Energy Informatics Research Group

Potential for district heating networks from waste heat: an assessment tool and its application to sewage treatment plants in the Canton of Zurich

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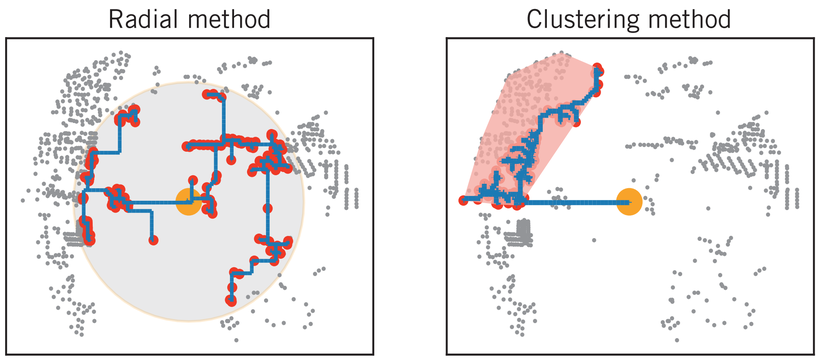
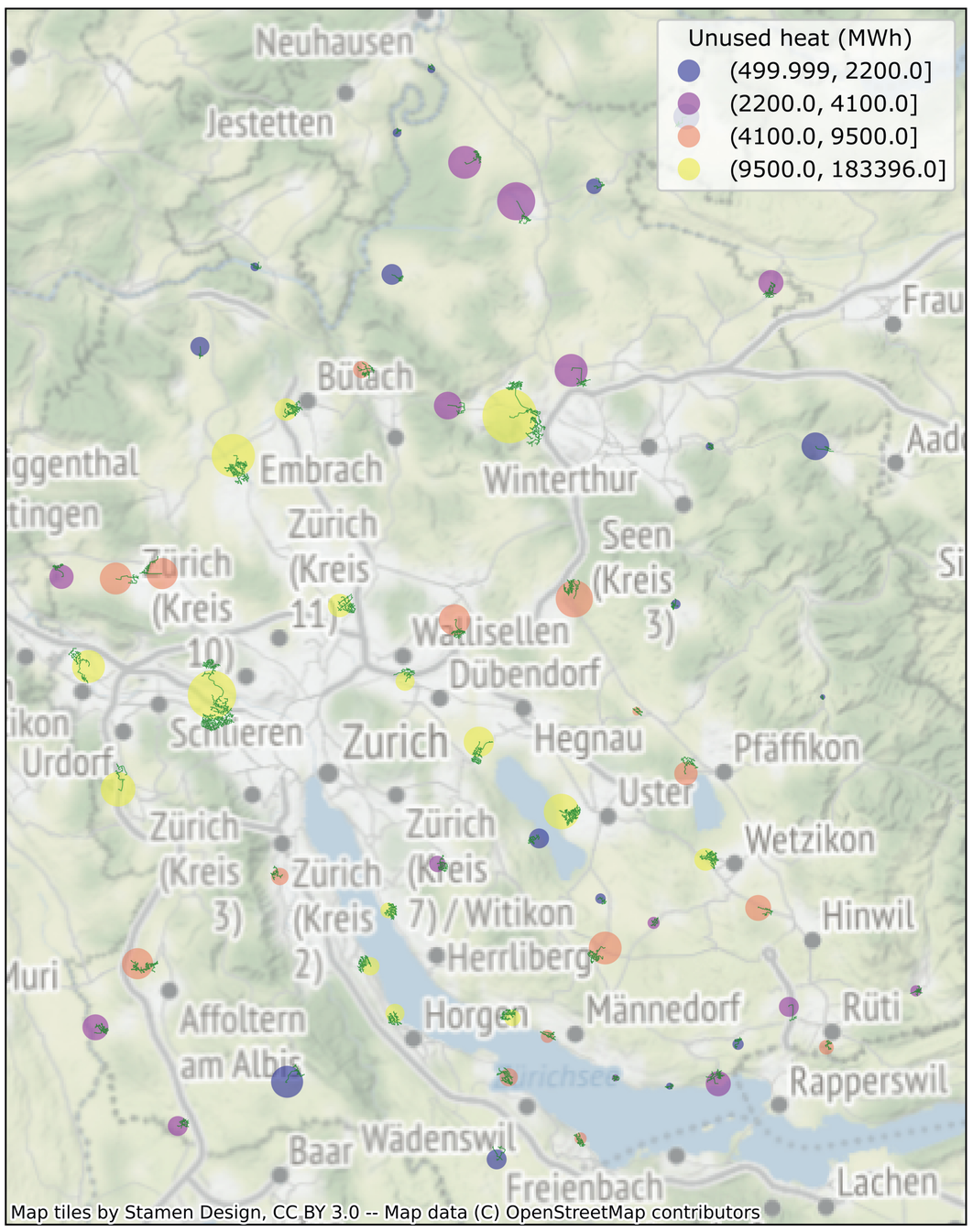
OBJECTIVES

