sweet swiss energy research for the energy transition

CROSS

Supported by

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

**Swiss Federal Office of Energy SFOE**

# DeCarbCH – Feasibility of 5th generation district heating and cooling

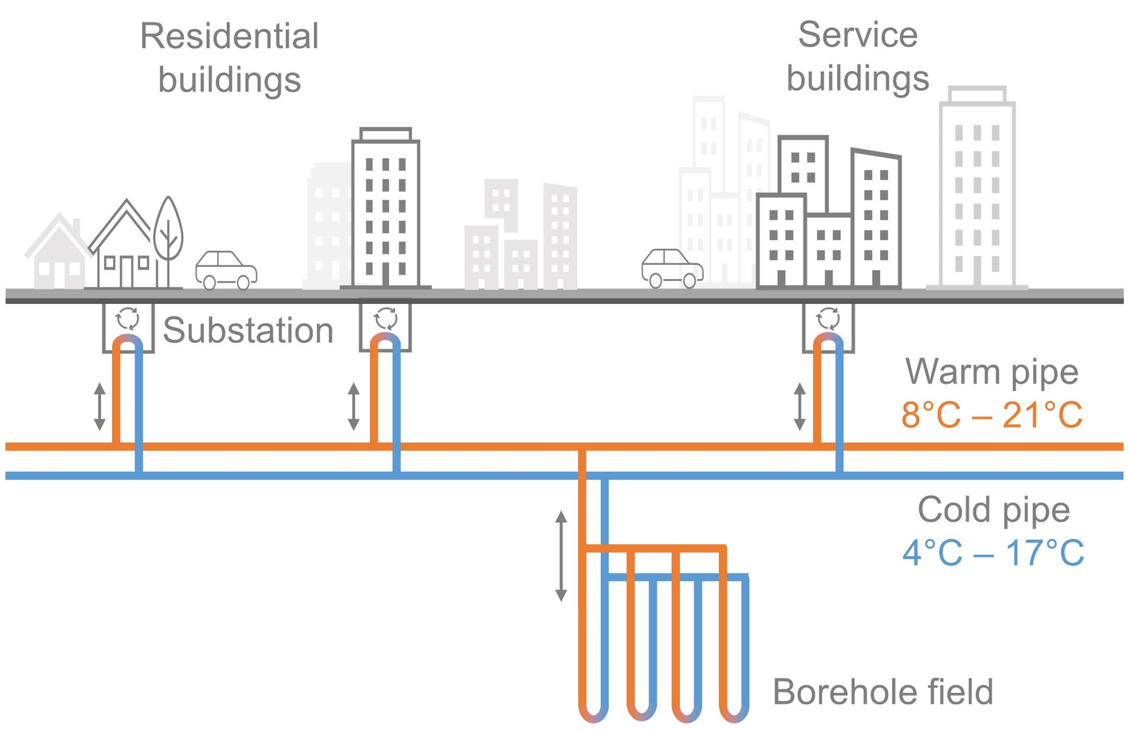
*Energy Efficiency Group, University of Geneva*

## Objectives

This project aims to evaluate the feasibility of 5th generation district heating and cooling (5GDHC) combined with borehole thermal energy storage (BTES) to achieve decarbonised thermal energy systems. The impact of heating and cooling demand structure will be assessed, to understand under which circumstances 5GDHC becomes more favourable than its alternatives.

## Methods

A model is developed for designing and evaluating 5GDHC combined with BTES. building substations equipped with booster HPs , a 2-pipe thermal network, and borehole fields. Key performance indicators (KPIs) include levelized cost of energy, upfront cost, greenhouse gas emission, final energy consumption, exergy efficiency, and the electricity peak power. The performance of 5GDHC is assessed against two alternatives: the Electrification option (electricity driven heat pump systems) and the BAU option (traditional gas boilers and compression chillers).




