

# Research and development of Demand side flexibility

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## Summary

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*The goal of the project is to improve the utilisation of energy flexibility in nZED to increase the integration level of RES. A novel Multi-task learning system, through a cosimulation platform will allow accurate characterisation and forecast of flexibility in nearly zero energy district.*

Research field:	Electrical power engineering and mechatronics
Supervisors:	Dr. Roya Ahmadiyahangar Prof. Dr. Jako Kilter
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between January 02, 2023 00:00 and January 22, 2023 23:59 (Europe/Zurich)

## Description

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### **The main objective of the PhD project is:**

design and implementation of a co-simulation platform capable of real-time, optimal scheduling of flexibility vectors to increase nZED flexibility. The focus of this PhD position will be on developing a co-simulation platform capable of integrating models of the energy districts, the electrical models, and the grid constraints (developed in the RTDS, MATALB), and forecasting models and algorithms (MATALB or Python), to achieve realistic, accurate and optimized scheduling and operation plan for flexibility resources.

### **Expected/hypothetical content of thesis:**

1. Introduction
2. State of the Art
  - a. Challenges and opportunities in the demand side flexibility
  - b. Overview of machine learning algorithms and their application in smart grids
  - c. Overview of co-simulation methods in power systems
3. Aggregation of Energy Flexibility from different flexibility vectors
  - a. Investigation and development of aggregation methods for energy flexibility , capable of distinguishing flexibility of AC and DC buses
  - b. Development of a novel deep learning-based multi-task learning model capable of forecasting the aggregated flexibility
4. Development of a Real-Time nZED Flexibility Assessment Smart Tool
  - a. Development of a co-simulation platform capable of integrating building models, as well as electrical models, grid constraints, and different electricity
  - b. Development of a novel multi-objective real-time optimal flexibility resource scheduling method based on available demand side flexibility to minimise electricity cost, considering grid technical constraints.
5. Validation and evaluation of designed solution
6. Conclusion and discussions

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

- Masters in power system engineering
- Basic understanding of Machine Learning



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