Project Greenlight

CITY OF VANCOUVER

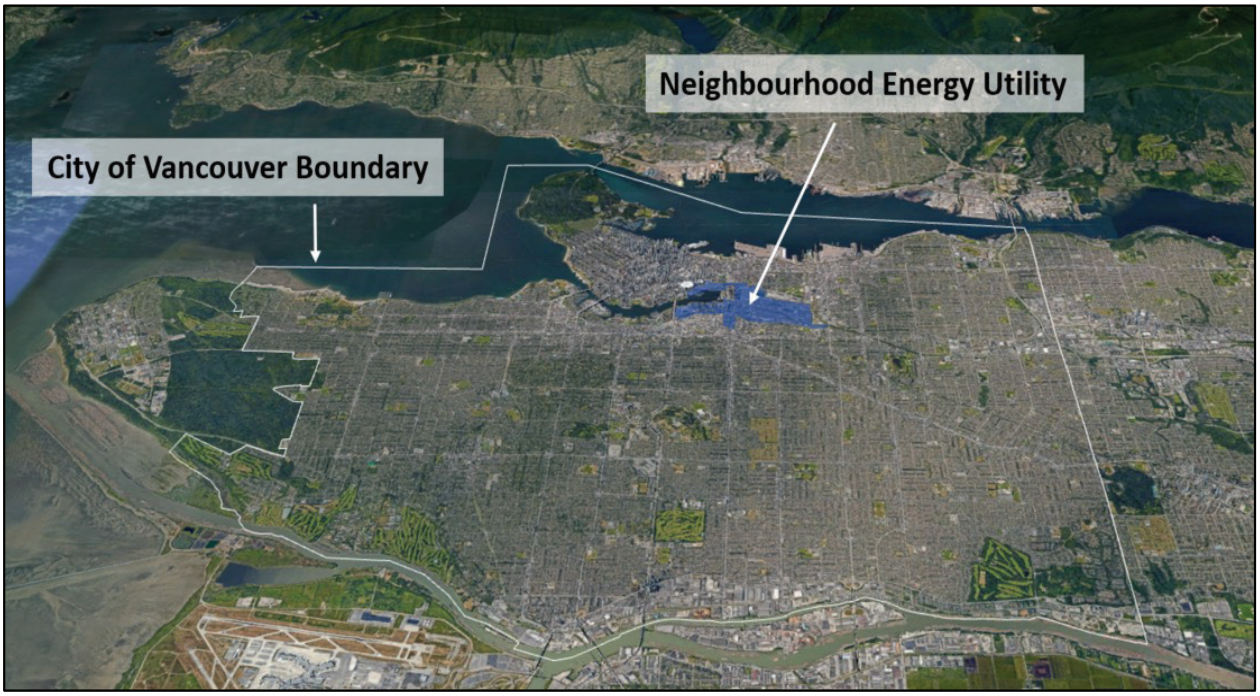
Targeted Call - Supporting Technical Information

The Neighbourhood Energy Utility (NEU)

View Targeted Call

NEU Service Area & Network

City of Vancouver & NEU Boundary Map



NEU Service Area and System Network

How the NEU Works

Step 1:

The thermal energy (heat) is captured at the False Creek Energy Centre using a heat exchange process integrated with a City of Vancouver sewage pump station. This supplies 70% of the utility's energy production.

Step 2:

The remaining 30% of the heat is supplied by high-efficiency natural gas boilers that provide supplemental heat on the coldest days of the year.

Step 3:

