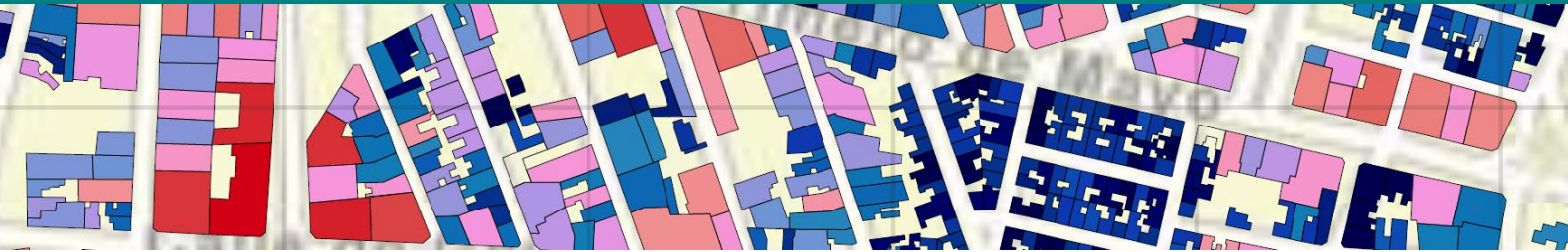# Master's Thesis

## Shining a Light on Heat Demand: The Role of Solar Gains in High-Resolution Heat Demand Modeling



## Motivation

Due to the ongoing sector coupling of electricity and heat, accurately modeling hourly heat demand is becoming increasingly important for modern energy systems. However, detailed building-level heat demand data remains limited or inaccessible, presenting a significant challenge for energy modeling. To address this, the IEE institute has developed a Python-based tool for estimating high-resolution heat demand time series using open data. This master's thesis offers the opportunity to build upon this tool and enhance its capabilities.

A key factor not yet fully integrated into the model is solar gain—the passive heat buildings receive from sunlight—which can substantially affect heating demand. The aim of this thesis is to assess the influence of solar gains and develop methods to incorporate them into the existing model. By working with open datasets and geospatial analysis, this work will improve model accuracy and contribute to more effective, data-driven energy planning.

Due to the interdisciplinary nature of the topic, we welcome applicants from a variety of fields such as electrical engineering, physics, building engineering, data science, or related areas. The focus of the thesis will be tailored to align with the individual's background, skills, and interests.

## RESEARCH QUESTIONS

- What is the impact of solar gains on hourly heat demand profiles?
- How accurately can annual heat demand at the building level be estimated using OpenStreetMap data?
- What are the differences in heat demand and time series when using different methodologies and data sources?

## TASKS & METHODOLOGY

- Conduct literature research on existing methods and datasets.
- Compare different methodological approaches for incorporating solar gain.
- Analyze time series and georeferenced data.
- Work with large datasets and automated data workflows.
- Develop and extend Python-based software.

## ORGANIZATIONAL INFORMATION

- Start: Immediately
- Support from the motivated IEE team
- Close cooperation with supervisor

- Modern workstations available at the institute
- (Partial) creation in home-office possible
- Writing in English

## Contact

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