Flexibilization of coal-fired power plants by Dynamic Simulation

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Due to the strong expansion of the fluctuating renewable energies (wind and photovoltaic), the boundary conditions for coal-fired steam power plants are changing significantly. The residual load will be much more volatile than in the past. From this development, a trend towards a highly flexible operation of conventional steam power plants can be derived. Key challenges for a highly flexible power plant operation are the reduction of the minimum load and the increase of the load change rate. Dynamic simulation models play a central role for the improvement of the transient operation as they provide a "tool" for the evaluation of flexibility measures.

This paper presents the dynamic modeling of a coal-fired power plant in Modelica/Dymola using the power plant library ClaRa (Clausius-Rankine). The focus is on the detailed non-steady-state modeling of the steam generator and the validation of the dynamic simulation model. Additionally, first results of simulation studies about the integration of a thermal energy storage and the increase of the load change rate are presented.

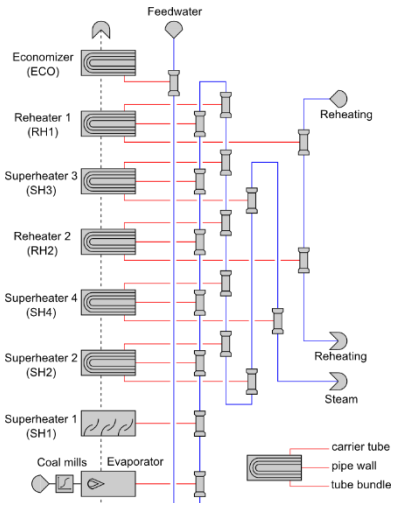

Figure 1. Modular structure of the steam generator model

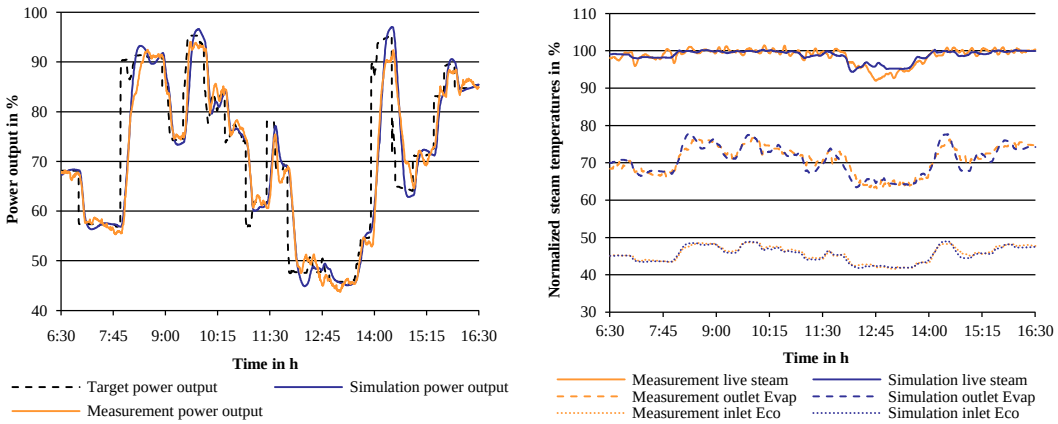

Figure 2. Comparison of the simulation (blue) and measurement values (orange) for power output (left diagram) and water-steam temperatures (right diagram)

References

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