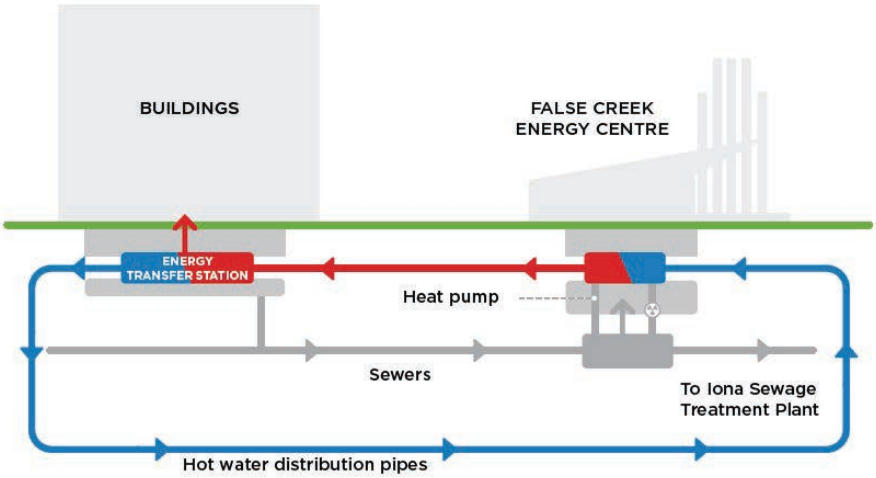
A distribution pipe system sends thermal energy – in the form of heated water – from the False Creek Energy Centre to the buildings that it services.

Step 4:

Each building has an energy transfer station that transfers the thermal energy (heat) to the building's mechanical system. The building's mechanical system then distributes heat and hot water to building occupants.

Step 5:

In your home, you wash your dishes, pour boiling water down the drain, take a shower and flush the toilet. The heat from the waste water you flush down the drain returns to the system to be captured and used again.



FALSE CREEK ENERGY CENTRE
How It Works

Key Components of the NEU

Generation Infrastructure

Thermal energy is generated at two energy centres.

The False Creek Energy Centre (FCEC), commissioned in 2010, contains the primary heat production equipment for the NEU, including 3 MW of heat pump sewage heat recovery capacity. The electricity input to the heat pump is from a clean, primarily hydro-powered electric grid (emission factor = 3 kg CO2e/GJ). An expansion of low carbon capacity is underway at FCEC, which includes the installation of an additional 7 MW of sewage heat recovery capacity, anticipated to be operational in 2022.

The NEU system also has a total of 29 MW of boiler capacity; 24 MW located at FCEC, and 5 MW located in the Mount Pleasant Peaking Plant, commissioned in 2021. All boiler infrastructure has the ability to utilize both conventional and renewable natural gas.

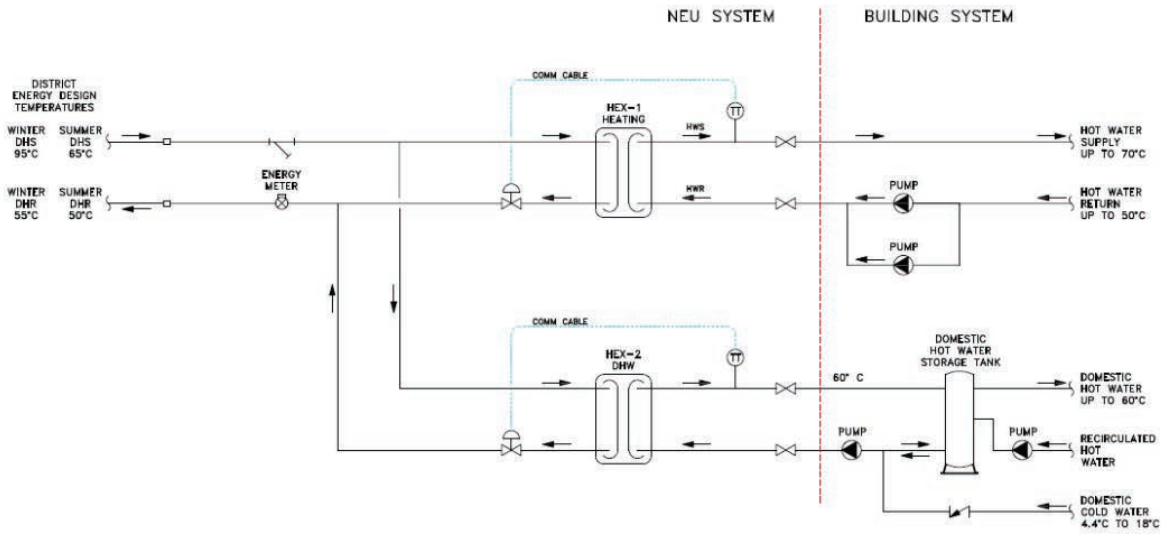
Over the next 20 years, the NEU will meet growing demand by incrementally adding an estimated 40 MW of renewable generation to the system, based on current development and load growth forecasts.

