

*Innovation in energy design and sustainability*

## THE COMMUNITY

Horseshoe Bay is a community of about 1,000 permanent residents located in West Vancouver, British Columbia. The 89 year old Sewell's Marina, a staple within Horseshoe Bay, is now being revitalized into a vibrant seaside community.



The redevelopment consists primarily of a resort village, including residential units, as well as some ancillary commercial-use units, both marine and non-marine related. This redevelopment will transform the marina into a distinctive, environmentally sustainable public space that:

- Celebrates the waterfront.
- Creates new economic benefits within the community.
- Promotes highly efficient, low-cost and low-carbon energy

This collaboration aims to refresh the local area while advancing sustainability objectives, helping the District of West Vancouver reduce greenhouse gas emissions and achieve its climate resiliency goals. In addition to helping the District meet its annual targets, this project will also improve energy security to the extent that it maximizes opportunities for its residents, businesses and institutions.

## THE ENERGY SYSTEM

From a discreet, centrally located facility within the development, the district energy system generates energy using a closed-loop ocean exchange system. Through a series of corrosion-resistant pipes, heat is exchanged between the development and a submerged heat exchanger located on ocean floor.

The submerged heat exchanger accepts or rejects heat during different operating modes depending on the season of the year — much the same way a car radiator works.

The heated or cooled water is then returned back to the district energy facility where the heat pumps convert low-grade energy into high-grade energy that can be used for space cooling and heating. No water is taken from or discharged into the marina.

Creative Energy's innovative approach to green energy will produce reliable, on-site heating and cooling with tangible environmental, economic and resilience benefits for Horseshoe Bay and West Vancouver for decades to come.

## REQUIREMENTS OF THE DEVELOPMENT

The system was designed to meet the development's need by providing a high percentage of the energy from low-carbon sources while keeping costs competitive to end users.

More than 90% of the development's thermal energy is expected to be delivered from the sea-water system, while high-efficiency boilers provide the remaining 10%. The use of the ocean exchange system has the added benefit of allowing development to avoid the installation of cooling towers, maintaining the community's scenic beauty.

Creative Energy's system is designed in a way that minimizes the impact to the marina's ongoing operations, the sea's natural ecosystem, and the development itself. Several factors in deciding the appropriate location of the sea water piping and heat exchanger are considered, including:

1. Minimize the disruptions to the marina during construction and operation.
2. Suitable access for maintenance and cleaning.
3. Optimize performance by locating the heat exchangers at the appropriate depth based on the ocean bathymetry.

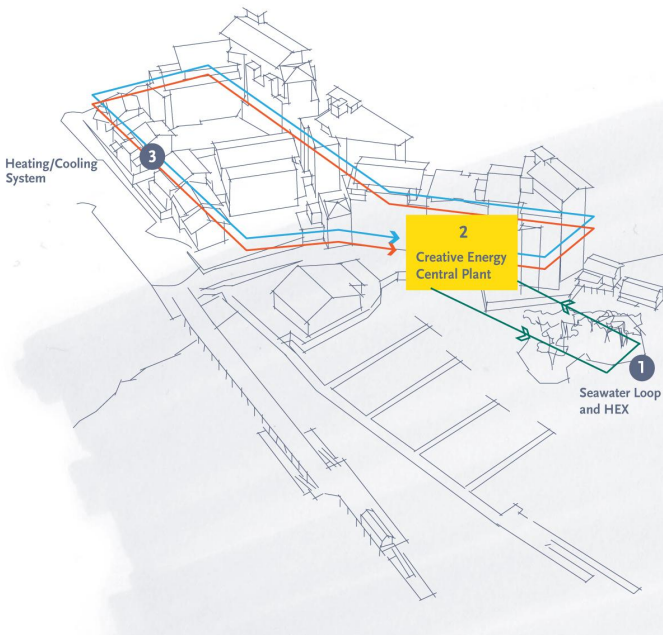
## TECHNOLOGY SELECTION

Due to the proximity of the project to the ocean and the desire to provide residents with both heating and cooling, a sea-water heat-exchange system was selected as the most feasible, low-carbon technology. Creative Energy evaluated both open and closed-loop systems for this project, and both options were evaluated based on their capital costs, operating costs, and environmental risks.

The closed-loop system was determined to be a more environmentally friendly approach with more consistent performance and lower risk of fouling parts.

Creative Energy reviewed the Department of Fisheries and Oceans (DFO) guidelines for these types of systems and determined that an open loop system would have required significant engineering and design efforts to mitigate the 'deleterious substance' produced at the outlet (i.e. water 1° C or more different to the surrounding waters), as well as mitigate the operating cost of dealing with fouled heat exchangers and changing intake screens.

By submerging the heat exchanger, we can eliminate the temperature stratification and avoid deleterious substances.



## EQUIPMENT SELECTION

To meet the criteria, heat exchangers with sacrificial anodes were selected as the preferred solution. Prior to design of the system, Creative Energy collected data pertaining to the temperature and growth activity in the marina waters.

Based on the salinity of the water and high growth rate equipment was designed to meet the following criteria:

- Ability to resist fouling in seawater
- Redundancy of equipment due to cleaning and
- Repair needs
- Ease of cleaning high algae growth in the area

Due to the chemistry and proximity of these anodes to the heat exchanger, the sacrificial anodes corrode before the heat exchangers themselves, and will be replaced as needed over the heat exchangers' lifespan. This is the same strategy used by ships to prevent corrosion.

Creative Energy's ocean exchange district energy system will provide the Horseshoe Bay community a source of sustainable, resilient, and affordable low-carbon thermal energy while minimizing the space requirements on-site and eliminating environmental impacts to the ocean bed. This project provides a truly unique triple-bottom-line approach to energy for the 21<sup>st</sup> century.



**SYSTEM PERFORMANCE & SPECIFICATIONS**

**ENVIRONMENTAL PERFORMANCE**

GHG Gas Reduction: 344 tonnes per year

Percentage of Energy from Sea Water: 90%

**ANNUAL ENERGY REQUIREMENT**

Heating: 1,307 MWh

Domestic Hot Water: 600 MWh

Cooling: 321 MWh

**SEA WATER PIPE**

Water flow rate: 300 gpm

Pipe Material: High-density Polyethylene

**SEA WATER HEAT EXCHANGER**

Heat Exchanger Type: 304SS w/cathodic protection

**HEAT PUMPS**

Heat pump lift: ~55F

Heat pump COP: 6