Title	Distribution of Energy Storage in Microgrids
Company	Saxion, Sustainable Energy Systems (Project BatteryNL)
Assignment Type	Internship/Graduation EEE
Version	20240426

Introduction

In order to combat climate change, our modern world is currently undertaking an energy transition. This transition aims to reduce carbon emissions int the atmosphere and to end our dependency on fossil fuels. However, the energy transition comes with a number of challenges that need to be tackled. There is an increasing penetration of renewable energy sources such as solar PV and wind turbines as well as the electrification of traditionally non electrical processes such as mobility and heating. In order to provide the required electricity network flexibility needed to match energy demand and production, so called smart microgrids can be used. These are power networks which can actively control certain types of connected loads such as heat pumps and Electric Vehicles (EVs), as well as use energy buffering in the form of energy storage devices such as batteries, to balance energy production and generation locally. Furthermore, the effects of implementing smart grids are not always certain, and should be evaluated on a case by case basis.

In this context, the research line of System Integration and Smart Energy (SISE), from the department of Sustainable Energy Systems (SES), is developing a laboratory called the 'Flexibility Lab'. Its objective is to offer a testing environment to help both students and researchers learn more about electricity network flexibility and hence the energy transition. Two types setups will be available to use in September 2024, including a nanogrid setup for system level simulations as a Hardware in Loop (HIL) setup for component level simulations. The setups will be useful within projects such as BatteryNL (see batterynl.nl), and eight year project with multiple partners in the Netherlands, tasked with developing the next generation of lithium-ion batteries, as well investigating the usages of such batteries in the electricity grid.

Problem definition

Within BatteryNL, SES is tasked with developing a system integration model. Furthermore, SES is interested in investigating the effects of storage positioning in microgrids, as a means to reduce the stress on the already congested electricity grid. In other words, what are the best and worst places to integrate storage into an electricity grid. This is highly dependent on the use case, specifically the grid topology, storage size as well as how the storage device is controlled. A python based tool was developed at the University of Twente in order to investigate this, but still needs to be tested real world use cases such as neighbourhoods and industrial parks, which are part of SESs project portfolio.

Objective

The objective of the assignment is to investigate the effects of adding storage to different locations in a use case using the python tool. For example, the difference between implementing a neighbourhood battery and several household batteries can be examined. Additionally, the Flexibility lab nanogrid should be used to conduct hardware simulation testing, and the results should be compared with the python tool. To achieve this, the case must therefore also be implemented and simulated in the Flexibility lab. The use case will be supplied by SES and agreed upon at the beginning of the project period.

Assignment
The assignment activities are as follows:

- Literature research; you familiarize yourself with the existing python tool, the flexibility Nanogrid setup and energy storage in microgrids.
- A use case must be implemented in the python tool, including relevant scenarios. To do this, you must become familiar with how the tool functions.
- A testing procedure must be created to test the use case in the Flexibility lab.
- If time permits, a Nanogrid implementation must be made of the use case.
- The results of both hardware and software simulation should be compared, and conclusions drawn.
- You document your approach, the results and your conclusions sufficiently so that another student can continue with your research when you have completed the project.

What we offer
At the research group of Sustainable Energy systems, you will be able to:

- Work on problems that are relevant to the energy transition.
- Work on projects with regional partner companies and institutes.
- Have the independence to make the research your own, and have your curiosity lead the way within the bounds of the assignment.
- Make significant and relevant contribution to the projects we have. This includes the potential for scientific publications as well as presentations for partners.
- Work with researchers within the group allowing you to get up to date knowledge of energy transition challenges and solutions.

Requirement of Student
The student should be:

- Comfortable with modelling and simulations, as well as energy networks.
- Comfortable with dealing with applied research oriented projects.
- Preferable comfortable with programming, including Python (or willing to learn)
- Proactive approach.
- Able to work independently.
- Able to manage client expectations.
- Be able to work toward strict deadlines.
- Have an acceptable level of communication (English or Dutch).

If you are interested please contact e.w.schaefer@saxion.nl for more information and to set up an interview.