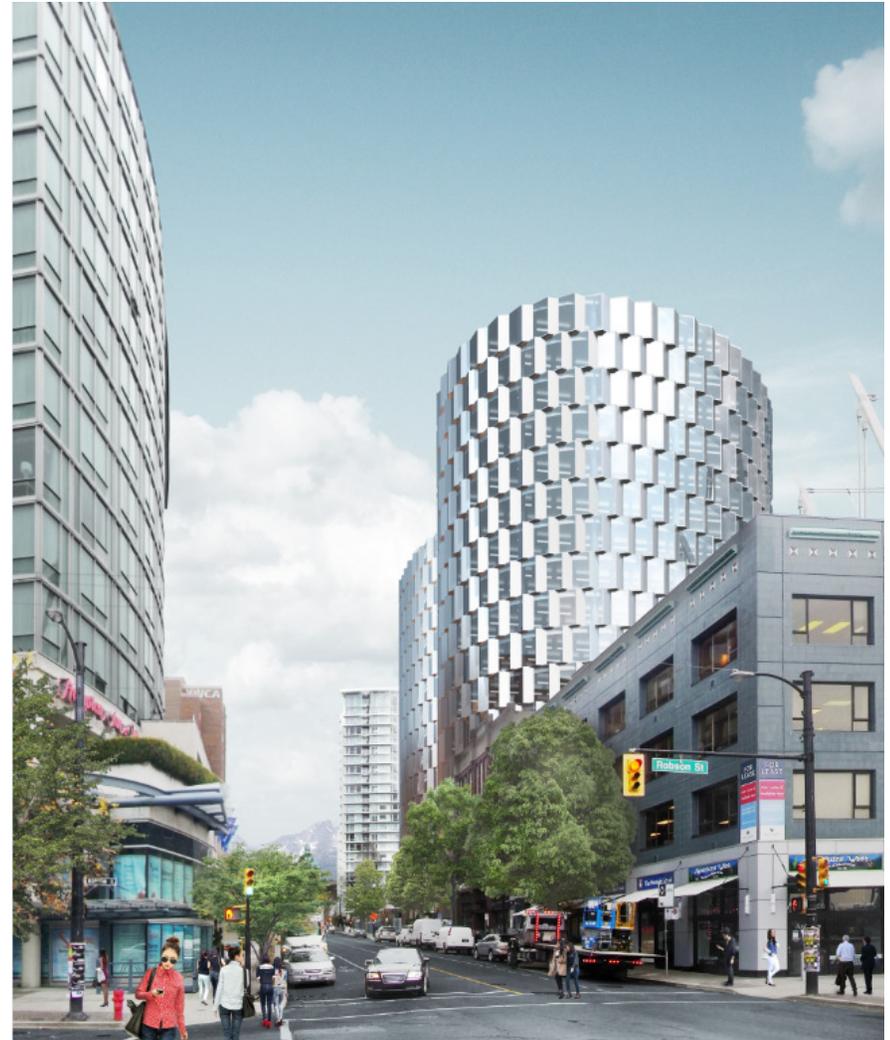
The electric steam boilers will be located within a ~700,000ft<sup>2</sup> office tower, Cooling of the office tower produces about 3,700MWH/yr of condenser heat at ~35C



The steam plant has a large year-round heat sink due to high volume of City incoming



Chiller condenser water will pre-heat the makeup water, improving overall plant efficiency



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## ELECTRIC STEAM PLANT FINAL CONFIGURATION



### CREATIVE ENERGY SUBSTATION

- 60kV Gas Insulated Switchgear
- 1x 18MVA Transformer (60–4.16kV)
- 1x 18MVA Transformer [future]

