Master's Thesis

Integration of local renewable energy sources with innovative storage systems, sizing and dynamic behavior analysis

Project location: Paul Scherrer Institut (PSI), Villigen, Switzerland
Thermo-Chemical Processes (TCP)
Energy and Environment Research Division

Project supervisor: Dr. Hossein Madi (hossein.madi@psi.ch, main contact)
Dr. Tilman Schildhauer (Tilman.Schilhauer@psi.ch)

Time frame: It can be undertaken as a 4 or 6 month thesis project.

Research background and context:

In the context of the pressing need for the EU energy system transformation, decreasing the dependence on fossil fuels and improving management of renewable energy technologies across all vectors are essential. Ambitious targets were set to shift the energy mix from fossil fuel usage to higher share of renewable energies in the future. The EU islands have the potential to become forerunners in the decarbonisation of the energy systems. Renewable energy sources such as wind and sun can be introduced; suitable storage and efficient local resources such as biomass and wastewater can be found.

This project is being conducted in the context of an EU project with the focus on integration of renewable energy sources (photovoltaic and wind turbine) and energy conversion units such steam boiler, gasification, anaerobic digester and etc.

Objectives of tasks:

This is a modeling/simulation project focusing on the sizing and dynamic behavior of the defined energy system elements. The energy system is consisting of PV, wind turbines, electrolyzer, a steam boiler, H_2 storage tanks, CHP, a gasifier and an anaerobic digester.

Tasks and responsibilities are:

- Analysis of the PV and wind profiles for the specified location.
- Analysis of the demand profiles (electricity, heat and gas).
- Identification of the boundary conditions for the energy flux management system and analyse various cases.
- Modify the existing Matlab code and introduce the new elements.

Your background:

- Master student in chemical/mechanical/process engineering or related field.
- Excellent skill in programming and simulation (Matlab simulation tool).
- Keen to work in teams on an applied project.
- Good command of English, writing and speaking.