HSLU Hochschule Luzern

Technik & Architektur
Master of Science in Engineering
Energy and Environment

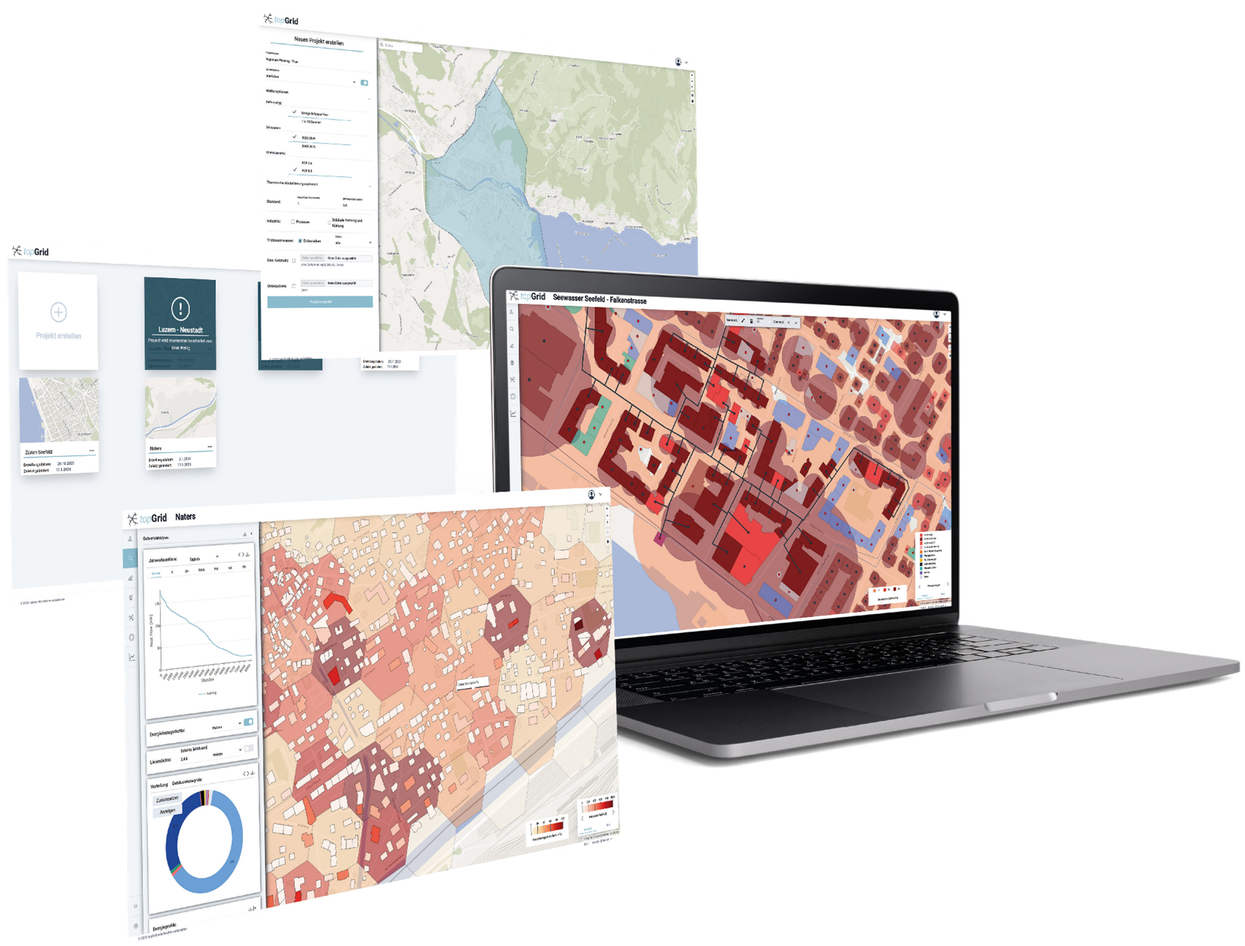
Master-Thesis

*top*Grid

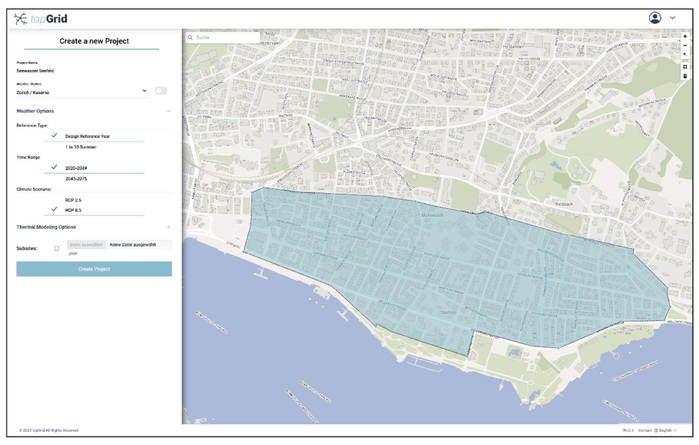
a Holistic District Heating- and Cooling-Planning Tool for Switzerland