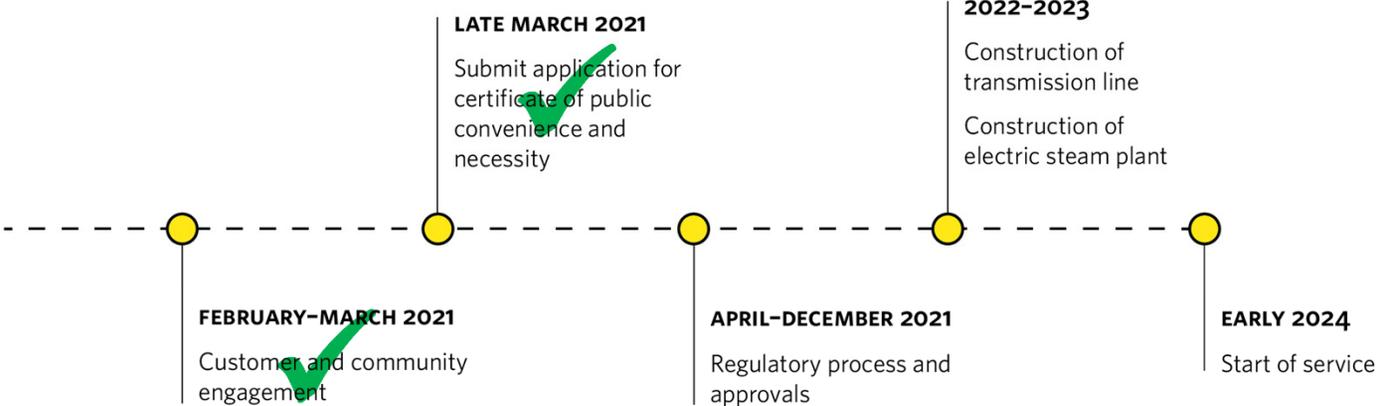
### ELECTRIC BOILER PLANT

- 2x 20,800PPH Electric Boilers
- 2x 20,800PPH Electric Boilers [future]

### GAS PEAKING PLANTS

- 1x 100,000PPH Gas Boiler
- 1x 200,000PPH Gas Boiler
- 2x 200,000PPH Gas Boiler

# PROJECT TIMELINE



## PROJECT BENEFITS

*Maintaining competitive rates for our customers while offering cleaner energy.*

System	Carbon Intensity (kgCO <sub>2</sub> /MWh)	Estimated 2024 Rate (\$/MWh)
<b>CREATIVE ENERGY</b>		
Creative Energy Downtown Vancouver System (natural gas)	251	\$72
With Decarbonization Project at 18% Low Carbon	209	\$77-\$86
With Decarbonization Project at 68% Low Carbon*	94	\$85-\$94
With Decarbonization Project at 100% Low Carbon	15	\$93-\$103
<b>OTHER UTILITIES**</b>		
BC Hydro Residential Service (electric baseboards)	11	\$131
UBC Neighbourhood District Energy Utility	220	\$116
City of Vancouver SEFC Neighbourhood Energy Utility	70	\$126
Surrey City Energy	148	\$128
Burnaby Mountain District Energy Utility	44	\$146

