



Modeling and Simulation of District Heating with Seasonal Storage

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Background

Low grade heat such as thermal energy from solar, industrial processes, etc. in a community does not match the heating demand, including space heating and domestic hot water (DHW) (as shown in Figure 1). For example, the heat could be over supplied in summer and under supplied in winter. Therefore, it is beneficial to use seasonal thermal storage for the low grade heat so that the excessive heat in summer season could be used in winter season.

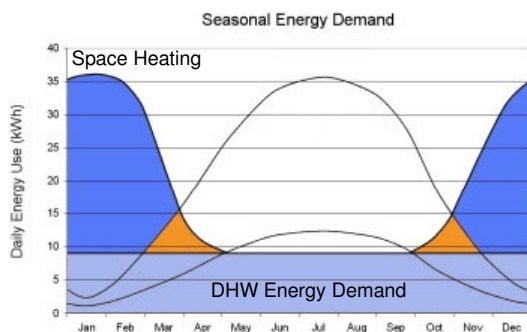


Figure 1: Mismatch between Energy Demand and Solar Heating Supply

This project focuses on the energy-efficient and cost-effective utilization of RES as well as industrial waste-heat for district heating (DH) through the use of large-scale, seasonal thermal storage solutions. Eindhoven University of Technology (TUE) and Tsinghua University have established international collaboration project on the subject. The project will use a state-of-the-art district heating (DH) system with an underground storage of 0.5 million m³ situated in Chifeng city, Inner Mongolia as pilot demonstration. Figure 2 shows the system scheme of this pilot project.

Objectives

The objectives of this project are (1) to develop a virtual testbed, through computational simulation, to analyze the performance of the different design options as well as operation strategies; and (2) validate the virtual testbed with measured data from the pilot DH system.

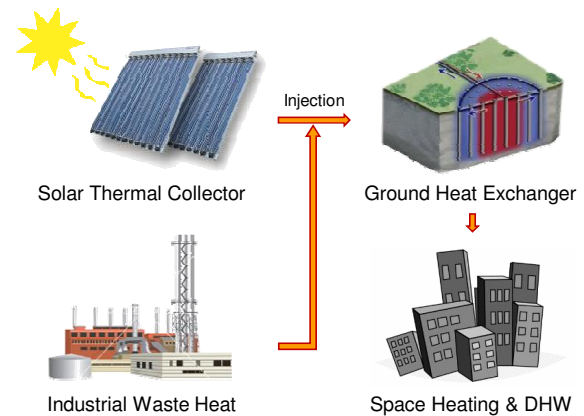
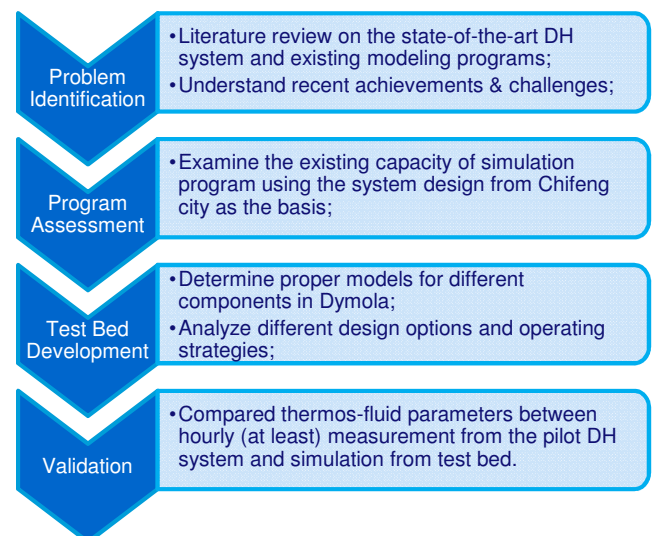


Figure 2: Scheme of the System

Methodology



Expected Results

- To assess the applicability of energy simulation program to model a DH system with seasonal thermal storage;
- To conduct numerical study and analysis on different design options and operation strategies for DH system;
- To demonstrate through a case study of a DH system by numerical simulations with experimental validation of seasonal thermal storage by using the pilot DH system.