https://doi.org/10.7250/CONECT.2024.002

ROBUST DESIGN OF 5TH GENERATION DISTRICT HEATING AND COOLING (5GDHC) SYSTEMS WITH SEASONAL THERMAL ENERGY STORAGE VIA GIS ASSESSMENT

Stanislav CHICHERIN[1*], Jonathan HACHEZ[2], Afraz Mehmood CHAUDHRY[3], Svend BRAM[4]

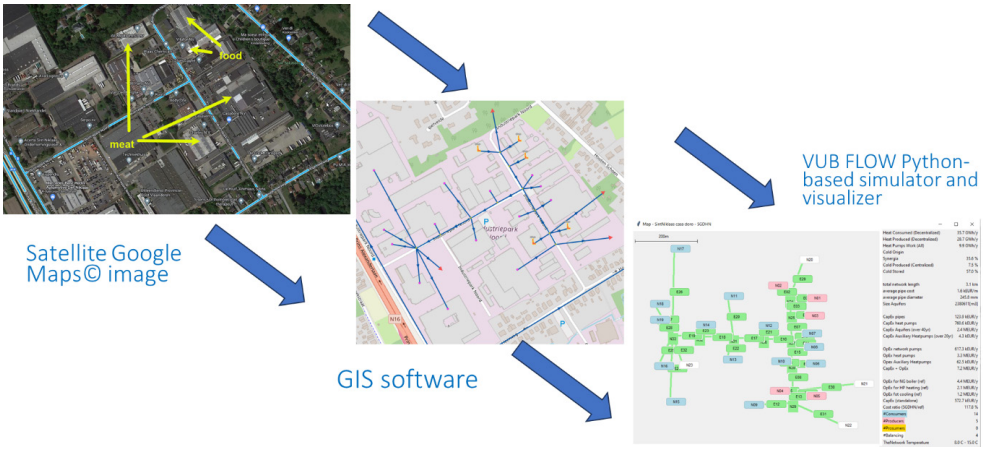
[1, 2] *Thermo and Fluid Dynamics (FLOW), Faculty of Engineering, Vrije Universiteit Brussel (VUB), Pleinlaan 2, 1050 Brussels, Belgium*

[1, 2] *Brussels Institute for Thermal-Fluid Systems and Clean Energy (BRITE), Vrije Universiteit Brussel (VUB) and Université Libre de Bruxelles (ULB), 1050 Brussels, Belgium.*

[*] ***Corresponding author.*** *Email address: stanislav.chicherin@vub.be*

Abstract – This research addresses the need for a method to compare waste heat potential and recovery in 5th Generation District Heating and Cooling (5GDHC) systems. Prosumer buildings, known for enhancing flexibility, are analysed using Geographic Information Systems (GIS) and image vectorization to evaluate 5GDHC systems. The study predicts the amount of waste heat available with an R2 of 0.96, utilizing Chaikin's algorithm to refine thermal images for automatic recognition of the sources of waste heat. Emphasis is placed on the absence of a method for asset design in 5GDHC, with considerations for annual energy calculations, radial network connections, and energy shares among building types. Recommendations for building connecting in Belgium are proposed, favouring 'B'/'C'-labelled buildings. The research explores the impact of building design on heating and suggests energy savings through regulation strategy changes. Dynamic models for heat pumps aim to reduce errors and emissions. The study connects energy indicators and GIS software, contributing to a top-down design approach in 5GDHC systems. The overall goal is to contribute to decarbonization and reduce CO_2 emissions in the energy sector.

Keywords – District energy systems; Geographic Information Systems (GIS); waste heat; renewable energy integration; prosumer; modelling



A first guess converted into a GIS image and then to a graph-theory-driven simulated location

ACKNOWLEDGEMENT

This project received funding from VLAIO in Belgium, ICON project OPTIMESH (VLAFLX7, https://researchportal.vub.be/en/projects/icon-project-optimesh & FLUX50 ICON Project Collaboration Agreement – HBC.2021.0395).