## Results

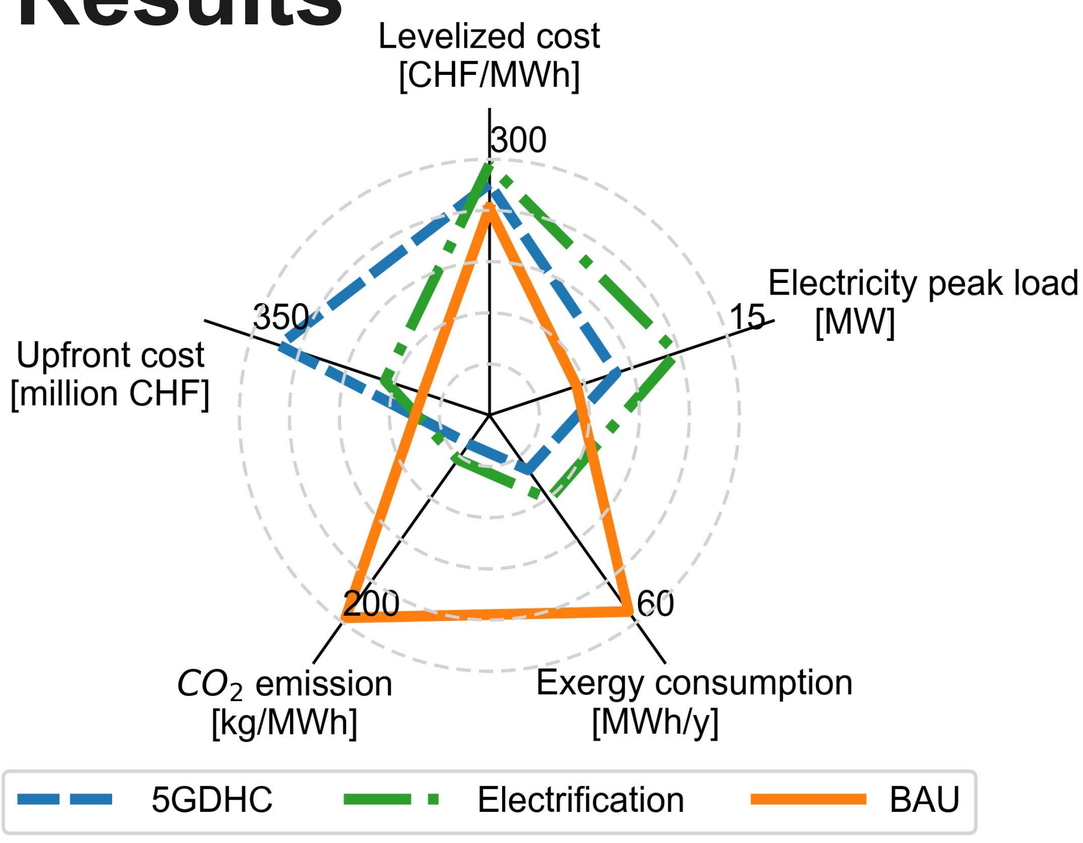



*Fig.1. KPIs of 5GDHC and reference systems*

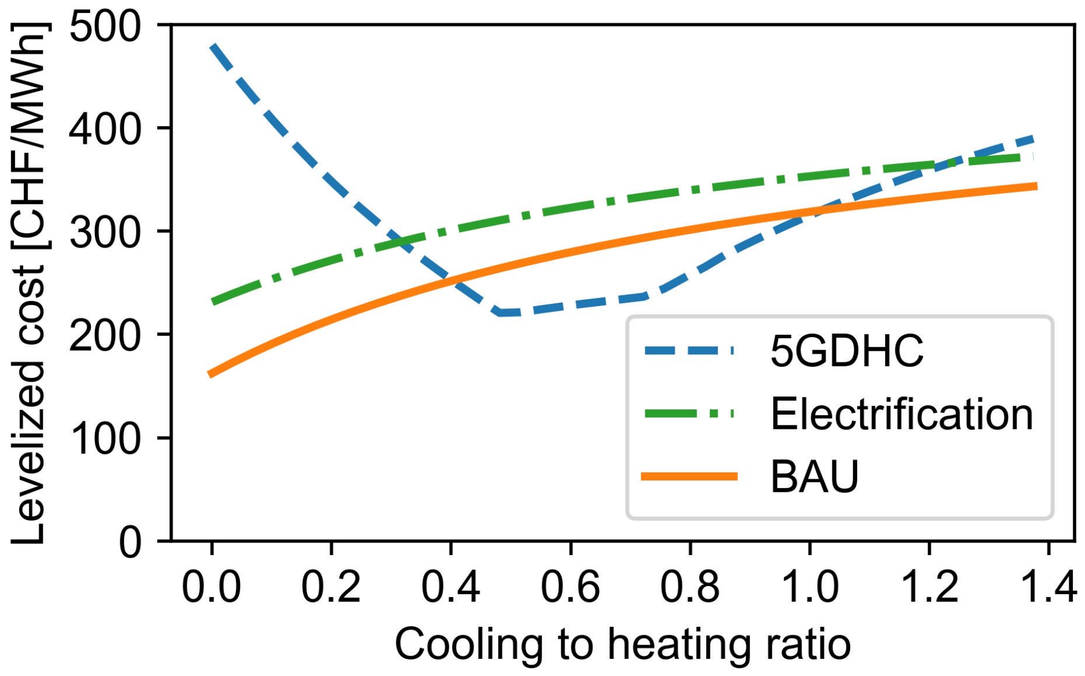



*Fig.2. Levelized costs of energy as a function of cooling to heating ratio*

## Conclusions

5GDHC could achieve lower levelized cost of energy, less $CO_2$ emission, higher exergy efficiency, and lower electricity peak load compared to modern electrified thermal systems. BTES promotes long-term synergies between heating and cooling demands. Cooling to heating ratio substantially influences the economic performance of 5GDHC with BTES.