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COMMUNITY ENERGY CASE STUDIES:

False Creek Neighbourhood Energy Utility Vancouver, BC



Integrated Community Energy System Application

- Neighbourhood Energy Utility (NEU).
- Low temperature community energy system that delivers space heating and domestic hot water to buildings.
- Heat extracted from using heat pumps located at a sewage pump station.

Context

- The City of Vancouver committed to the development of a model sustainable neighbourhood. The project objectives were to future proof the last large development area in the City of Vancouver by making the neighbourhood energy efficient.
- False Creek Neighbourhood Utility is located in Vancouver, BC. The site is a brownfield development adjacent to Vancouver's False Creek. The site was previously industrial and is being redeveloped to provide multi-family homes mixed with retail and community buildings.
- The site includes the Athletes Village as well as neighbouring parcels to the South and east of the Village. It will initially be used to house athletes for the 2010 Olympic Games. As such, there was no ability for slippage in the schedule.
- The sewer heat recovery facility in the NEU will be the first of its kind in North America, and already has spurred interest by other developers to consider sewer heat recovery as an energy source.

Archetype Characterization

Spring 2009

- Archetype: District Heating
- Size: 80 Acre
- Mix: 585,000 sq m of development; 85% residential



Drivers and Rationale to do the Project

 A neighbourhood energy utility was identified as a key component to enhance the sustainability of the development.

Benefits

- Reduction of greenhouse gas emissions by 30%, compared to a conventional development which uses gas fired make up air units with electric in-suite heating.
- The rate structure is designed so that the heating cost to building occupants is comparable to conventionally heated buildings. The return on investment for the City is 6%.

Project Description (Neighbourhood Energy Utility - NEU)

System Characteristics:

The Neighbourhood Energy Utility (NEU) is a low temperature community energy system that uses sewer heat recovery as an energy source. It consists of:

- a community energy centre that produces heat,
- an underground pipe distribution system to deliver heat to individual buildings, and
- an energy transfer station in each building to connect each building to the distribution grid and meter energy used by each building.



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Project Description (Continued)

Process & Technology

Primary source of energy:

- The community energy centre utilises sewer heat recovery
- · Heat extracted from untreated sewer at integrated pump station and heat pump
- The heat pump has a COP of 3.5 and will be used to extract low grade thermal energy and provide temperatures of 65°C.

Back up source of energy and also used to supplement heat on the coldest days of the year:

• The community energy centre utilises high efficiency natural gas boilers.

Other source of energy:

• A number of the buildings incorporate roof top solar modules (solar thermal collectors) to return energy into the NEU.

Cooling:

- A central cooling plant was considered in the original feasibility study, and was rejected due to the low cooling requirements and inconsistency with the principles of sustainability.
- In building, cooling is provided using heat pumps that reject heat into the parkades, eliminating the need for roof top cooling towers.

Design Load / Operation

Design Load:

- The peak load for the system is 11 MW.
- The projected consumption is 25,000 MWh/ year.

Operation:

- Thermal energy is provided using a variable temperature, variable flow design. Temperature will vary from 65°C to 95°C, depending on load.
- The system will deliver space heat and domestic hot water to all buildings located within the South East False Creek Development Plan Area.
- The heat pumps are designed to meet 30% of the peak load.
- Approximately 70% of annual energy provided by heat pumps.
- During summer, boilers will provide domestic hot water.

Storage

• This project has no energy storage system except the distribution network.



Considerations for Implementation & Ownership

- The NUE is owned and operated by the City of Vancouver.
- As part of the official development plan for the area, new buildings are required to connect to the district heating system.
- The City of Vancouver is a Charter City (it is not regulated by the Local Government Act). To permit the City to develop and operate the system, the City had to amend its Charter, as operating an energy utility was not defined within its powers.
- As a city owned utility, the City sets the rates for energy through council.
- A specialist design firm was retained by the City to complete all phases of the project from feasibility to commissioning.
- All design was completed in accordance with the American Society of Mechanical Engineers pressure vessel requirements (ASME B31.1).

Operation - Component expectancy and challenge

- The design life of the pipeline distribution system is 25 years.
- The design life of the heat pump is generally 17 to 20 years.
- Due to scheduling, an 8MW temporary boiler facility was installed to provide heat to the site while the permanent heating plant was under construction.
- Initial commissioning of the NEU and building systems was completed. This resolved any potential operating issues during the start-up phase.

Costs and Financing

- Capital Costs / Financing
 - The capital costs of the NEU infrastructure (approximately \$36 million) will be recovered through rates to the customers.
 - While the City is self financing much of the project, funding was received from a grant from Infrastructure Canada.
- Operational Costs / User fees
 - The NEU is designed to provide customers with rates that are comparable to conventional heating systems, which in Vancouver is electric baseboards with corridor make-up air units.
 - Heating rates include a consumption charge and a demand charge.
 - Typical rates are \$0.07/kWh.
 - Support was obtained from the Gas Tax Fund¹.

¹ http://www.buildingcanada-chantierscanada.gc.ca/funprog-progfin/base/gtf-fte/gtf-fte-eng.html



Relationship to Other Best Practices

- The NEU is part of a sustainable brownfield redevelopment of the South East False Creek area of Vancouver.
- In addition to utilisation of sewer heat recovery and solar thermal collectors, the buildings meet a LEED Gold performance level.
- The site includes a mixture of land uses which supports compact and complete communities.
- In addition, the buildings are designed to exceed the energy requirements of the City Energy Utilisation By-law by 20% (based on ASHRAE 90.1-2001).

Lessons Learned (as of February, 2009)

- Work is ongoing to complete construction and commission the system, and lessons are still being learned.
- At the outset, the City engaged the developer to ensure the building designs were compatible with the NEU.
- Within the city, numerous departments had responsibility for aspects of the project (finance, legal, planning, engineering, and utilities). While the project benefited from initial input from these departments, consolidation of responsibilities into a single entity streamlined the decision making process and development timelines for the project simplified the project decision making process.

Additional Information

 Additional information may be obtained from the City's web site at <u>http://vancouver.ca/neu</u>

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