

# Design and Performance Assessment of Cold Thermal Energy Storage Systems for District Cooling Systems

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## Summary

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*We are looking for a highly motivated and self-driven PhD student/Early-stage researcher to investigate the state-of-art technologies in the realm of cold thermal energy storage (cold TES) systems. As a doctoral researcher, you will contribute to the development of physics-based/machine learning models for enhanced performance, efficiency, and reliability of Cold TES in the context of district cooling applications. The prospective candidate will be part of TalTech's research group of Smart District Heating Systems (led by Prof. Anna Volkova), focused on conducting industry-relevant research, writing top-tier scientific publications, and participating in funded projects.*

Research field:	Chemical, materials and energy technology
Supervisors:	Prof. Dr. Anna Volkova Sreenath Sukumaran
Availability:	This position is available.
Offered by:	School of Engineering Department of Energy Technology
Application deadline:	Applications are accepted between June 01, 2024 00:00 and June 30, 2024 23:59 (Europe/Zurich)

## Description

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With the increasing share of intermittent renewable energy sources, the energy storage (ES) technologies have become relevant in energy sector. Electrical and thermal ES are widely studied for proper electricity and heat demand management. However, the exponential growth of cooling demand in recent years poses a new challenge to energy planners and policymakers. Adoption of cold TES systems provide a promising solution through peak load shifting and economic savings. The water and ice forms the typical choice for cold media. However, the cold TES technologies evolved over the years in terms of storage media, heat transfer mechanisms, and system designs.

An in-depth literature review on cold storage technologies is needed to identify the current reach of study. With thorough understanding of drivers & barriers, emerging technologies are ranked using multi-criteria Analysis. Highly suitable technologies are then modelled using data-driven/physics-based methodologies to simulate the cold storage behavior under various conditions. The performance, efficiency, and reliability of these cold TES are investigated in the context of district cooling systems. Further, optimal integration of cold TES systems with futuristic DC infrastructures can be studied. These research results will be presented at international conferences as well as submitted in top-tier scientific journal articles. These outcomes are expected to contribute towards wider adoption of cold TES systems in global cooling sector.

Main supervisor: Prof. Dr. Anna Volkova

Co-supervisor: Dr. Sreenath Sukumaran

### **Responsibilities and (foreseen) tasks**

- Conduct detailed literature reviews and identify gaps in existing cold storage technologies
- Examine heat transfer mechanisms, and performance assessment methods
- Develop data-driven/physics-based models to simulate the cold storage behaviour
- Explore new approaches to improve performance, efficiency, and reliability
- Collection, handling, and processing of data for carrying out the research work
- Preparation of technical reports and scientific publications
- Participation in conference visits, research secondments/training
- Carrying out research in line with the agreed research plan
- Supporting the teaching activities of the department

### **The following requirements are important:**

- Master's degree in Physical Sciences, Engineering, Applied Mathematics or any other related field

- Knowledge of heat transfer physics related to thermal energy storage
- Genuine interest to pursue a doctoral degree in the topic of the position
- Good command of scientific writing and research skills
- Excellent written and communication skills in English
- Ability to work independently as well as a part of a interdisciplinary team.
- Willingness to be involved in other related projects of the research group.

**The following experience is an advantage:**

- Experience in energy system modeling, data analysis, and experimental techniques
- Hands-on experience in thermal system modeling softwares such as ANSYS, COMSOL etc
- Familiar with system design and modelling of thermal energy storage
- Published papers in good quality scientific journals
- Basic knowledge of Estonian language

**What we Offer:**

- 4-year Ph.D. position in a leading technological research university in Europe with a large portfolio of dedicated research, industrial, and study-oriented projects
- Opportunity to pursue applied research in one of the relevant real-world research topic.
- Involvement in international and national research projects on smart energy systems
- Opportunities to attend international conferences, workshops, and trainings to present findings and exchange knowledge.
- Attractive salary package with potential for performance perks. Also, no tuition fees for doctoral studies
- Full-time staff position with state health insurance and contributory pension benefits

**Application process**

Interested candidates are required to submit the following documents

Motivation letter outlining your research interests and fit with the job profile (max. 2 A4 pages)

A research plan based on the given project description

CV including proof of scientific activity (publications, conference participation, etc.)

A certified copy of bachelor's and master's degree certificate and an official transcript of records (if the originals are not in English, translations are needed,)

An English abstract or summary of the MSc thesis

Recommendation letters from atleast one academic references

Proof of proficiency in English

A scan of travel document

**About the department**

The Department of Energy Technology (DET) at TalTech is the leading research institution in Estonia that studies various aspects of energy production and energy supply options. It is the only institution in Estonia involved with thermal engineering and district heating at the university level. DET maintains ongoing partnerships with government authorities and agencies, municipalities, energy policymakers, heat suppliers, and consumers. The activities of the DET include energy planning, chemical engineering, environmental engineering, thermal engineering, thermal power plants, heat economy, thermal energy, and district heating. DET is involved in national and international projects, including the development of low-temperature and ambient temperature district heating solutions, climate change mitigation with CCs and CCU technologies, large heat pump potential evaluation, and bioeconomy. Additional information about DET is available at <https://taltech.ee/en/departments-energy-technology>

Research group of Smart District Heating Systems and Integrated Assessment Analysis of Greenhouse Gases Emissions Group deals with developing new technical solutions for the transition of district heating systems towards an intelligent, highly efficient, and regenerative energy supply concept and with integrated assessment analysis of greenhouse gas emissions. The main research topics are related to transition and improvement measures for existing and technical solutions for planned district heating systems. Research group participates in national and international research and educational projects.

**Additional information**

The job location is in Tallinn, Estonia. On-campus accommodation is possible (subject to availability). For more information about the position, feel free to contact:



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