topGrid

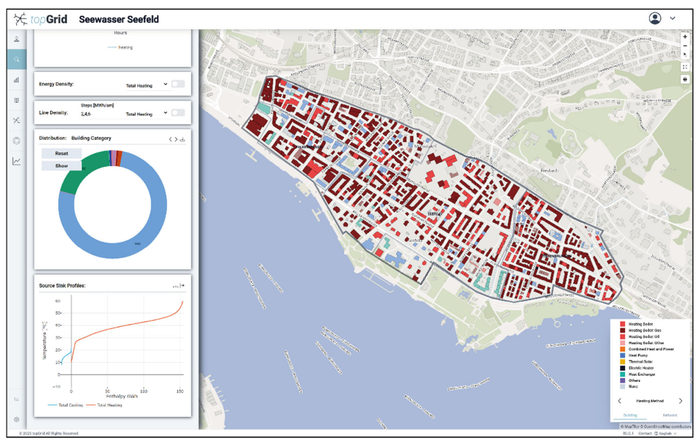
Digital Thermal Grids



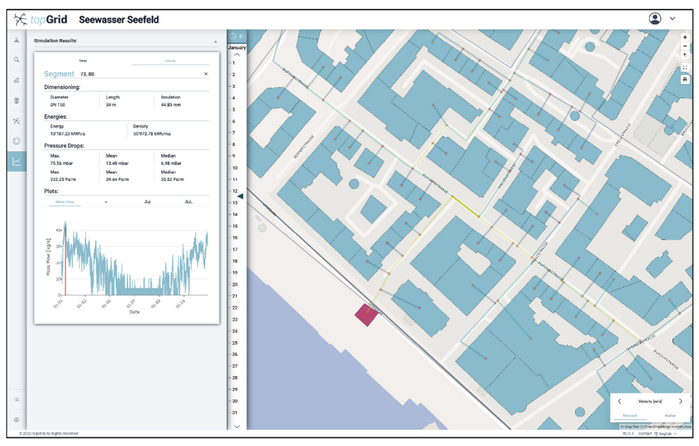
Model



Analyze



Simulate



Problem Statement & Objective

In Switzerland, space heating accounts for approximately 75% of total building energy consumption and predominantly relies on fossil fuels. To achieve the energy transition and to meet the CO_2 targets, the decarbonization of Swiss building parks is inevitable, and holistic energy planning is crucial. District heating and cooling networks play a critical role in this transition. However, current energy and district heating and cooling network planning tools are inadequate, creating a demand for comprehensive planning applications.

To address the aforementioned challenges, this thesis aims to develop a comprehensive web application for holistic energy and district heating and cooling network planning in Switzerland.

Solution Concept

This thesis introduces *top*Grid, an intuitive online tool which enables a detailed holistic, data-driven approach for an efficient energy and thermal network planning.

*top*Grid can leverage the Swiss Federal Housing Registry (GWR) to model thermal demands, including both heating and cooling, of any arbitrary site in Switzerland. Based on the modeled demand, it provides intuitive graphical tools to visualize various characteristics, such as energy sources, thermal requirements, and heating methods, etc., at both individual building and site-wide levels. Additionally, it aids in identifying potential for district and heating and cooling networks implementation and allows users to design and simulate various network configurations, including user-defined network topologies.

The tool simulates both centralized and decentralized networks on an hourly basis. Thereby, *top*Grid automatically selects the required heat pumps and chillers depending on the temperature levels. Based on the results, all units and the network are dimensioned, and the annual costs are calculated. Additionally, the network characteristics can be analyzed to identify possible weak points.

Conclusion

The thesis was successful in developing a holistic energy and thermal network planning tool. The application includes all necessary tools for planners in Switzerland. *top*Grid is ready for its first application in real world projects.

Grand Jonas

Advisor:
Prof. Dr. Beat Wellig

Expert:
Dr. Andrea Grüniger

FH Zentralschweiz

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