Clean Air Partnership

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Building Low-Carbon Communities: Decarbonizing Residential Energy Systems

April 24, 2025	Webinar Recording	Slide Deck

Creative Energy is developing a low-carbon solution that decarbonizes space heating and cooling for North Oak, a residential project in Oakville. The design utilizes geoexchange and ambient loop systems, heat pumps, boilers, and utilizes energy modeling software to create an efficient and sustainable district energy system. The combination of the geo fields and ambient distribution will allow buildings to share energy with one another, and enable in-suite heat pumps within the building to operate reliably and efficiently. The system is expected to avoid almost 1,000 tonnes of GHG emissions a year. In this webinar, Keith Bate, Director of Engineering, and David Angelo, Director of Relationships (Canada East) presented on the North Oak community energy system and additional low carbon energy projects lead by Creative Energy, highlighting the potential for emissions, energy, and long-term financial savings.

Presenters

- Keith Bate, Director of Engineering, Creative Energy, keith.bate@creative.energy
- David Angelo, Director of Partnerships (Canada East), Creative Energy, david.angelo@creative.energy

Key Findings

- District energy (DE) can lead to improved energy efficiency, reduced operating costs, and lower emissions, especially in dense areas like university and hospital campuses.
- Payoff periods are often misunderstood in the context of energy systems, particularly when comparing utility-scale systems to individual building systems. Instead of focusing solely on payback, a life-cycle cost analysis should be performed, which compares capital, operational costs, and maintenance over time. For thermal energy utilities, costs are generally recovered over the long-term, often around 30 years, through fixed capacity charges.
- Efficiency gains vary based on climate. Thus, project analysis must include a comprehensive evaluation of local conditions.
- To facilitate the transition towards DE, municipalities may need to consider implementing policy changes that promote the adoption of such systems. While municipalities can encourage developers to engage with DE utilities, more concrete measures may be necessary to ensure meaningful progress in decarbonizing systems reliant on fossil fuels, such as gas boilers.

Presentation Overview

Understanding District Energy Systems

- District energy (DE) involves providing thermal energy to multiple buildings from a central plant, which reduces emissions and operational costs while allowing buildings to maximize usable space.
- In traditional energy systems, each building has its own heating and cooling equipment, whereas the DE model employs a centralized approach.
- Understanding the cost structure of energy systems is critical for effective financial planning in building development, because construction costs for DE systems are significant at the outset, and ongoing energy and maintenance expenses may increase over time due to inflation and efficiency losses. Operation and maintenance costs are recurring and require planning for potential future costs such as equipment renewal that might occur as systems age.
- A utility model allows costs to be incorporated into a predictable monthly charge, enhancing budget management for building owners. Furthermore, by pooling costs into fixed capacity and variable consumption charges, a more manageable pricing mechanism can be established, emphasizing the potential for savings through larger, more efficient systems.
- Greenfield projects, which are built on undeveloped land, often present fewer challenges compared to infill projects that require retrofitting existing infrastructure. Retrofitting systems in established cities can be costly due to the need for traffic management and other logistical hurdles.
- Density requirements for energy projects vary, but high-density developments, like those made up of 20-story towers, are typically more viable for thermal energy systems. In less dense situations, simpler system designs are preferred, such as open-loop geo-exchange projects that utilize plastic pipes.
- In British Columbia, milder climates allow for the successful implementation of air source heat pumps (ASHP), while in Ontario, geothermal exchange technology is preferred due to its ability to provide consistent efficiency that is unaffected by atmospheric temperature fluctuations.
- ASHP still function in colder climates, and can achieve an average coefficient of performance of about two, even in conditions where winter temperatures can drop to -26 degrees Celsius.
- Municipalities recognize the benefits of DE and municipal suggestions have led developers to engage with DE utilities.

Ontario Case Study – North Oak Community Energy System

- The North Oak project in Ontario is a large residential development (currently under construction) and is a collaboration between Creative Energy and Minto Homes that focuses on low-carbon heating and cooling solutions.

- North Oak features a centralized energy center with gas boilers for peak heating demand and domestic hot water, complemented by geo-exchange systems consisting of vertical boreholes.
- The design allows for energy sharing between buildings via an ambient network, enhancing resilience compared to standalone systems.
- Integration of in-suite heat pumps and energy transfer stations ensures efficient transfer of energy from the geo-exchange fields to individual buildings, leveraging existing infrastructure.
- The project is designed to be expandable, allowing future phases to seamlessly integrate into the overall energy strategy.

Additional Resources

- North Oak Community Energy System

Contact Information

Please reach out to us at any time with questions, input, or for additional information

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