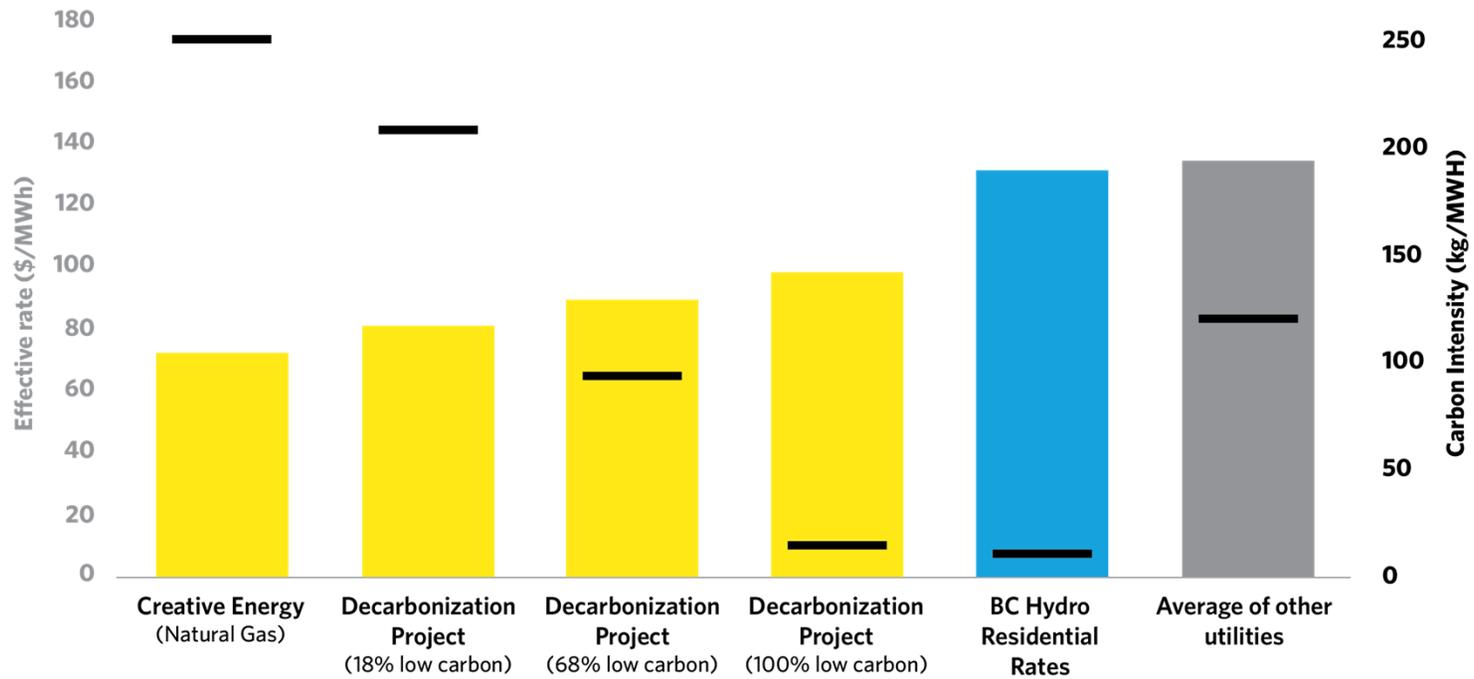
\*68% low carbon energy meets current City of Vancouver Low Carbon Energy System policy requirements.

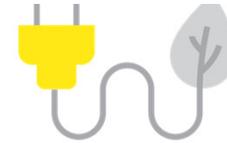
\*\*Other utilities' rates are estimated based on 2021 benchmark information from the City of Vancouver's '2021 False Creek Neighbourhood Energy Utility ("NEU") Customer Rates - RTS 14023' and escalated to expected rates in 2024.

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## PROJECT BENEFITS

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## PROJECT INNOVATION AND BENEFITS

The district system aggregates the emissions of over 215 buildings into a single plant. This enables an overnight fuel switch to drastically reduce these emissions in a single project



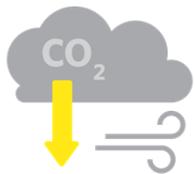
### Affordable Low Carbon Energy

- Base-loaded generation allows 15% of peak capacity to displace up to 50% of gas-powered generation
- Base-loaded generation minimizes electrical demand charges
- The project scale unlocks Transmission Rates from BC Hydro, ~25% cheaper than business rates
- Heat recovery from cooling raises plant efficiency



### Resiliency

- Third fuel source now available (natural gas, fuel oil and electricity)
- Full gas generation maintained (4 boilers, 700,000PPH)



### Environmental

- GHG emissions reductions of at least 25,000TCO<sub>2e</sub>/year (equivalent to planting **30,285 acres** of new forest)
- Air Quality improved in downtown Vancouver
- Able to provide low carbon energy to ~5M ft<sup>2</sup> of new development



**THANK YOU!**

Kieran McConnell

[kieran@creative.energy](mailto:kieran@creative.energy)

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