CSI Center for Sustainable Infrastructure

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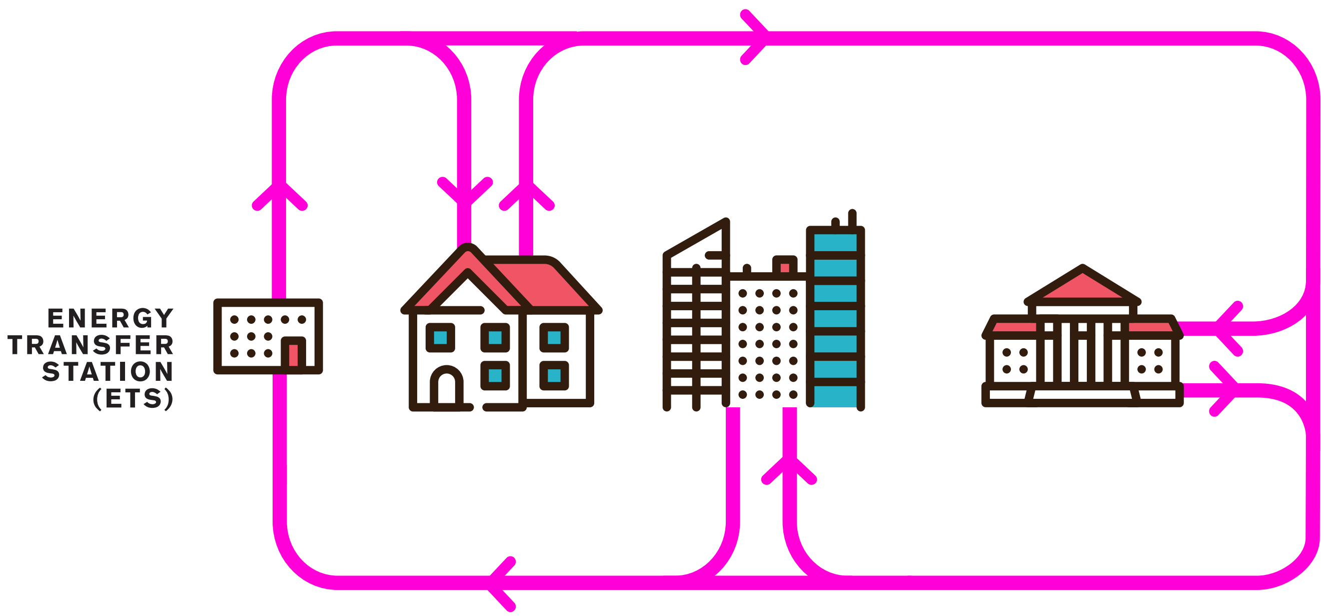
MARCH 5, 2020



DISTRICT ENERGY SYSTEMS

WHAT IS IT?

District energy systems use loops of water to efficiently share thermal energy between users. Depending on system design they can share various temperatures of water from steam to hot water to ambient temperature water and even cold water. These systems reduce the need for any individual building on the system to meet all their own heating and cooling loads on-site. The district system supplies all or most of the heating and cooling needed.

A key to system efficacy is that the district system will offset heating and cooling loads between users on the same system. For example, while an office building be cooling in hot summer weather, at the same time a multi-family building connected to the same system will require hot water for bathing, dish and clothes washing. In this example, the heat rejected from the office building reduces the amount of additional heating needed for domestic hot water uses. District heating is often integrated with power generation.

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MOST COMMON USES?

- District energy systems distribute thermal energy. On occasion they may also be linked with a micro-grid of electrical energy (where sources may be renewable energy, and batteries) or can be part of a combined heat and power system (where energy generation typically by combustion uses the excess heat to supply thermal energy to system users).
- District systems can be a small as connecting two buildings or as large as an entire city.
- Neighborhood scale district systems can grow and connect to cover more and more of the city users.
- Many large campuses with single ownership will install district systems.

OPPORTUNITES FOR INTEGRATION

- Industries can export heat to adjacent food processing or other steam hosts.

HOW IS IT MADE?

- This article focuses on ambient temperature systems as they can be the most efficient.
- Low-temperature or ambient temperature district energy systems connect multiple low-grade heat sources and heat sinks that are conveyed to users by water (or sometimes glycol as a type of antifreeze) via an uninsulated buried piping network.
- The pipes need not be uninsulated as the ground temperature is typically well above freezing.
- As the water moves through the pipe network of the system, the ground temperature tends to keep the flowing water at a stable temperature.
- The difference between this temperature e.g., 55° F and the heat needed for indoor comfort e.g. 68°F is only 13°.
- The energy required to make up a gap of 13-degrees is often much less than if an air-based system is used – where outdoor temperatures could range from below zero F to 110° F.

Creating a district system requires identifying sources of heating and cooling demand and linking them together with a thermal pipe network. Each of the users must agree to pay for their share of the thermal energy they consume – but sometimes it can be at a cost-savings to traditional sources of heating and cooling.

DESTINATION/FATE

- Once established, district energy systems can last for decades or longer. The cost to implement the system can be offset by savings to customers who do not have to spend capital for their own systems. Operations and maintenance of district systems is required. Trained plumbers and mechanical engineers are often engaged to keep systems operating.
- Smaller scale district systems do have a market value and can be sold if correctly configured as larger energy utilities will purchase district systems to harvest the stable revenues generated by the users.

CONCERNS

Contracts for heat from private entities can be complex. Sharing thermal energy is not specifically regulated which means that the potential for a monopoly can cause friction if owners fail to maintain the system with the revenues or increase prices higher than competitive options.