

Combined gas and power optimization

Short-term scheduling of a combined natural gas and electric power system may be formulated as a two-stage optimization model and solved using mixed integer stochastic programming [1]. More stages could be considered and approached using the multi-stage stochastic programming. Benders decomposition [2] may be used to solve a nonlinear optimization problem.

A related problem is integration of the natural gas and electricity networks in terms of power and gas optimal dispatch [3]. A mathematical model of the problem may be formulated as a minimization of the integrated gas-electricity system operation cost with constraints involving the power system and natural gas pipeline equations and capacities. The problem may be solved using a hybrid approach combining evolutionary strategies and Interior point method.

Another related problem is tri-/multi-generation [4]. Various models exist optimizing energy cost, annual costs, CO₂ emissions. Optimization methods include linear programming, branch and bound, evolutionary algorithms for single- and multi-objective optimization.

References

- [1] D. Hu. Short-term scheduling of a combined natural gas and electric power system with wind energy. MSc thesis. Iowa State University
- [2] Benders, J. F., "Partitioning procedures for solving mixed-variables programming problems", *Numerische Mathematik* 4(3): 238–252, Sept. 1962
- [3] C. Unsihuay, J. W. M. Lima and A. C. Z. de Souza, Modeling the Integrated Natural Gas and Electricity Optimal Power Flow, Power Engineering Society General Meeting, 2007. IEEE, Tampa, FL, 2007, pp. 1-7. doi: 10.1109/PES.2007.386124
- [4] G. Chicco, P. Mancarella, Distributed multi-generation: A comprehensive view, *Renewable and Sustainable Energy Reviews*, Volume 13, Issue 3, April 2009, Pages 535-551, ISSN 1364-0321, <http://dx.doi.org/10.1016/j.rser.2007.11.014>.

Contributors:

Dr Fabrizio Lacalandra, QuanTek