

Masterarbeit

## Development and design of an innovative integrated steam storage for Carnot Batteries

**Content:**

Carnot batteries are a promising storage technology for electric grids with a growing share of renewables. Compared to other base-load capable storage technologies, like pumped hydro or compressed air energy storages, Carnot batteries are independent of geographical constraints. Especially Carnot batteries based on a heat pump process for charging and an Organic Rankine Cycles for discharging allow the use of readily available components and an effective integration of low-temperature waste heat to boost the efficiency. Although they do not reach as high power-to-power efficiencies as lithium batteries, Carnot batteries allow a less costly extension of the storage capacity which basically consists of a hot water vessel. However, as Carnot batteries base on thermodynamic cycles, their flexibility is limited. Integrated storages enable a more flexible and stable operation.

Within the scope of this work, a novel integrated steam storage for an existing Carnot battery prototype will be developed and designed. First, various modular and scalable geometries will be evaluated in terms of storage capacity, heat transfer and mechanical stability. Afterwards, the most promising concepts will be determined and a steam storage prototype will be designed in CATIA, accompanied by thermal and mechanical calculations/simulations. The overall goal is to develop an innovative steam accumulator that can be directly integrated in Carnot batteries to increase their performance.

Language: English or German

**Tasks:**

- Literature review regarding Carnot batteries, steam accumulators and storage design
- Definition of scalable geometries, design of storage prototype
- Thermal and mechanical calculations of the storage
- Visualization and discussion of simulation results
- Written documentation of conducted work and visualization of results

**Prerequisites:** Basic know-how in CATIA, thermal and mechanical calculations

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