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Waste Heat and Sorption Technology: A Pathway to Decarbonize District Energy

Dr. Majid Bahrami
Professor, Faculty of Applied Sciences
Simon Fraser University (SFU),
British Columbia, Canada

Abstract

More than 50% of urban greenhouse gas emissions come from building heating and cooling. Currently, these demands are met using high-grade energy sources like natural gas boilers, oil-fired heating systems, and electric heaters/heat pumps, while abundant low-grade heat from distributed energy resources (DERs) remains underutilized. Secure decarbonization of the grid necessitates a diverse mix of technologies. Waste-heat-driven sorption technology, offering significant potential for cooling, heat pumping, low-grade heat upgrading, and thermal energy storage, is a key solution. Sorption technology boasts several advantages over traditional methods: it harnesses various, often freely available, heat sources like solar thermal, geothermal, and waste heat from power generation or industrial facilities and data centers; reduces electricity dependence, thereby lowering costs and emissions; and operates reliably without harmful materials, chemical refrigerants, moving parts, or rare-earth minerals.

District energy networks are crucial for achieving a fully sustainable future due to their flexibility in integrating various renewable sources to heat and cool buildings in densely populated urban centers. However, this transition faces challenges such as the intermittency of renewable energy and the integration of waste heat from diverse sources, including oil/gas, bioenergy, and industrial facilities, which are often located in rural areas and discharged in large amounts to the environment.

This talk will provide a comprehensive 'cradle-to-grave' overview of the challenges facing the decarbonization of district energy networks, emphasizing the importance of waste heat utilization. It will cover emerging waste-heat-driven heating, cooling, and storage technologies, the hurdles to their commercialization, and their crucial role in decarbonizing buildings, district energy systems, and energy grids.