

Decarbonizing the Heat: Challenges and Opportunities

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Abstract

Heating, cooling, and domestic hot water systems in buildings account for ~20% of total energy demand and 17% of GHG emissions in Canada.

Governments around the globe have set ambitious goals to increase the installation of electric heat pumps to decarbonize the buildings heating and cooling load. However, the radical and complete replacement of fossil fuels with renewable electricity for heating may not be feasible and could lead to significant ‘capacity wastes’ in the grid. Furthermore, this transition may not be feasible due to the inability of the grid to cope with all-electric heating loads in addition to the fast-increasing electrification of the transport sector. Therefore, decarbonization of the grid should be planned and achieved by using a greater mix of technologies. In this context, waste-heat driven technology has shown enormous potential for cooling, heat pumping, low-grade heat upgrading, and thermal energy storage. District energy networks can also play a central role in the transition toward a fully sustainable future, due to the great flexibility they provide for integrating various renewables to heat and cool buildings in densely populated urban centers.

This talk will provide a prospective on the challenges and opportunities facing the decarbonization of heating/cooling systems with a focus on sorption heat transformers and storage systems – a multi-scale approach – ranging from synthesizing functional composites to fabricating heat/mass exchangers to developing sustainable heat pumping systems and their pivotal role in decarbonizing buildings, district energy networks, and the Canadian energy grid.