Distribution Infrastructure

Thermal energy generated at the energy centres is circulated to buildings in the NEU service area via a closed loop two-pipe hot water distribution network, providing separate supply and return loops. The distribution network is comprised of pre-insulated steel piping buried in City streets along with other utilities.

Energy Transfer Stations

Each building is connected to the NEU via an Energy Transfer Station that is owned by the NEU, where the heat provided by the NEU is transferred to the building systems for end uses within the building. A typical ETS schematic and building connection is shown below.



System Operating Temperaturs

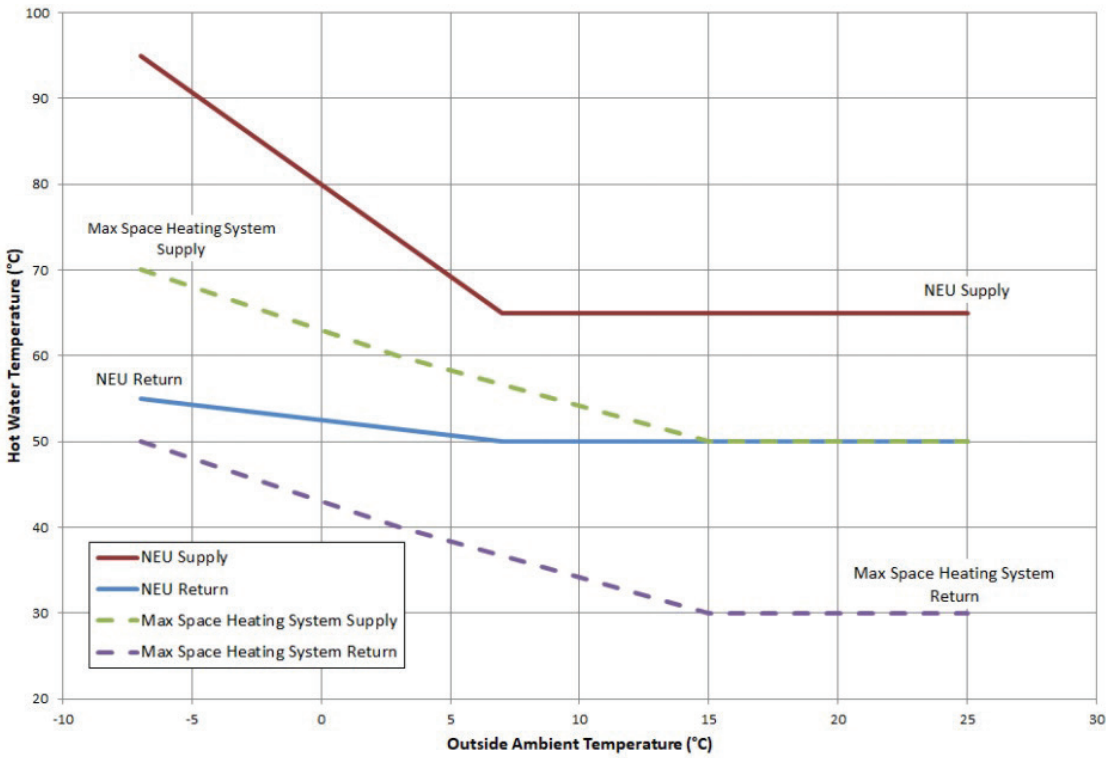
The NEU system operates at the temperatures shown in the table below. The NEU supply temperature fluctuates based on outdoor air temperature but is never less than 65°C. This ensures the NEU can always provided domestic hot water to the building at 60°C (in line with the plumbing code recommended domestic hot water storage temperatures to avoid bacterial legionella contamination).

