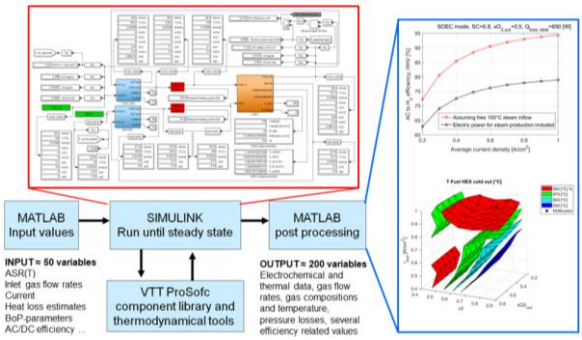
Reversible solid oxide Electrolyzer and Fuel cell for optimized Local Energy miX

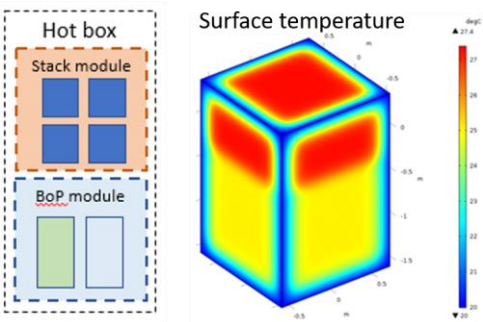


WP4 objectives

In the REFLEX project, system modelling was performed using Simulink software utilizing the MATLAB-based ProSOFC component library developed by VTT. The operating principle of the software is described in the adjacent figure. The system modeling activity was divided into 4 different phases, where each phase has objectives adapted to the current design level of the project.

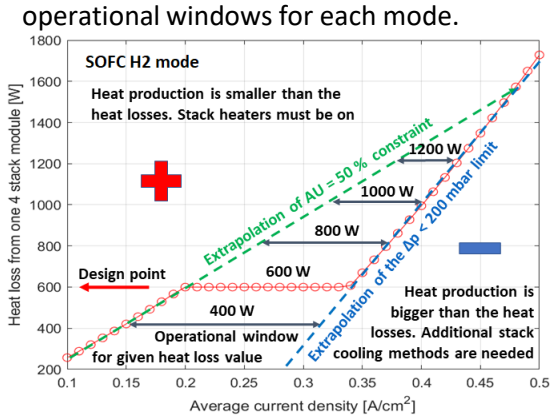
1/ Concept level system design

Before the actual system modeling, a rough description of the 3D structure of the planned system must be performed, in order to allow the system modeling to be done on the basis of feasible heat loss estimates. When designing the thermal management, all REFLEX operating modes (electrolysis, fuel cell in H2 or natural gas) are taken into account to be combined in one geometry.



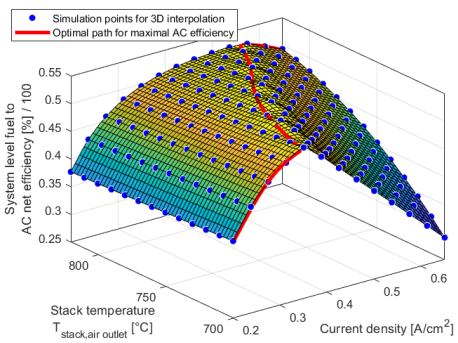
2/ System modelling for design phase

The purpose of the system design phase is to find a feasible system layout and dimensions including its BoP-components to allow the system to meet its performance requirements. One key task is to determine the size of the operational windows for each mode.



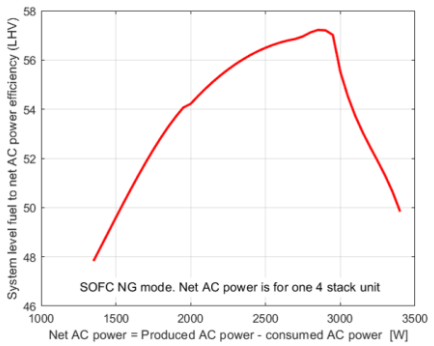
3/ System modelling for operational phase

After the system layout and its components are fixed in the design phase, one can move on to the operational phase simulations. At this stage, it is examined in more detail under which conditions the operation of the system is optimal also in such a way that it takes into account the factors influencing the life-time of the system, although the focus of system modeling is now shifting to the study of issues relevant to the end user. To achieve this goal (in the next phase) it is still useful to study the interactions between key operational parameters and operational constraints over the entire operational window.



4/ Interface to the end-user application

At the stage when the system model is combined with the model describing / controlling the end-user application, the system model must also be able to function under the control of the end-user application. In SOFC mode, this could mean that the only input to the system model would be the AC output power, which is usually considered to be the output value of the system model. Since the same output power can be produced in several different ways, the system model must be able to find (in real time) from the N-dimensional parameter space an unambiguous optimal operating point for each output power. For this purpose, a response surface method based optimization tool was developed.



The REFLEX project – www.reflex-energy.eu
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