# Optimal Decarbonization of Urban Energy Systems: A Case Study for a German City

EINS ENERGY INFORMATION NETWORKS AND SYSTEMS

TECHNISCHE UNIVERSITÄT DARMSTADT

## Bachelor's Thesis / Project seminar

### Motivation

The energy transition within urban settings presents a critical challenge in achieving a sustainable future. Within the scope of the NEED project [1] this thesis focuses on modeling the energy transition for a German city, considering sector coupling, demand flexibility, and urban infrastructure. The goal is to develop a spatially resolved multi-modal energy system optimization model to analyze various scenarios, such as achieving zero $CO_2$ emissions by 2050 in the urban context, with a special focus on the heat sector.

### Goal

The goal is to conduct a comprehensive analysis of the city's energy transition toward a low-carbon system using the GeoPipe framework. This comprises evaluating the current state of energy production and consumption and developing a spatially resolved digital model of the city's energy system. Different decarbonization pathways will be developed and assessed for individual districts, as illustrated in Figure 1.

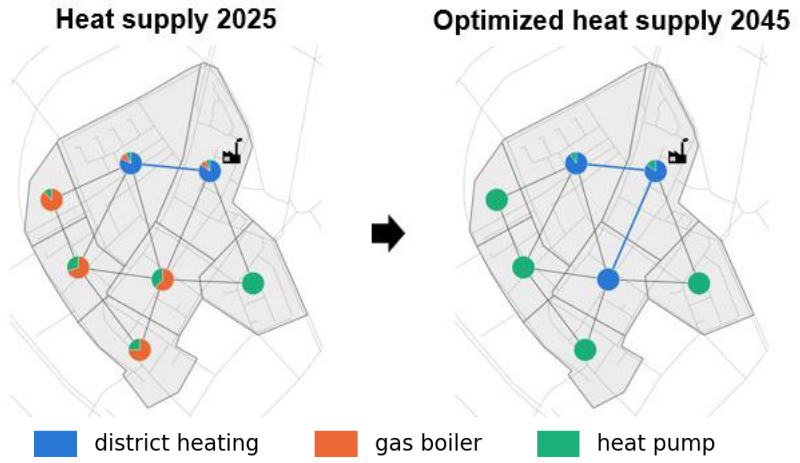


Figure 1: The energy system's status quo and the optimized energy system in 2045.

### Tasks

1. Literature research on
   a. Energy system modeling
   b. Energy system status quo of the considered city
2. Setup a case study for a German city
3. Calculate different decarbonization scenarios
4. Analyze, discuss and validate
5. Write thesis

### Requirements

- Good German / English
- Python programming skills
- Highly motivated

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Contact me if you are interested!

[1] M. Duchon et al., "A Platform Ecosystem Providing New Data For The Energy Transition," ACM SIGEnergy Energy Inform. Rev., vol. 4, no. 4, pp. 226–237, Oct. 2024, doi: 10.1145/3717413.3717435.