

# Short-term production planning for district heating networks with JModelica.org

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The short term thermal production planning problem is solved in two steps by integrating physical plant models into the standard approach. The first step aims at solving the discrete variables from the unit commitment sub-problem (UCP) using standard mixed integer linear models and optimization techniques. The second step focuses on the economic dispatch sub-problem (EDP) described by high-fidelity, continuous time, physics-based Modelica models together with nonlinear optimization techniques from the JModelica.org platform [1]. The output of the second step includes optimized power flows but also highly relevant variables such as supply temperature, supply flow rate, turbine by-pass valve in the cogeneration plant. The optimization is formulated as a maximization of the benefit from heat and electricity sell over a finite time-horizon.

The proposed method is validated in several test cases using experimental data from a plant in Nyköping. The optimizations demonstrate the feasibility and the high economic potential of the proposed approach when comparing with measurement data and the standard optimization techniques. The optimized planning schedules result in a balance between produced and consumed heat, priority to low-cost boilers and maximization plant revenue. Compared to measurement data, the optimizations result in a significantly lower supply temperature, a more extensive usage of the external cooler for higher efficiency and higher electricity production, fewer starts of units as well as an appropriate use of the accumulator tank.

The high-level description of optimization problems using JModelica.org provides useful means to specify flexible optimization problems including constraints on arbitrary process variables such as heat load of the production units, supply temperature and flow rate, pressures.

## References

- [1] Åkesson J., Årzén K-E., Gäfvert M., Bergdahl T., Tummescheit H.: Modeling and Optimization with Optimica and JModelica.org—Languages and Tools for Solving Large-Scale Dynamic Optimization Problems, *Computers and Chemical Engineering*, 34:11, pp. 1737–1749, November 2010.