Dynamic modelling of a 10kW hybrid system SOFC + mGT

Master Project (30 ECTS)/Semester Project (10 ECTS)

Administrative

Supervision: Martin Gay, Prof. J. Van Herle
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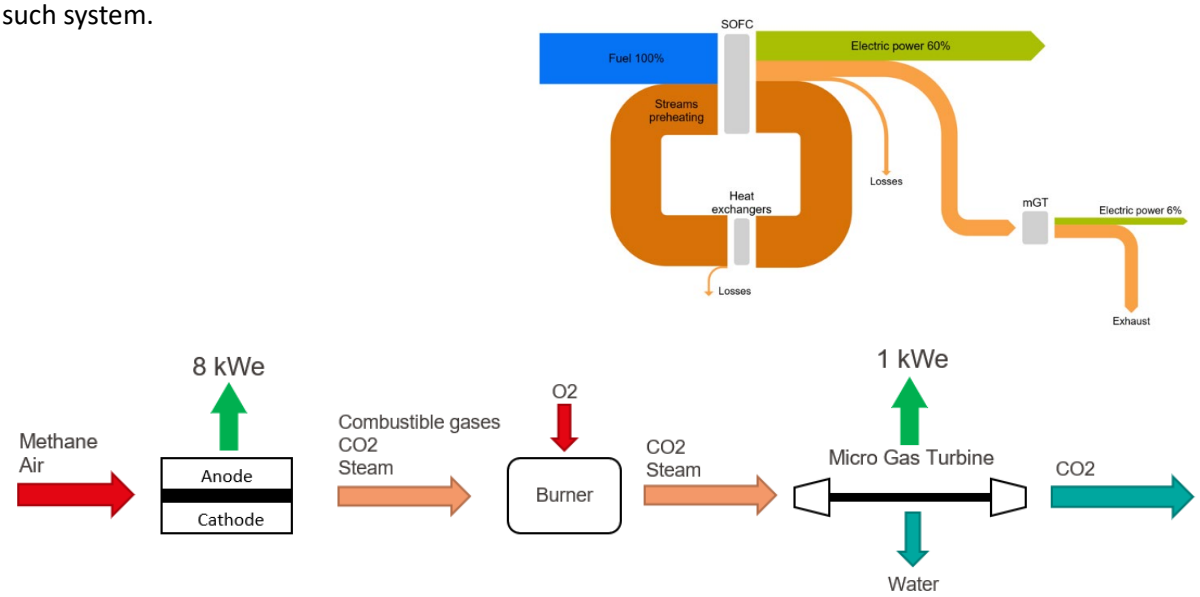
Location: Sion or remotely (travel allowance offered)
Remarks: If interested, please send your CV, with a short motivation letter, to Martin.

Project description:

An 8 kW SOFC is coupled to a micro gas turbine (mGT) to maximize the conversion of methane into electricity. Coupling these two technologies has never been done before and requires a complex Balance of Plant (BOP) to maximize the heat exchanges and thus maximize efficiency. The consequence is a strong interplay between the two technologies and the intermediate components. Steady-state simulations have been made for the sizing of the components and the efficiency maximization. However, variations have not been simulated yet, especially during load variations and system start-up or shutdown.

The goal of this project is to create a dynamic model of the whole system, assess the behavior of transients, and assess the consequences of the variations of some working parameters of the SOFC, the mGT, and the whole system. According to the results, define if RTO algorithms could be applied on such system.



Your tasks:

1. Create 1D dynamic models for the SOFC, the mGT, the burner, and couple them together to create a dynamic model of the whole system using OpenModelica.
2. Assess the consequences of load variation, start-up and shutdown.
3. Perform a sensitivity analysis: vary a set of parameters and assess the consequences in terms of efficiency, stability, safety, etc.
4. If possible, validate the dynamic model of the SOFC and the mGT with existing setups (not built yet)

Knowledge in coding is a plus (object oriented, declarative programming)