Optimal Bidding in Restructure Power System

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Abstract

This paper dealt with brief knowledge of optimal bidding in restructured power system. Participants in a competitive electricity market develop bidding strategies in order to maximize their own profits. On the other hand, it is necessary for regulators to investigate strategic bidding behavior in order to identify possible market power abuse and to limit such abuse by introducing appropriate market management rules.

Keywords-- Optimal Bidding, Electricity market, Energy Auction

I INTRODUCTION

Since the 1980's much effort has been made to restructure the traditional monopoly power industry with the objectives of introducing fair competition and improving economic efficiency. The creation of mechanisms for power suppliers, and sometimes for large consumers, to openly trade electricity is at the core of this change. Ideally, the market structure and management mechanisms or rules in an electricity market are sufficiently well designed and competition among participants sufficiently vigorous to direct the operation of the market towards maximizing social welfare.

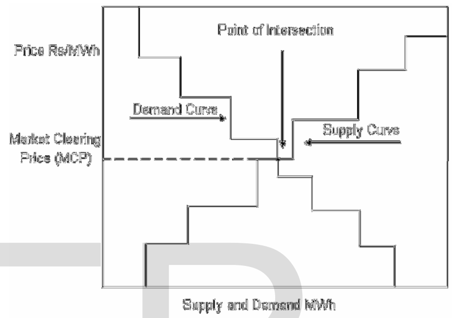
OPTIMAL BIDDING

For a GENCO to survive in competitive environment, it has to operate very efficiently. But only efficient operation sometimes may not suffice because in the energy auction it has to sell its products at competitive prices to get the maximum profit out of it. Several factor affect the profitability of GENCO like own bids, bids placed by its competitor, total energy demands among others etc.

While a GENCO has no control over the bids of its competitors and the energy demand, it can make its own strategy to place such a bid that provides it highest profit at lower risk. By risk it is meant that the amount of regret involved. A bid is called highly risky if it can yield large profit but its probability of being selected is low, so more often than not it will not be selected leading to regret. A low risk bid is such bid, which may have lower profit earning capability but high probability of being selected, so there is no regret.

The Method by which the optimal bidding problem is solved are as follow:

1 Game theory
2 Dynamic Programming
3 A genetic algorithm based method
4 Optimization based bidding strategies
5 Markov Decision Process



II Energy auction and competitive bidding

In a competitive electricity market, the seller and buyers submit bids for energy buy and sell. The bids are generally in the form of price and quantity quotation and specify how much the seller or buyers are willing to buy or sell and at what price.

After the bids are available to the market operator, it settles the market based on some criteria. Once the market is cleared, all selling participants receive a uniform price for their power delivered, i.e., the market price from the buying participants.

In case of auction, where all winning bidder are offered the same price without discrimination, and regardless of their individual bid, is known as non-discriminated or second price auction. This is usually, the price of the highest priced bid that is cleared in the market.

The non-discriminated auction provides incentives to bidders to bid their true costs and avoid guessing the bids of other.

On the other hand, in a discriminated auction or first price auction, all bidders are not offered the same price after the market is settled. The bidders get the price that they had actually bid for, in the first place. A disadvantage of this system is that, it can give to

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gaming opportunities for the participants thereby providing ample scope for over-bidding and pushing up the market clearing price.

Once the buyer and seller bid the amount of energy and the price, the power exchange forms an aggregate supply bid curve for consumers. The curve for suppliers and aggregate demand bid curve for consumers. The curves are plotted on coordinates of, supply and demand energy and price as shown in the figure (1). The point of intersection of two curves determines the market-clearing price (MCP). At this point, the supply satisfies the demand.The pointof intersection of two curvesdetermines the market – clearing price. determines the market- clearing price (MCP). At this point, the supply satisfies the demand.

The MCP is the price of electric energy that is paid by consumer at all the places. The sellers are also paid the price equal to the MCP.

Consider the power exchange auction. MCP is the highest sell bid or lowest buy bid accepted in the auction .Thus, a seller is certain he will be paid no less than its cost of production if he bids its marginal cost, and may be paid more. If a seller bids less than his marginal cost, he would lose money because his bid may set the MCP. If he bids more than his marginal cost, he may bid more than other sellers and fail to be selected in the auction. If the MCP is higher than this marginal cost, and then he would earn profit or contribution to fixed cost. Buyer itself makes similar considerations.

