Use of Waste Heat from a Wastewater Treatment Plant in a District Heating Network: A Case study from Latvia

Marita Agate ZIRNE, Vivita PRIEDNIECE

Institute of Energy Systems and Environment, Riga Technical university

Contact information:

Address: Azenes Street 12

Phone number, +371 22081590

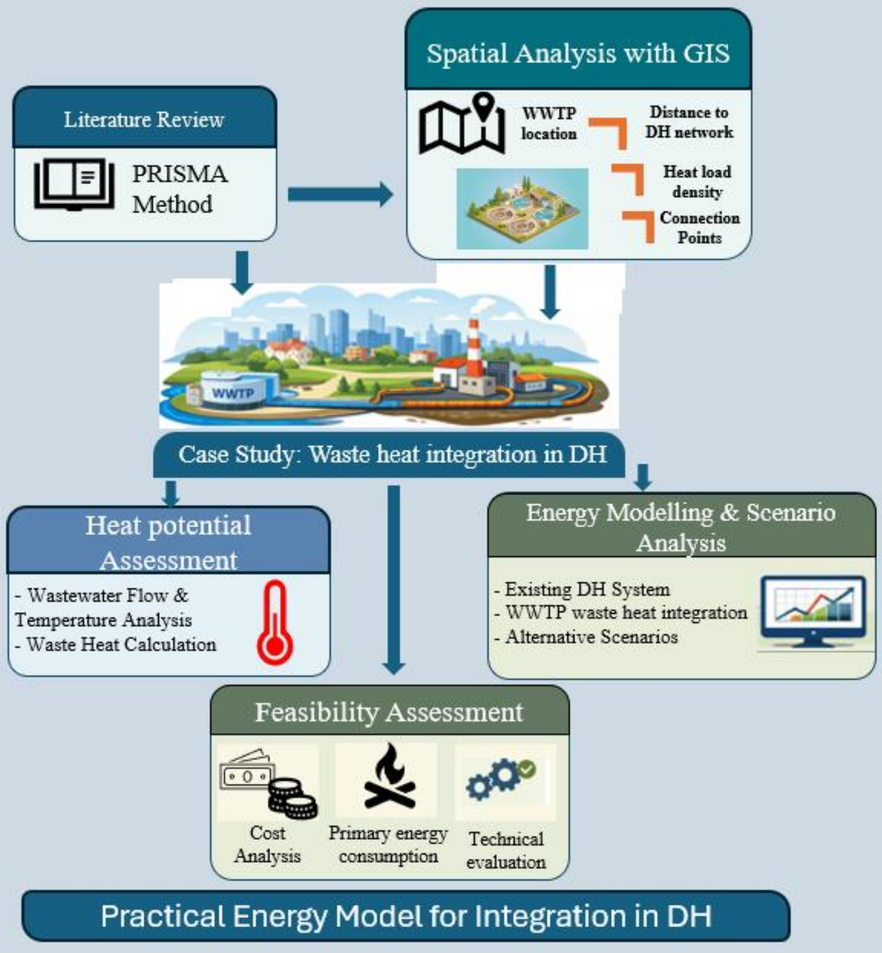
E-mail: marita-agate.zirne@edu.rtu.lv

Wastewater Heat Recovery for Sustainable District Heating Systems

The energy model is based on a detailed **deterministic simulation** of the heat supply system, representing both the existing DH system and several alternative scenarios that incorporate waste heat recovery from a wastewater treatment plant (WWTP), including the use of a heat pump.

These scenarios are evaluated in terms of their impact on **primary energy comsumption** and **peak load**.

This methodological approach enables the development of a **practiacally applicable case study model**, which can serve as a foundation for the broader integration of WWTP water heat into DH systems in Latvia.



Research framework for the study

Introduction

Increasing the share of renewable energy sources (RES), reducing greenhouse gas (GHG) emissions, and improving energy efficiency in district heating (DH) systems are not only technical challenges but also essential steps towards a sustainable and climate-neutral future, helping the European Union (EU) to achieve its **clean energy and climate goals**.

This step is closely related to the EU energy policy, which promotes **energy efficiency implementation** in DH and cooling systems.

In Latvia, similarly to other Nordic Countries and the Baltic States, heating accounts for a large part of **energy consumption**, and the DH plays a crucial role in the heat supply structure.

Methodology

To develop an energy model for the case study on integrating waste heat from a WWTP, a multi-level methodology combining spatial analysis, energy demand assessment, and feasibility analysis is applied.

