Thesis

Life cycle analysis 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 targets. For example, the switch from fossil fuels to renewable energies is shifting the environmental impacts between environmental impact categories and life cycle phases. It is no longer the direct CO_2 emissions of the operation that are determining, but indirect effects such as the resource requirements to produce energy technologies. 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 assess and evaluate the environmental impact of individual energy technologies used in neighbourhood energy systems (e.g. heat pumps, heat storage systems, photovoltaic systems, etc.) over their entire life cycle. To this end, a complete life cycle analysis (LCA) is to be carried out or existing LCAs adapted so that the local conditions of the example neighbourhood and future technological developments are considered. The aim is to integrate the results into an energy system model (ESM) - methodological requirements for linking LCA and ESM must therefore be considered when carrying out and processing the results.

Procedure

- Literature research for (1) the collection of existing life cycle analyses of the selected energy technology and (2) the definition of methodological requirements from the coupling of ESM and LCA
- Implementation of the LCA in accordance with corresponding ISO standards and relevant guidelines (e.g. ILCD Guidebook)
- Collection of LCA data, in particular on local conditions in the sample neighbourhood and future technological developments via literature and other suitable data sources (e.g. company surveys)
- LCA modelling using LCA databases and software (OpenLCA or GaBi)

What you bring along

- Interest in sustainability topics as well as technologies and challenges of the energy transition
- Previous knowledge in the implementation of life cycle analysis, in best case experience in the application of LCA software
- Structured and systematic way of thinking and working

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

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