

Where can thermal networks support Lucerne's heating transition?

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1. Introduction, Research Questions and Goals

The heating sector remains a major challenge for achieving the net-zero target by 2050. In the Canton of Lucerne, several buildings cannot be supplied with individual renewable heating systems due to spatial or technical constraints. These buildings create a planning gap: alternative collective solutions are required, but their spatial distribution, heat demand, and economic suitability were not yet available in a structured canton-wide form.

"Determine technical feasibility and economic viability for thermal networks including all critical properties in the Canton of Lucerne?"

Develop a reproducible GIS workflow to identify, cluster, and evaluate potential thermal-network zones across the Canton of Lucerne.

2. Methodology

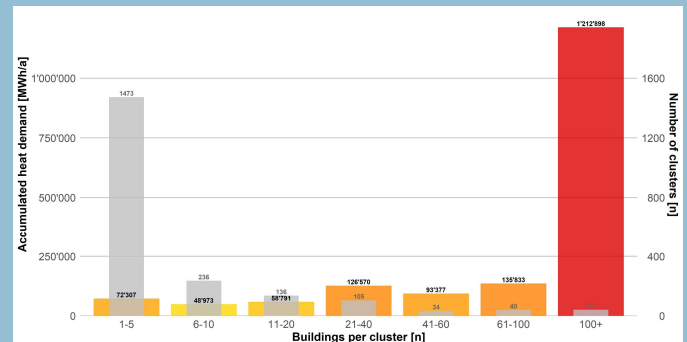
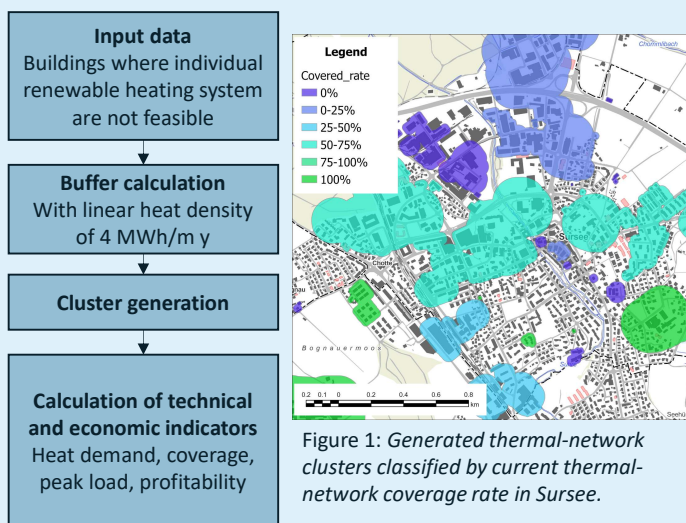


Figure 2: Comparison of accumulated heat demand (colored) and number of clusters per buildings per cluster in gray.

Under the baseline heat price of 0.25 CHF/kWh, most technically feasible clusters are economically viable. The reduced-price sensitivity case of 0.1838 CHF/kWh shows that profitability is strongly dependent on the assumed tariff model.

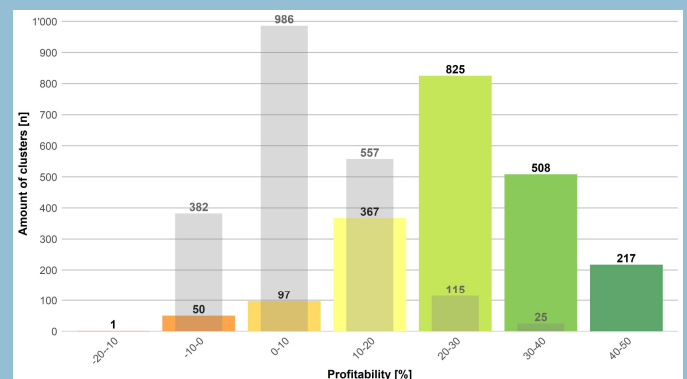


Figure 3: Comparison of profitability with heat price of 0.25 CHF/kWh and 0.18 CHF/kWh in gray.

The results indicate that thermal-network potential is concentrated in a limited number of large clusters, while many smaller clusters are spatially isolated. The workflow provides a useful canton-wide screening tool, but detailed feasibility studies must still consider heat sources, pipe layout, ownership structure, and local tariff assumptions.

3. Scope, Results and Discussion

The spatial analysis quantified the scale of potential thermal-network development using four key indicators derived from the generated cluster dataset.

Buildings included	18'110
Clusters generated	2'095
Accumulated heat demand	1'749 GWh/y
Share of cantonal demand	37 %

Large clusters contain the majority of the relevant heat demand and therefore represent the main priority areas for further planning.

Although many clusters are small, the heat demand is concentrated in a limited number of large clusters. The 115 clusters with more than 40 buildings account for more than 82 % of the heat demand considered in the analysis.

4. Conclusion and Recommendations

The developed dataset should be used as a screening tool and initial prioritization layer for cantonal and municipal heat planning, not as a site-specific solution. Future work should verify promising areas through detailed feasibility studies, stakeholder coordination, and integration with available renewable heat-source potentials before concrete thermal-network projects are initiated.

References

Thalmann, S., Nussbaumer, T., Zaugg, D., & Cueni, M. (2025, December). Planungshandbuch Thermische Netze. EnergieSchweiz, Bundesamt für Energie BFE. <https://qmthermischenetze.ch/> (p. 201-234)