

Thesis

Multi-criteria decision analysis as a method for the selection of energy technologies for neighbourhood energy systems



Initial Situation

The mobility and energy transition is key to achieving climate protection targets. Urban areas have high potential for renewable energies and sector coupling due to their energy requirements and infrastructure density. Numerous solutions exist, from PV systems and heat pumps to sharing services and virtual power plants. With the energy transition, however, new *conflicts of interest* are arising between ecological, economic and social objectives. For example, the switch from fossil fuels to renewable energies is shifting the environmental impact from direct CO₂ emissions during operation to indirect effects such as the resources required to produce energy technologies. At the same time, new technologies such as heat pumps are necessary to achieve a climate-neutral energy supply, but are associated with (initially) higher investment costs, which also have a social impact on the affordability of energy. As part of the *adjust* research project, these challenges are to be made visible with a digital tool that supports the participatory and multi-criteria planning of post-fossil and multi-sectoral energy and mobility in the neighbourhood - using Herne as an example.

Objective

The aim of this thesis is to carry out a multi-criteria decision analysis (MCDA) for the future development of an energy system in a neighbourhood in Herne. The MCDA is a method for structuring a decision problem (e.g. which technology should be used for heat supply?), considering different alternative solutions (e.g. geothermal vs. solar thermal), target variables (operating costs vs. emissions) and subjective weightings. The exemplary MCDA is then to be summarised as a methodological guideline to integrate the MCDA method into the planned *adjust* tool.

Procedure

- Literature research to select a suitable MCDA method
- Implementation of the MCDA according to the methodology
- Definition of the decision problem, target values and decision alternatives in participatory formats (e.g. workshops) with stakeholders from Herne
- Definition of suitable criteria for evaluating the alternatives, collection of data for these criteria and normalisation of the collected data
- Weighting of target values via participatory formats (e.g. stakeholder survey)
- Summarising and interpreting the results
- Creation of a guideline for integrating the method into the planned tool adjust

What you bring along

- Interest in sustainability topics as well as technologies and challenges of the energy transition
- Prior knowledge of or interest in the MCDA methodology
- Good communication and organisational skills as well as methodological knowledge for conducting workshops or surveys
- Structured and systematic way of thinking and working

If you have any questions, feedback or interest, please contact:

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