NEU System Operating Temperatures

	NEU Design Condition		Building Space Heating System Design Condition		Building Domestic Hot Water System Design Condition	
	Winter	Summer	Winter	Summer	Winter	Summer
Max. Supply Temperature (°C)	95	65	70	50	60	60
Max. Return Temperature (°C)	55	50	50	30	4.4	18
Min. Temperature Differential (°C)			20	20		

As the outdoor air temperature drops, the NEU supply temperature will increase as shown the graph below.

NEU System and Building Heating System Operating Temperatures



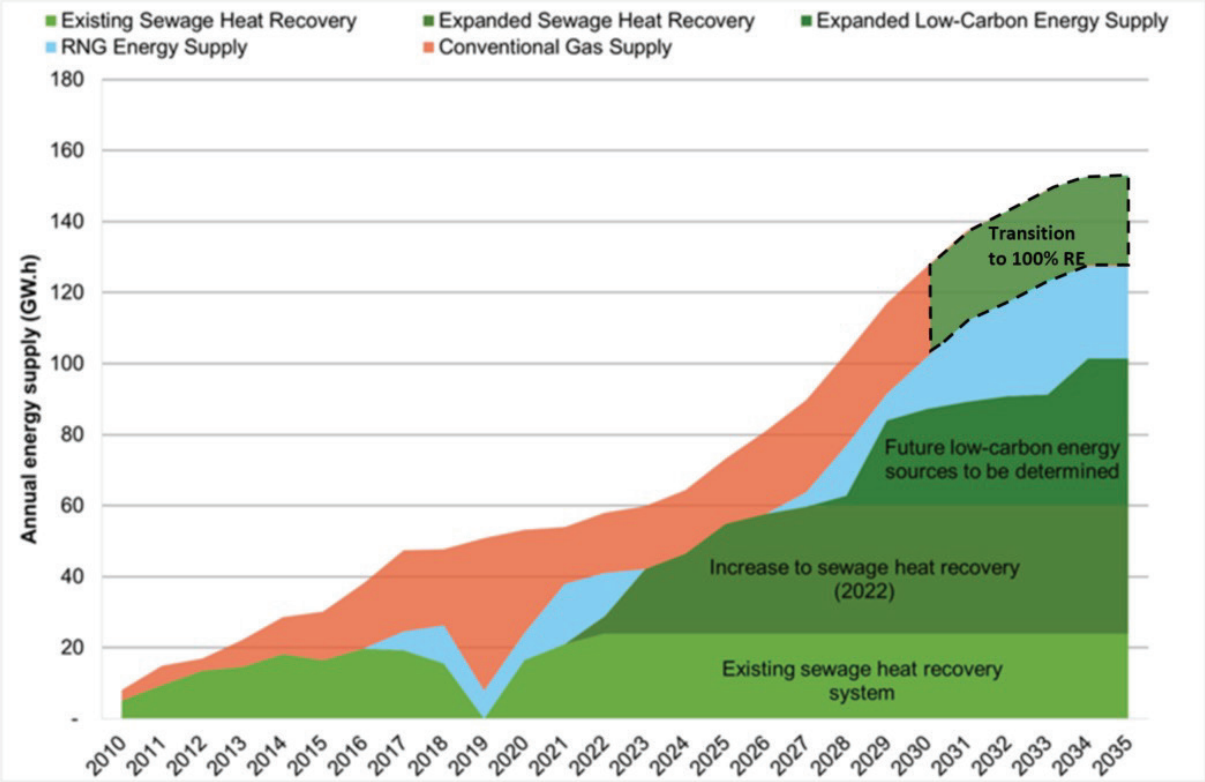
Project NEU Supply

The NEU aims to supply an average of 70% of its energy from renewable sources. This has been achieved by utilizing sewage heat recovery as the primary source of renewable energy with renewable natural gas (RNG) being blended in to top up the environmental performance as needed. The graph below shows the projected make-up of the annual energy supply for the NEU from 2010 – 2035. The graph represents modeling for 70% renewable energy.

The Base Low-Carbon Energy Supply includes the existing 3 MW of heat from sewage waste, which will soon be supplemented with an additional 7 MW of expanded sewage heat recovery (scheduled to come online in 2022). Beyond that, additional low carbon energy supply will need to be added to meet the growing baseload as the system continues to expand. The RNG supply is intended to fill the gaps between investments in low carbon generation.

