Demand flexibility in the electrical power sector

Purpose

This seminar is geared towards those with an interest in power grids and in energy markets. The purpose is to introduce the concept of demand flexibility, and how it can used to stabilize grids, to reduce cost, and to reduce emissions.

Learning outcome

At the end of the seminar, participants are able to:

- ✓ Explain the concept of power grid stability
- ✓ Explain the concepts underpinning power markets
- ✓ Explain the concept of demand flexibility
- ✓ Give examples of demand flexibility
- ✓ Give examples of value stacks
- ✓ Explain the role of mathematical optimization in the context of demand flexibility
- ✓ Highlight a few of the challenges around mathematical optimization in the context of demand flexibility
- ✓ Use open-source software to model and optimize demand flexibility

Teaching form and your preparation

- The first day will be a course. The second day will be an interactive workshop where each participant will be given an exercise to complete a small digital project.

Time and place

The course consists of two consecutive workshop days. The venue is at Delta Centre, Narva mnt 18, Tartu.

- Workshop I: 01.01.2024, 9:00 - 15:45, room 1020
- Workshop II: 02.02.2024, 9:00 - 15:45, room 2004

Facilitator:
Dr. **Jorn Baayen** (LinkedIn profile) leads the demand flex architecture team at Shell Energy. His expertise spans software, mathematical optimization, as well as commercial practice.

General information

- Course certificate: You will receive a course certificate after completion of the two workshop days and completing the project. The details with deadlines will be announced on the second day of the workshop.
- Language: English.

Program

Workshop I (01.02.2024 from 9:00 to 15:45)

09:00 **Welcome**
Short introduction and presentation

09:15 **The power grid**
Generation and consumption of electrical power needs to be balanced at all times. Grid frequency as a measure of balance.

10:25 **Coffee/tea break** (provided by organisers)

10:40 **Energy markets**
Long-term contracts, spot markets, and ancillary services in support of grid stability.

11:30 **Lunch** (at own expense)

12:30 **Demand flexibility and value stacking**
Examples of demand with flexibility potential. Demand following price and carbon intensity signals. Demand flexibility for ancillary services. Stacking value streams.

13:45 **Coffee/tea break** (provided by organisers)

14:00 **The role of mathematical optimization**
Modelling flexible demand. Modelling value stacking and value maximization. Historical context. Mathematical characteristics of demand flex optimization problems.

15:45 **End of workshop I**

Workshop II (02.02.2024 from 9:00 to 15:45)

09:00 **Getting started with RTC-Tools**
Introduction of RTC-Tools, an open-source package that can be used to model demand flex optimization problems.

Coffee break provided by organisers

11:40 **Lunch** (at own expense)

12:40 **Project**
A project where we look at a production process that a) uses electrical power as an input, and that b) includes an option to store/buffer intermediate product. Participants are encouraged to bring their own examples of such processes.

14:10 **Coffee/tea break** (provided by organisers)

14:25 **Project**
Additional time to work on project.

15:25 **Evaluation and wrap-up**

15:45 **End of workshop II**

For any inquiries feel free to contact the organisers:
Johann Langemets (johann.langemets@ut.ee) or **Oskar Soop** (oskar.soop@ut.ee).