

Master Thesis:

Developing generic Life Cycle Inventory models of Battery Container Storage Systems

Background/:

The shift towards renewable energies, coupled with their inherent fluctuations, has driven a growing need for energy storage capacity on grid level. In order to advance the energy transition in a sustainable manner, a thorough examination of the sustainability of storage technologies is essential. Given the dynamic nature of the market, analysing different storage technologies regularly requires the development of new models. However, particularly for stationary Container Storage Systems (CSSs), which play a central role in this context, there is a remarkable lack of understanding about the variety of designs, which is especially evident in their cooling and management systems. Accordingly, there are only a few mature models for the sustainability assessment of CSSs in the literature, referred to as life cycle inventory (LCI) models.

Therefore, the aim of the master's thesis is to gain a comprehensive understanding of the CSS market and to develop generic Life Cycle Inventory models in order to enable comparable sustainability assessments.

The planned master thesis is carried out within the Research group "Research for Sustainable Energy Technologies" (RESET) at ITAS, KIT (https://www.itas.kit.edu/english/rg_reset.php).

Description of work:

Required tasks within the scope of the above-mentioned topic description:

- Conducting a comprehensive literature review of the field
- Analysing the current state of the art in the construction and operation of Container Storage Systems (CSSs), while also considering future developments as foundational elements for the life cycle inventory:
 - Gathering information from manufacturers, operators and other stakeholders in the field
 - Collecting data on physically available CSS
 - Defining components to be subjected to detailed analysis
- Performing Material and Energy Flow Analyses (MEFA) on CSSs
- Consolidating the acquired data into one or more generic life-cycle inventory models
- Optional, depending on the candidate's knowledgebase, conducting a streamlined Life Cycle Assessment (LCA)
- Critically reflecting on the results and providing recommendations for further research.

- Personal qualification:** Students of industrial engineering, process engineering or similar disciplines
- Basic technical and economic understanding of energy technologies
 - Good knowledge of MS Office, especially Excel
 - First knowledge in the field of life cycle assessment
 - Independent and result-oriented way of working
 - Good English speaking and writing skills
- Duration:** Limited, 6 months
- Starting date:** Immediately
- Application:** Please send your application including a short CV and your current transcript of records to the named contact persons.
- Contact persons:** Friedrich Jasper (friedrich.jasper@kit.edu),
Dr. Manuel Baumann (manuel.baumann@kit.edu), and
Dr. Marcel Weil (marcel.weil@kit.edu)

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Karlsruhe Institute of Technology