Thermal Simulation of Power-Controlled Micro-CHP Systems for Residential Buildings

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Future energy systems will include an increasing part of renewable energy sources. Nonetheless, due to the variable power that e.g. wind power and photovoltaics provide, flexible and efficient solutions are needed to close the gap between the loads and the profiles of the renewable energy sources. One of the most promising technologies for the future are combined heat and power (CHP) units which could provide electricity to stabilize the electrical grid and produce heat at the same time which can be used to supply buildings with space heating and domestic hot water.

This paper shows a modelling approach of whole-system simulations with Modelica. This includes models for a CHP plant, storages and the supplied building. Different control strategies can be used as it is shown in figure 1.

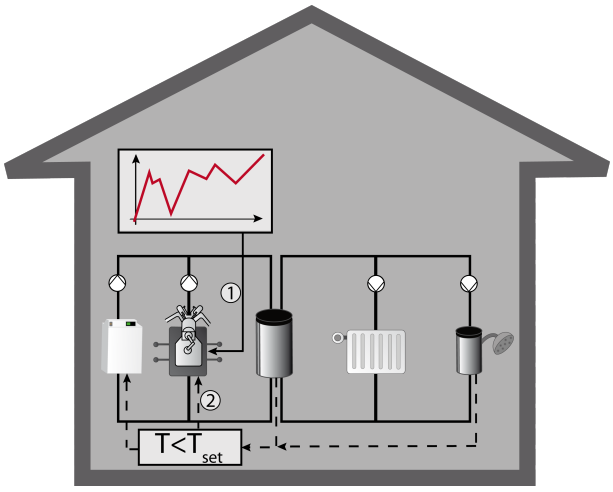

Figure 1: Analysed system with two different control strategies for the CHP plant

The strategies that are presented are the power-controlled mode (figure 1, control strategy 1)and the heat-controlled mode (figure 1, control strategy 2). In the power-controlled mode a pre-defined profile for the plant is set up and the plant runs as much as possible according to this profile. Just for security reasons (to high temperatures) it can be switched off. In the heat-controlled mode the plant always runs when a heat demand for space heating or domestic hot water is determined.

Both strategies are presented in an example to show the effects that occur in a coupled simulation of the CHP plants in interaction with storages and the heat sinks. This is for example the feedback of the actual storage temperature to the operation of the plant. Those effects have to be considered to analyse future energy systems in detail.