- Evaluation of **low-temperature distring heating networks** (DHN) potential from waste-heat sources
- Application of **graph and clustering techniques** to define the pipework linking to potential consumers
- Estimation of the **energy and financial viability** of DHNs sourced by sewage treatment plants in Zurich area

METHODOLOGY

- Application of the **DHgeN open-source tool** to define potential new DHNs around each sewage treatment plant in the Canton of Zurich
- **Sizing of the DHNs** based on the estimated building annual demand covered by the residual thermal potential of the plants
- Comparison of a simple **radial** approach and a **clustering**-based one to find the consumers to be connected to the heat source
- Sorting the geographical clusters of potential consumers by their estimated **financial revenue**

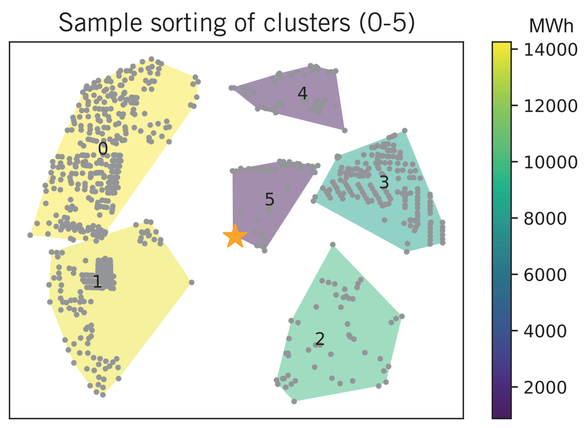




RESULTS

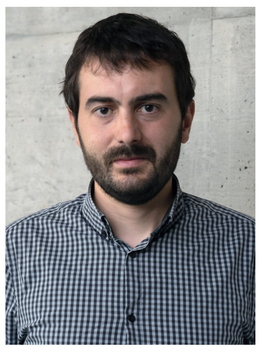
- **13,077** buildings (**6%** of the building stock) as potential consumers of DHNs connected to the existing **61** plants in the area.
- **Over 20%** reduction in pipework length and saving in investments using the clustering approach

DN	Unitary cost (CHF/m)	Radial approach Length (km)	Radial approach Cost (kCHF)	Cluster approach Length (km)	Cluster approach Cost (kCHF)
< DN50	1200	364	435670	268	322142
< DN100	1400	89	125045	69	96902
< DN200	1900	63	120563	54	102969
≥ DN200	1900	17	32490	18	33252
Total		**533**	**713767**	**409**	**555265**



CONCLUSIONS AND OUTLOOK

- We developed an **assessment workflow** to identify the potential consumers of DHNs sourced by waste heat and estimate the network length using the DHgeN tool.
- The case-study application has shown a coverage of **6% of the building heat demand**, with a **14% saving** in electricity compared to a base scenario with decentralized air-air heat pumps, and a competitive unitary cost (**0.04 CHF/kWh)** for the infrastructure.
- The method based on open geodata can be **extended to other areas** in Switzerland.



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Project repository: https://gitlab.idiap.ch/eguzki/heat-excess - DHgeN repository: https://github.com/idiap/dhgen

Data sources:
Wärme dataset from the canton of Zurich (as of 16.11.2022)
JASM dataset provided by SCCER JA S&M project (2017)
TMY weather file of Zürich Airport (2007-2021) from Climate.OneBuilding.Org.