III Auction and bidding protocols

An auction is an economically efficient mechanism to allocate demand to suppliers, and the formation of electricity markets.

Bidding is an issue connecting to the auction. It is obvious that development of bidding strategies should be based on market model and activity rules, especially, auction rules and bidding protocols.

Many auction methods exist, and can be classified in many ways. Two main categories differ according to whether the auction is static or dynamic.

In static auctions, the bidders submit sealed bids, while in dynamic auctions bidders can observe the bids of others and revise their own sequentially.

Static auctions can be classified according to discriminating or non-discriminating pricing. In the former bidders are paid their offered prices if they win. In non-discriminating auctions, all winning bidders are paid a uniform price, such as the first losing bid or the last winning bid.

In cases of multiple sellers or multiple buyers, the non-discriminating pricing auction is usually employed to encourage the bidders to bid their marginal costs or benefits.

Auctions can also be classified as “open” or “sealed-bid”. Open auctions may be classified as English (ascending bid) or Dutch (descending bid).

Sealed-bid auctions can be classified into ‘first price’ and ‘second price’ auctions, and both of them are usually referred to as non-discriminating auctions, the only difference is whether the uniform price is set according to the last winning bid or the first losing bid. An auction is called a double one when both the sellers and buyers are required to submit bids.

To our knowledge, almost all operating electricity markets worldwide employ the sealed bid auction with uniform market price.Another important factor related to bidding strategies is bidding protocols. Depending on different market designs, the energy bids may include several price components (multi part bid) or a single price component (single-part bid).

In either case, the energy bid may include several energy price segments depending on the amount of energy supply.

IV Conclusion

Electricity market is same as other markets (e.g. vegetable market) but with some exceptions. These exceptions are due to high risk in electricity market.

Electricity market is very risky because electricity is not storable in bulk quantity. Cost of continuity of electricity is more than cost of electricity in electicity market.

In a fully competitive electricity market, each participant should bid at its marginal cost in order to maximize its revenue. However, some practical electricity markets such as India electricity market are not a perfectly competitive one because of the particular characteristics such as the severe generation and transmission constraints.

So, it is critical for a GENCO to devise a good bidding strategy in order to maximize its potential profits.

References

[1] A.K. David, and F. Wen, "Strategic bidding in competitive electricity market: A literature survey," in Proc. IEEE Power Eng. Soc. Power Eng. Conf., 2000, pp. 2168-2173.

[2] M. Shahidehpour and M. Alomoush, Restructured Electric Power Systems. New York: Marcel Dekker, 2001 H. M. Merrill, "Regional transmission organizations: FERC Order 2000", IEEE Power Engineering Review, July 2000, pp.3-5.

[3] The European Commission, Opening up to choice: The single electricity market, 1999. 7. R. D. Tabors, "Lessons from the UK and Norway", IEEE Spectrum, Aug. '96, pp.45-49.

[4] Svenska Kraftnlit, "The Swedish electricity market reform and its implications for Svenska Kraflnlit", Second Edition, 1997.

[5]NationalElectricity Market Management Company (Australia), "An introduction to Australia's National Electricity Market", 1998.

[6] W. Mielczarski, G. Michalik and M. Widjaja, "Bidding strategies in electricity markets", Proceedings of Power Industry Computer Applications Conference, 1999.

[7] T. Alvey, D. Goodwin, X. Ma, D. Streiffert and D. Sun, "A security constrained bid clearing system for the New Zealand wholesale electricity market", IEEE Transactions on Power Systems, May '98,pp.340-346.

[8[J. Parikh, K. Bhattacharya, S. Reddy and K. Parikh, Chapter 5- Energy System: Need For New mentum, India Development Report: 1997, Oxford University Press, 1997.

[9] A. K. David, "Risk modelling in energy contracts between host utilities and BOT plant investors", IEEE Transactions on Energy Conversion, June 1996, pp.359-366.

[10] H. Rudnick, "Pioneering electricity reform in South America", IEEE Spectrum, Aug. '96,

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