

# AI applications in Local Electric Power Systems

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## Summary

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*The Department of Electrical Power Engineering and Mechatronics at TalTech invites applications for a fully-funded PhD position in the field of AI applications in local electric power systems, with a special emphasis on applying Generative Pre-trained Transformer (GPT) and deep learning (DL) technologies in the energy domain. Recent advances in GPT applications can be used in electric power systems to improve the presentation and interpretation of multi-modal datastreams. Deep learning can significantly improve the accuracy of energy consumption and production forecasts but also aide in grid planning. The specific focus of this research lies in the investigation of state-of-the-art AI technology and relevant applications to propose novel AI-based applications for electric power systems.*

Research field:	Electrical power engineering and mechatronics
Supervisors:	Prof. Dr. Argo Rosin Dr. Tarmo Korõtko
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, 2023 00:00 and June 30, 2023 23:59 (Europe/Zurich)

## Description

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This PhD position offers an exciting opportunity to conduct cutting-edge research in the field of AI applications in local electric power systems, with a special focus on applying GPT and DL technologies. The research will aim to develop innovative solutions that leverage the power of AI to enhance the efficiency, reliability, and sustainability of energy systems at the local level.

The research will primarily focus on exploring the potential of GPT and DL techniques in addressing critical challenges faced by local electric power systems. This includes developing advanced algorithms and methodologies for load forecasting, demand response, energy optimization, and grid stability. The aim is to leverage the capabilities of GPT and DL models to improve the accuracy and timeliness of load forecasts, enable effective demand response strategies, optimize energy utilization, and enhance the stability and resilience of local power grids.

The candidate will work on developing novel AI models and frameworks that can effectively handle the complexities and uncertainties of local power systems. This will involve analyzing large-scale data from various sources such as smart meters, IoT devices, weather data, and distributed energy resources. The candidate will design and train deep neural networks, including GPT models, to learn from this data and make intelligent decisions for optimal energy management and grid operation.

The developed AI applications are to be validated in real-world local power system scenarios. The research outcomes will contribute to advancing the state-of-the-art in AI applications for local electric power systems and have the potential to transform the way energy systems are managed and operated. This research position offers a unique chance to contribute to the advancement of AI technologies in the energy domain and make a significant impact on the transition towards sustainable and intelligent local electric power systems.

### Supervisors:

Main supervisor: Dr. Tarmo Korõtko  
Co-supervisor: Prof. Dr. Argo Rosin

### Responsibilities and (foreseen) tasks

- Investigate the potential of GPT and DL models for improving various aspects of local electric power systems, including load forecasting, demand response, energy optimization, and grid stability.
- Develop novel algorithms and methodologies to leverage GPT and DL technologies in energy system modeling, control, and optimization, with the aim of enhancing system performance and operational efficiency.

- Analyze large-scale data from smart meters, IoT devices, and distributed energy resources to train and refine AI models, enabling accurate predictions and efficient decision-making in local power systems.

### **Applicants should fulfil the following requirements:**

- master's degree in electrical engineering, computer science or applied informatics from last 5 years
- a clear interest in the topic of the position
- principal understanding of electric power systems and a strong background in AI, machine learning, and DL
- Strong programming skills (e.g., Python, TensorFlow, PyTorch)
- excellent command of the English language
- profound 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 published scientific papers
- practical experience in working with large datasets, databases and data science
- operations systems engineering

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 the region 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.
- The opportunity to carry out high-level research in the domain of AI applications in energy systems.
- Access to state-of-the-art research facilities for microgrids, renewables integration and power system digitalization.
- Opportunities for student exchange through EuroTeQ and Erasmus+ programmes, visits to research conferences and laboratory facilities and networking with leading universities and research centers.

### **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 Dr. Tarmo Korõtko [tarmo.korotko@taltech.ee](mailto:tarmo.korotko@taltech.ee)



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