District Heating: Why do It?

District energy systems distribute heat generated in a centralized location for residential and commercial hot water and space heating requirements. Heat energy from a district energy system is distributed through underground insulated pipes that connect to buildings. District energy systems eliminate the need for a boiler or furnace in each individual building and can provide higher efficiencies and better pollution control than localized equipment. Beyond fossil fuels traditionally used for heat production, district energy systems are adaptable to a wide variety of alternative energy sources including geo-exchange, solar, biomass, waste heat recovery and nuclear power.

"District energy was the vehicle for meeting our renewable energy supply objectives" Chris Baber, NEU Manager, City of Vancouver

Among the guidelines that governed the redevelopment of SEFC were ambitious greenhouse gas reduction and energy-efficiency objectives. In 2003, Brian Crowe, the City of Vancouver's Assistant City Engineer for Water and Sewers, championed the idea of implementing a district energy system as a means of meeting energy efficiency and sustainability targets. District energy systems offer the flexibility of using a wide range of renewable energy resources. For this reason, the City of Vancouver's Neighbourhood Energy Utility (NEU) team had their choice of technologies.

"First we had to determine our objectives," says Chris Baber, the City of Vancouver's NEU Manager, "by identifying the types of energy usage and quantifying the demand." Designing an efficient district energy system requires a holistic approach to system design. To choose an appropriate energy source, the team had to determine which technology would best meet the social, environmental and economic objectives and constraints of the new community.

To help with this, FVB Energy and Compass Resource Management were retained by the City of Vancouver to conduct a district energy feasibility analysis. FVB Energy analyzed a wide variety of energy source options, producing a "Heat Source Options" report for the City. Two viable alternatives emerged from this process: biomass or sewer heat recovery. Compass Resource Management, led by Trent Barry, produced a business analysis report evaluating the economic, environmental and social performance of the two heat source options.

Based on the results of this study, the City of Vancouver approved the development of the NEU in spring 2006. The NEU team explored the two options in depth, hosting a series of public consultations before eventually arriving at a decision.

THE CONTENDERS: BIOMASS VS. SEWER HEAT RECOVERY

Biomass

A biomass facility is a boiler-based energy plant that efficiently burns wood or other organic waste. Modern biomass plants are equipped with state-of-the-art emissions controls to mitigate adverse effects on air quality. As an energy source, biomass is considered to be greenhouse gas neutral since wood waste emits carbon dioxide into the atmosphere regardless of whether it is burned or left to decompose naturally. Biomass has gained popularity in northern Europe due to its low environmental impact. There are a few examples of biomass plants locally, in Seattle, Washington, and Revelstoke, BC.

Sewer Heat Recovery

Sewer heat recovery, in contrast, is a less proven technology than biomass. There are only three sewer heat recovery systems worldwide that recover heat from untreated sewage, two in Oslo, Norway and one in Tokyo, Japan. Sewer heat recovery captures waste heat from municipal sewage. Similar to a geo-exchange system, electric heat pumps transfer thermal energy from warm sewage (12–25 degrees Celsius) to a higher temperature useful for residential space heating and domestic hot water. Compared to geo-exchange, sewer heat recovery is more efficient due to higher heat source temperature and lower installation costs.

"Nobody's ever captured heat from mid-system in the middle of the city." Ray Tarnai, Sandwell

Public Consultation

The City of Vancouver initiated a public consultation process to determine which technology would be implemented. As both biomass and sewer heat recovery were relatively foreign concepts, the public responded with both a keen level of interest and a high level of concern.

For the biomass option, there was a widely held perception that the combustion process would result in harmful air pollution, that the neighbourhood would be negatively impacted by fuel deliveries, and that it would require an unsightly industrial smokestack. The public was more supportive of sewer heat recovery, though concerns were raised about the possibility of odour and contamination.

"Implementing a new technology requires a great deal of public education," says Chris Baber. "The public's perceptions are not always based on technological facts. If you don't have sufficient materials to present when you go public, people's imaginations are left to fill the gaps. If we had had (an additional) six or twelve months, we would have continued to work with the public to address the perception issues." In the case of this project, in order to stay on schedule the NEU team had to decide which system to implement. Sewer heat recovery prevailed as the technology of choice.

The City initiated a second public engagement process concerning the design of the False Creek Community Energy Centre, the facility that would house the NEU operations (see page 12). At the outset, the public was apprehensive about the construction of an industrial facility amidst a high-density residential neighbourhood. "People were fearful of opening up the sewer in their neighbourhood…but it became educational," says Ray Tarnai of Sandwell, the engineering consultants who held the contract for the design of the Energy Centre.

Despite the fears that were raised, "We thought, we've got to do something, we can't do nothing. We needed to find the right solution for the future," remembers Tarnai. "In the end, the public said, 'we're okay, as long as we don't notice it.'"

CHALLENGE **To municipalities and utilities: to future-proof their energy infrastructure by implementing energy distribution and supply systems that support renewable technologies and prioritize the use of locally available sources of energy.**