Load pattern adjustment in electricity generation market

Nguyen The Hoach、吳幸珍

E-mail: 321412@mail.dyu.edu.tw

ABSTRACT

Abstract – This thesis solves problems of a specific electricity market in the context of a new designed market for electricity generation. Because of the designed electricity market with single-sided auction for power generation companies, the single buyer doesn ' t have any feedback to the electricity price. This makes the designed electricity market less competitive. The thesis proposes a new approach to deal with congestion phenomenon in deregulated electricity market. The approach offers the single buyer the flexibility by adjusting its own load pattern to deal with gaming behaviors based on congestion in power system. This solution is considered as compensation for the lack of demand feedback upon electricity price in single-sided auction. Congestion is regarded as an opportunity cost which plays a significant role in electricity price. In this thesis, an opportunity operating state of a system is considered in which there is some adjustment of load pattern to utilize cheap energy sources. Then the deviation of optimal demand from real demand is calculated. This deviation is useful information from time-ahead market for demand participants in single-sided auction markets for the supply. Two optimization models based on optimal power flow (OPF) are proposed to implement this approach. The first model generates a dispatch result without congestion constraints. Its objective is to minimize the generation cost of a power system. The second model is a full-constrained OPF model which uses the generation dispatch results from the first model. Its objective is to minimize square of deviation between desired load pattern and opportunity load pattern. Simulation on IEEE 30-bus case system has proved the correctness and its efficiency.

Keywords : electricity market; congestion; optimal power flow; dispatch algorithm;demand adjustment.s

Table of Contents

REFERENCES

[1] F. C. Schweppe, M. C. Caramanis, R. D. Tabor, and R. E. Bohn, “ Spot Pricing of Electricity ” , Kluwer Academic Publisher, Boston, MA, 1988.
[2] M. Lu, Z. Lu, Z. Y. Dong , and T. K. Saha, “ A Novel Approach to Evaluate Congestion of Composite Power System Planning in a Competitive Electricity Market, ” [3] Xiaohong Guan, Yu-Chi Ho, Pepyne, D.L., “ Gaming and price spikes in electric power markets, ” IEEE Trans. Power Syst., vol. 16, no. 3, pp. 402 – 408, Aug. 2001 [4] Haoyu Zhou, Zhiyong Tu, Talukdar S., Marshall, K.C., “ Wholesale electricity market failure and the new market design ” , in Proc. IEEE PES General Meeting, June 2005 [5] Bompard, E., Ma, Y.; Napoli, R., Abrate, G., “ The Demand Elasticity Impacts on the Strategic Bidding Behavior of the Electricity Producers ” , MA, 1988.
[6] Michael Hsu; An introduction to the pricing of electric power transmission; Utilities Policy, Vol. 6, No. 3, pp. 257-270, 1997.
[7] F. Milano, “ PSAT, Matlab-based Power System Analysis Toolbox, ” available at http://thundebox.uwaterloo.ca/..fmilano, 2002.
[8] F.F. Wu, P. Varaiya, ‘ ‘ Coordinated multilateral trades for electric power networks: theory and implementation ’ ’ , International Journal of Electrical Power & Energy Systems, vol. 21, pp. 75-102, February 1999.
[9] F. D.Galiana, M. Illic, “ A mathematical framework for the analysis and management of power transactions under open access ” , IEEE Trans. On Power Systems, Vol. 13, No. 2, 1998, pp. 681-687..
[10] R. D. Zimmerman, C. E. Murillo-Sanchez, and R. J. Thomas, “ Matpower's Extensible Optimal Power Flow Architecture," Power and Energy Society General Meeting, 2009 IEEE, pp. 1 -7, July 26-30 2009.
[11] H. Wang, C. E. Murillo-Sanchez, R. D. Zimmerman, and R. J. Thomas, “ On Computational Issues of Market-Based Optimal Power Flow," Power Systems, IEEE Transactions on, vol. 22, no. 3, pp. 1185 -1193, August 2007.
[12] M. Lommerdal and L. Soder (2004). Combination of Two Methods for Congestion Management. IEEE International Conference on Electric Utility Deregulation, Restructuring and Power Technologies (DRPT2004), Hong Kong.
[13] Thilo Krause, “ Congestion Management in Liberalized Electricity Markets- Theoretical Concepts and International Application? EEH ?Power Systems Laboratory, Eidgenosische Technische Hochschule, Zurich, May 2005.
[14] W.W. Hogan, Contract networks for electric power transmission, J. Regul. Econ. 4 (1992), pp. 211-242.
[15] S.N. Singh and K. David, "Congestion management in dynamic security constrained open power markets? Computers and Electrical Engineering, 29 (2003), pp. 575-588.
[16] Ashwani Kumar, S.C. Srivastava, and S.N. Singh, "A Zonal Congestion Management Approach Using Real and Reactive Power Rescheduling? IEEE Trans. On Power Systems, Vol. 19, No. 1, Feb. 2004, pp. 554-561.
[17] M. Huneault and F. D. Galiana, "A Survey of the Optimal Power Flow Literature,?IEEE Transactions on Power Systems, vol. 6, no. 2, pp. 762?70, May 1991.
[18] Optimization Toolbox 4 Users?s Guide. The MathWorks, Inc., 2008.
[Online]. Available: http://www.mathworks.com/access/helpdesk/help/pdf_doc/optim/opti m_tb.pdf [19] MINOPF: [Online]. Available: http://www.pserc.cornell.edu/minopf/ [20] TSPOPF: [Online]. Available: http://www.pserc.cornell.edu/tspopf/ [21] B. A. Murtagh and M. A. Saunders, MINOS 5.5 User?s Guide,Stanford University Systems Optimization Laboratory Technical Report SOL83-20R.
[22] J.Carpentier and P. Bornard, “ Towards an integrated secure optimal operation of power systems, ” in Proc. 1991 IEE Int. Conf. Advances in Power System Control, Operation, Management, vol. 1, pp. 1 – 16.