

Local markets in electric microgrids

Summary

A PhD position in the domain of electric microgrids and on the topic of local electricity markets jointly supervised by Tallinn University of Technology and Aalto University (cotutelle agreement). The aim of this research is to increase the economic feasibility of microgrids and individual prosumers by optimizing microgrid economic performance through participation in ancillary service markets and providing prosumers access to multiple electricity grid services.

Research field:	Electrical power engineering and mechatronics
Supervisors:	Dr. Tarmo Korõtko Prof. Dr. Matti Lehtonen
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2022 00:00 and June 30, 2022 23:59 (Europe/Zurich)

Description

To foster innovation in the electric power domain by introducing private capital into the development of smart grids, microgrids need to become economically beneficial. To make participation in microgrids attractive for prosumers and to obtain favorable conditions from the larger electricity grid, microgrids need to also address their needs. The extensive participation in the provision of ancillary grid services enables grid companies to limit capital investments and operation costs and introduces new revenue streams to microgrids. Prosumers are interested in access to a variety of electricity grid services to enable them active engagement in managing their operations and economic performance.

Microgrids with mixed ownership of assets require dedicated methods for the optimal dispatch of prosumer assets. A recognized approach to manage the higher-level operation of microgrid prosumers, while maintaining the ability to optimize microgrid operations, is using a peer-to-peer/platform local market mechanism. Local markets for electrical prosumers inside microgrids are an actual research topic, but market mechanisms commonly enable trading of one specific commodity. The use of a local electricity market platform enables to implement different markets for prosumers, while enabling the microgrid operator to maintain a holistic view of microgrid operations.

The main objective is to increase the economic feasibility of microgrids and individual prosumers by optimizing microgrid economic performance through participation in ancillary service markets and providing prosumers access to multiple electricity grid services.

Responsibilities and (foreseen) tasks

- State of art analysis on economic aspects of microgrid operation, ancillary electricity markets, microgrid economic optimization methods and existing local market mechanisms applicable to electric microgrids.
- Research, development, mathematical modelling, and experimental verification of microgrid economic optimization method considering participation in ancillary service markets.
- Research, development, mathematical modelling, and experimental verification of microgrid local market platform.

Applicants should fulfil the following requirements:

- a master's degree in Electrical engineering from last 5 years
- a clear interest in the topic of the position
- profound knowledge of electric power systems, electric microgrids and electricity distribution networks
- excellent command of English
- strong and demonstrable writing and analytical skills
- capacity to work both as an independent researcher and as part of an international team



- capacity and willingness to aid in relevant organizational tasks

The following experience is beneficial:

- (co-)authored scientific papers published in Q1 or Q2 journals
- programming using high-level programming languages (e.g., Python, C++, C#, Java or similar)
- mathematical optimization, programming, and algorithm development
- power system economics and electricity markets

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in the leading microgrids research group in Estonia with a large portfolio of pan-European and national research and development, and study projects, mainly concerned with renewable energy integration and digital and AI applications in electric power systems.
- A double-degree program in cooperation with Aalto University and co-supervised by one of the most recognized electric power system researchers in the region.
- The chance to do high-level research in the domain of microgrids and renewables integration in an international and enabling environment with state-of-the-art research infrastructure.
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of electric microgrids, energy storage and renewable energy.

About the department

The Department of Electrical Power Engineering and Mechatronics of Tallinn University of Technology is an interdisciplinary research center that focuses on socially relevant and future-oriented research and teaching issues related to power engineering and mechatronics. The mission of the Department is to be a leader in electrical engineering and technical studies and development projects in Estonia, known and valued in society, and a respected partner in both national and international cooperation networks and organizations. The department has coordinated and partnered several international projects, including Horizon 2020, INTERREG, 7FP, Nordic Energy Research etc.

The Department of Electrical Power Engineering and Mechatronics conducts research within 7 research groups and operates state of the art laboratories with high end equipment, offering also accredited services in the fields of lighting and different electrical measurements. The focus areas of the department are related to domestic and global challenges related to increasing digitalization, decarbonization and decentralization of electric power systems and increasing use of renewable energy sources. The department carries out research in the following relevant areas:

- optimization of electric power systems and system analysis to find possibilities for electrification and decarbonization
- diagnostics and monitoring of equipment and systems
- cyber security, 5G data communications and artificial intelligence
- energy networks and research on hydrogen technologies, including energy storage, renewable energy, low carbon technologies, consumption management, IoT applications in energy
- implementation of smart industry, including industrial robotics, automation, 3D printing, machine vision
- implementation of energy and resource efficiency, including digitization of supply chains, mapping of opportunities to optimize systems and reduce energy consumption
- development of smart city solutions, including environmentally friendly and self-driving vehicles / drones, digital twin applications.

Additional information



For further information, please contact Tarmo Korõtko tarmo.korotko@taltech.ee or visit <https://taltech.ee/en/department-electrical-power-engineering-mechatronics>



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