In this study, a **geographic information system** (GIS) is used for **spatial analysis** to identify the location of WWTP, their distance to the existing DH network, the density of **heat loads** in the surrounding area and potential connecting points to the DH.

The potential amount of recoverable heat from WWTP is determined through an annual analysis of wastewater flow and temperature data, using a standardised method for heat calculation:

$$Q_{rec} = \dot{v} \cdot \rho \cdot C_p \cdot \Delta T$$

The Case study description

A case study analyses the DH system that provides space heating and domestic hot water in a medium-sized town in Latvia, which relies on a boiler house and serves as a typical system in Latvian conditions.

The DH system has 2 heat sources – 3 boilers in one boiler house with a total installed capacity of 11 MW and a cogeneration plant with a heat capacity of 4.5 MW, which can transfer 3.5 MW of heat energy to the network.

During the heating season, the cogeneration plant acts as the primary source, and the second boiler house supplements it according to the required load, while in the summer season, it provides hot water.

The fuel used in boiler houses is wood chips.

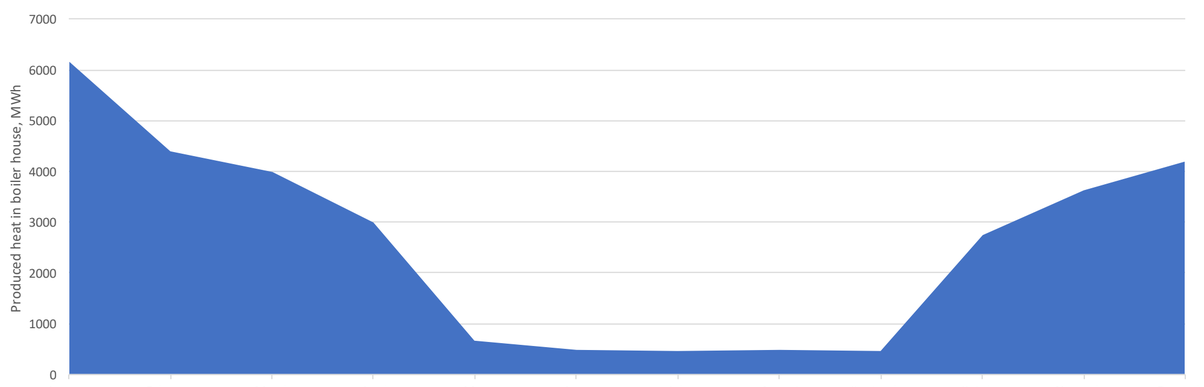


Fig.1 Produced heat in boiler house

Results

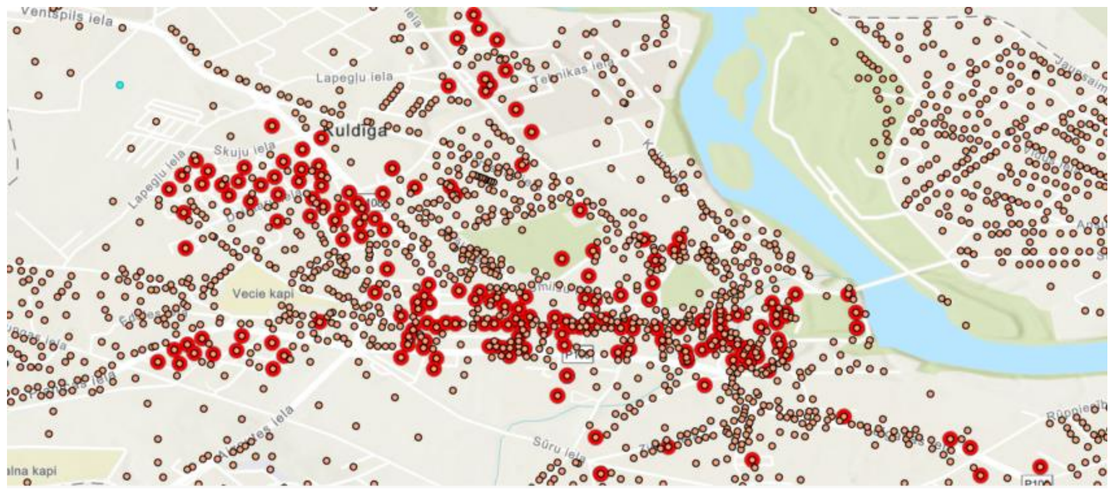


Fig.2 Spatial analysis of heat load