Tools and Concepts for Wastewater Heat Recovery

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IDEA CampusEnergy2020
What’s the Big Deal about Wastewater Energy?

- Completely Renewable
- Low Carbon
- Easy to Find

The average North American produces 200-300 litres (50-75 gal) of wastewater per day.

Near-zero carbon footprint is achievable if clean electricity is used to run heat pumps.

It’s literally in every urban settlement.
Sources of Wastewater for Heat Recovery

Homes & Businesses

Industries

Sewers

Wastewater Treatment Plants
Wasted Heat

The average sewage temperature is about 10 °C warmer than the drinking water supply in Vancouver.

In a city with 1 million people, this temperature differential amounts to about 8,000 GJ per day, or about 500 t CO$_2$e per day worth of natural gas.

Most of the heat loss is probably happening in the first few minutes of discharge from buildings.
## Typical Resource Availability

<table>
<thead>
<tr>
<th></th>
<th>Multi-Family Building</th>
<th>Small Town / Urban District</th>
<th>Mid-Size City</th>
<th>Large City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>500</td>
<td>5,000</td>
<td>50,000</td>
<td>500,000</td>
</tr>
<tr>
<td>Recoverable Wastewater Energy (Avg. kW)</td>
<td>50</td>
<td>300</td>
<td>3,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Domestic Hot Water Consumption (Avg. kW)</td>
<td>150</td>
<td>1,500</td>
<td>15,000</td>
<td>150,000</td>
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</tbody>
</table>
Wet Weather Effects

Dry weather flow is very predictable and steady.

Rainwater or snowmelt entering sewers spikes the flow up and the temperature down.

Over 700 US cities have combined sewer systems and will behave like this graph. Separated systems also experience wet weather flow but to a lesser extent.
Challenges

- Maintain sewer system operations
- Getting access to sewage
- Solids handling
- Temperature / use limitations
- Cost and GHG footprint of electricity
Technology

• Building-Scale
• Inline Systems
• Offline Systems
• Heat Pumps
“Heat-Seeking Sewer Model”

Uses an existing sewer system hydraulic model to generate heat resource analysis. Can quantify impacts of multiple projects.

Allows cities to identify opportunities ranging from micro-scale to major district energy systems.

Model results from Richmond, BC.
Supportive Policy – BC Context

2007
GHG Reduction Targets Act – commits public sector organizations to carbon neutrality and sets goal of 33% reduction in GHG emissions by 2030

2010
Winter Olympics – Vancouver and Whistler heat the Athletes’ Villages with wastewater

2015
Metro Vancouver develops draft policy for Liquid Waste Heat Recovery

2018
Metro Vancouver introduces Carbon Pricing Policy for capital projects

2020
North Shore Wastewater Treatment Plant to include 5 MW effluent heat recovery system.
Long-Range Outlook

Circular Economy

Decarbonizing Electrical Grids

Lower Temperature Requirements for Buildings

Improved Products and Expertise
False Creek Energy Centre Sewage Heat Pump
Vancouver, BC

Questions?

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