The intended Conventional Gas Supply is represented in red. By 2030 the NEU will need to replace the forecasted conventional natural gas supply with renewable energy in order to meet a 100% renewable energy target.

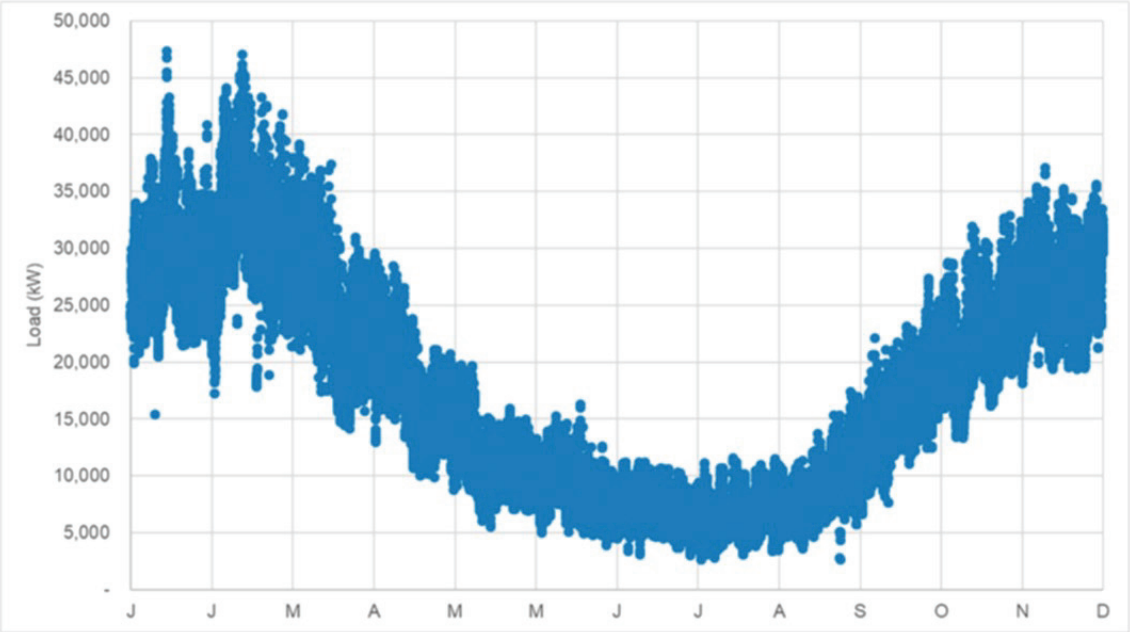
Projected NEU Supply Based on 70% Renewable Energy



Daily and Seasonl Peak Demand

A significant challenge in the operation of a thermal utility is the large variation in system demand driven by daily and season peak demands. Peak demand refers to the window of time in which the most energy is needed in order to provide heat and hot water to the network. The figure below shows the forecast NEU load profile in year 2035 over the course of an average year in Vancouver. The NEU's daily peak is observed between 7-8.30am, coinciding with when people wake-up, turn on their heating and take showers. As the temperature decreases in the winter months a seasonal peak is observed, driven by increased space heating demand.

Forecast Daily and Seasonal Peak at NEU Buildout



Load Duration Curve

The NEU Load Duration Curve, provided below, illustrates the challenge of peak demand. In 2020, a peak demand of 19 MW was observed. While the first 3 MW of energy generation equipment can be utilized continuously year-round, any additional capacity will operate at a lower utilization. For example, in 2020 the system only exceeded 10 MW for a total of 48 days, and 15 MW for just 2.5 days. Currently, natural gas boilers are deployed as a way of conveniently meeting the system peaks as they benefit from the ability of being turned on/off readily. They are also low in capital cost, which is advantageous for a piece of equipment that will have a low utilization. A key challenge in the transition to 100% renewable energy is identifying the technologies that are best placed to meet these peak demands, while remaining cost effective.

NEU 2019 Load Duration Curve