Maximizing Renewable Heat Contribution: Integration of Distributed Clean Energy Technologies into District Heating

Summary

We are looking for a highly motivated and self-driven PhD student/Early stage researcher to study the innovative aspects of solar energy utilisation in district heating (DH) systems. The main objective of research work involves the design & development of a solar energy laboratory and conducting simulation/experimental studies related to innovative concepts of solar DH systems. During the study period, the PhD candidate will have a chance to enhance not only his/her research and teaching ability but also leadership and project management skills. The prospective candidate will be part of TalTech's research group of Smart District Heating Systems with a motivated team led by Prof. Anna Volkova, which is focused on conducting industry-relevant research, writing top-tier scientific publications, and participating in popular scholarly conferences.

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 October 02, 2023 00:00 and October 23, 2023 23:59 (Europe/Zurich)

Description

Renewable thermal energy is set to play a significant role in the future of the energy sector. This category includes solar heat, geothermal energy, heat generation from biomass, and heat produced from renewable electricity sources. Solar energy and heat pump technologies can be used for centralised and decentralised heat generation. There is a need to understand the influence of solar energy and heat pumps on heating sector experimentally. However, only a few university laboratories are focused on solar heating aspects. In this context, developing a facility for experimental research in solar heating systems is planned at the Department of Energy Technology, TalTech. This PhD project will be focused on the development of the proposed solar energy laboratory.
At first, a detailed design of the proposed laboratory (consisting of solar collectors, heat pumps thermal storage, hydraulic system, and control) will be developed using suitable simulation software. An experimental set-up will be built on the department's building roof-top and then different tests will be carried out in real conditions. Both simulation and experimental results during the study period will contribute to the researcher's doctoral thesis. All the necessary hardware equipment and software tools will be provided for the proper and smooth implementation of the proposed research work. The research results will be presented at international conferences as well as published in scientific journal articles. One of the preliminary studies carried out by the research group is available at https://doi.org/10.3390/solar3030028

The goal of the research is to analyse decentralised clean energy technologies integration into district heating. District heating is undergoing a transformation towards more sustainable energy sources. It is important to evaluate, how decentralised clean energy technologies can be coupled with district heating system. The scenarios should be modelled, in which decentralized and centralized renewable heat generation either compete or enhance overall system efficiency and flexibility

Main supervisor: Prof. Dr. Anna Volkova
Co-supervisor: Dr. Sreenath Sukumaran

Responsibilities and (foreseen) tasks

- Determination of the proper design for the proposed solar energy lab considering technical and economic aspects
- Study the influence of weather parameters (solar radiation, ambient temperature, wind speed and direction, and snowfall) on the overall system performance and its resilience
- Experimental study on the thermal characteristics (flowrates, temperature, pressure, etc.) of the heating network during fluctuating solar irradiation

- Provides insight into the load balancing, parallel consumption, the integration of heat pumps, etc
- Comparison of simulated and experimental results, thereby developing a digital twin of the proposed laboratory
- Collection, handling, and processing of data for realizing the experimental set-up
- Preparation of technical reports and scientific Publications
- Participation in conference visits, research secondments/training
- Carrying out research in line with the agreed research plan
- Minimal teaching assistance related to energy science may be included

The following requirements are important:

- Master's degree in engineering (preferably in thermal engineering, power engineering, or environmental engineering)
- Experience with energy system modelling and/ or experimental studies
- Firm intention to pursue a doctoral degree in the topic of the position.
- Excellent presentation and communication skills in English
- Good command of scientific writing and research skills
- Ability to work independently as well as a part of a dynamic & interdisciplinary team.
- Willingness to be involved in management & administrative tasks related to the project.

The following experience is an advantage:

- Experience with simulation tools such as TRNSYS, POLYSUN, EnergyPRO
- Professional experience in designing engineering systems
- Professional experience with laboratory equipment
- PS! No previous knowledge of solar energy technology is expected. However, it will be a plus

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
- A chance to pursue high-level research in one of the hot and trending research area.
- Participating in international and national research projects on district heating and district cooling
- Opportunities for conference visits, research secondments/training, and interdisciplinary networking with partners both locally and internationally
- Attractive salary package with potential for performance perks. Also, no tuition fees for doctoral studies
- This full-time position includes state health insurance and contributory pension benefits.

Sounds interesting?
Then submit the application with the following materials:
- Motivation letter (maximum one A4 page with a clear, but honest description of the suitability of your skills with the job description and requirements)
- A research plan based on the project description (as given above)
- CV and other proof of scientific activity (publications, conference papers, etc.)
- A certified copy of the master´s degree certificate and an official transcript of records (translations are needed, if the originals are not in English)
- An English abstract or summary of the MSc thesis.
- Proof of proficiency in English

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/department-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:

Prof. Anna Volkova anna.volkova@taltech.ee
Dr. Sreenath Sukumaran sreenath.sukumaran@taltech.ee

or visit https://taltech.ee/en/department-energy-technology/research-groups

To get more information or to apply online, visit https://taltech.glowbase.com/positions/706 or scan the the code on the left with your smartphone.