Optimization of plant operation strategies

Name and Surname :	**Michael Wittmann**	Name of PhD's manager(s):	**Prof. Hans Müller-Steinhagen**
Speciality/ Degree :	**Dipl.-Ing.**		
		Laboratory name :	**DLR e.V., Institute of Technical Thermodynamics**
PhD starting date :	**01 / 06 / 2006**	Laboratory address :	**Pfaffenwaldring 38-40, 70569 Stuttgart, Germany**

Nowadays, the usual political instrument for establishing renewable energy into the market is the feed-in-tariff. It offers a flat price structure for the electricity, which leads to a plant operation strategy that intends to maximize the electricity output. The countries in which solar thermal power plants (STPP) are mainly being constructed at the moment are Spain and California/United States. The prevailing laws in both countries offer the operators the opportunity to sell the produced electricity also at the free electricity market. This opportunity gives the operator the chance to increase its revenue and assets, respectively. In order to use this advantage new plant operation strategies are necessary, which take into account the new boundary conditions of the market.

The technical key component to participate in the market is the thermal energy storage. It allows the facility to decouple the solar availability and electricity production. This is essentially necessary for the operator to act flexible at the energy market to fulfil his offers. It is obvious that the highest revenue is attained when the highest price is being paid. This makes the knowledge of the upcoming electricity prices essentially important. Therefore, electricity price forecasting is needed. Also, weather information for the next days plays an important role to establish an adequate electricity offer at the market.

In the presentation, classical forecast models (ARIMA and GARCH) will be introduced and assessed, which are needed for electricity price predictions. All optimization strategies are designed for a certain class of mathematical problem. In the case of STPPs different adoption has to be done. It will be shown how to set up a suitable mathematical model from the technical model of the STPP. Furthermore, different global optimization strategies which are able to deal with non-linear and non-differentiable target functions and boundary conditions are introduced and their pros and cons discussed. Upcoming work will be further refinement of the optimization and implementation of uncertainties due to forecast failures of weather and electricity price, respectively. This additional independent variable may then lead to multi-objective optimization problems, i.e. more than one independent target function needs to be optimized.