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USE OF WASTE HEAT FROM A WASTEWATER TREATMENT PLANT IN A DISTRICT HEATING NETWORK: A CASE STUDY FROM LATVIA

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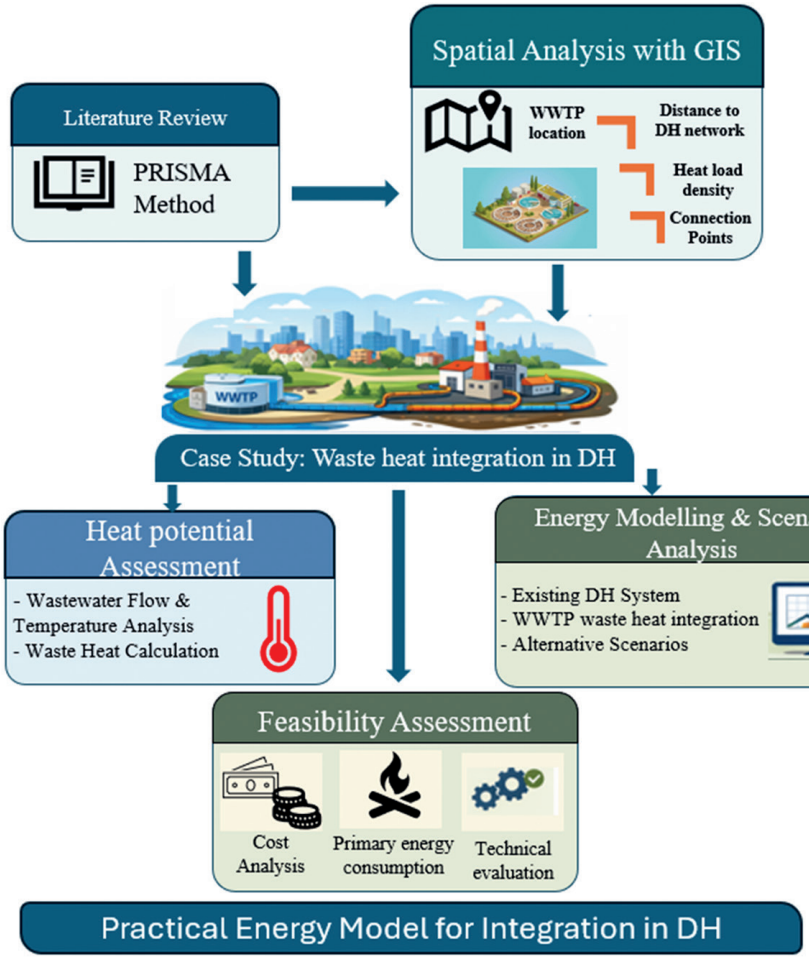
Abstract – Increasing the share of renewable energy sources (RES), reducing greenhouse gas (GHG) emissions, and improving energy efficiency in district heating (DH) systems are not only technical challenges, but also essential steps towards a sustainable and climate-neutral future, helping the European 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. For over 100 years, DH systems have proven to be an effective way to supply heat to buildings, and the development of DH has enabled the use of multiple heat sources, including low-temperature sources such as waste heat. In Latvia, similarly to other Nordic Countries and the Baltic States, heating accounts for a large part of energy consumption, and DH plays a crucial role in the heat supply structure. However, many of these systems are outdated and dependent on fossil fuels, which is why their sustainability and energy efficiency are limited. To ensure that DH systems comply with the EU goals, modernization is needed, including the integration of RES, the deployment of zero-emission technologies, and improvements in energy efficiency. In this study, the PRISMA method is used for literature analysis to evaluate the available research on the use of waste heat in DH systems. To develop an energy model for the case study on integrating waste heat from a wastewater treatment plant (WWTP), a multi-level methodology combining spatial analysis, energy demand assessment, and feasibility analysis is applied. A geographic information system (GIS) is used for spatial analysis to identify the location of WWTPs, their distance to the existing DH network, the density of heat loads in the surrounding area, and potential connection 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 standardized method for heat calculation. 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 WWTPs, including the use of heat pumps. These scenarios are evaluated in terms of their impact on primary energy consumption and peak load. This methodological approach enables the development of a practically applicable case study model, which can serve as a foundation for the broader integration of WWTP waste heat into DH systems in Latvia.

Keywords – District heating; energy modelling; sustainability; waste heat



Research framework for the DH system and waste heat

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