

THE ELECTRICITY PRODUCERS BID PRICES FORMATION BASED ON PROFITABILITY

Umbrasko, I., Varfolomejeva, R., Mahnitko, A.
Riga Technical University
Inga.Umbrasko_1@rtu.lv

Annotation

Pricing is based on charges which envisage the inclusion in to cost (tariff) some actual expenditure, and not infrequently the inclusion of all. As a result, power generating companies have reduced incentives for the efficiency increasing, because the consumers compensate all charges, regardless of work effectiveness. In this case, in the prices and tariffs may be included an investment component as: the funds for capital investment, so that volume in the absence of market constraints and reliable picture of cost of production is defined as arbitrarily.

Keywords

An aggregate, bid, electricity market, profitability.

1 INTRODUCTION

The new relationships entrance into energy sector leads to real reflection cost problem in electrical power production and charges reduction. Market relations, which are lever in the modernization of the production process in the energy sector, should lead to producers (suppliers) energy production cost reduction to achieve maximum economical efficiency.

The model of energy suppliers bid formation which is based on level of profitability is proposed below. In order to apply bids (actually it is just product output in the market) is need to have some first data for it formation. Those data first of all are: price forecasting for a day-ahead, load forecasting, their own units (aggregates) characteristics and some economical data in connection with which can be changed the competitor's prime cost or energy amount, hence the price in the market. In the modeling dos not take into account random factors as: outages, abrupt discharge / on-load, etc.

2 THE MARKET PRICE

For large power units the charges (costs) for hourly electricity production depending from capacity P often are approximated by second-degree polynomial, it is expressed in money equivalent [2]:

$$C_{\Sigma}(P_i) = C_{R,i} \cdot C(P_i) = C_{R,i} \cdot (\alpha_i + \beta_i \cdot P_i + \gamma_i \cdot P_i^2), \quad (1)$$

where $C_{R,i}$ - energy resources cost, for example, fuel including delivery and technical preparation; $\alpha_i, \beta_i, \gamma_i$ - parametrs of cost characteristics $C(P_i)$.

Where three possible options if aggregate's positioning in the economic space at attitude of predicted that hour price: cost price of aggregate energy unit is less than market price; cost price of aggregate energy unit is greater than market price; cost price of aggregate energy unit equals to market price. So, considering those options together with the cost characteristic and functional features of the aggregate possible to estimate the level of bids which are submitted on a competitive electricity market.

3 AGGREGATE TECHNICAL-ECONOMIC CHARACTERISTICS

The aggregate income (revenue) for economic model we can assume as linear dependence:

$$R(P_i) = c_{el} \cdot P_i, \quad (2)$$

where c_{el} – the electricity price. In this connection can say, that for each aggregate exist minimal price in the market c_{el}^{\min} with which still there is a sense participate in that and stand as a supplier of electricity. For this price corresponds the 1st function, which is characterized with electricity cost c_0 and income R_0 equality, it is point O . When the market price equals $c_{el} > c_{el}^{\min}$ (2nd function), the area of income exceeding over electricity cost

is increasing, but for $c_{el} < c_{el}^{\min}$ (3rd function) everywhere in working area $P_{\min} \dots P_{\max}$ it is less than electricity cost. In the last case it is impossible participate in the market, because if electricity supplier applies any bid price and it will be satisfied the negative income to this supplier will be guaranteed.

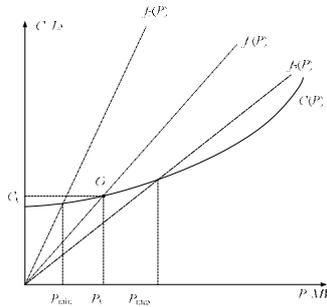


Fig.1. The generating aggregate characteristics

That way the first step of bid price is determined with generated power at capacity P_0 and price c_{el} .

From the conditions that at point O performed equality $R_0=c_0$ is easy to determine P_0 and c_{el}^0 values, because derivatives equals each other

$$\frac{\partial C_{\Sigma}(P_i)}{\partial P_i} = C_{R,i} \cdot \frac{\partial C(P_i)}{\partial P_i} = C_{R,i} \cdot \varepsilon, \quad \frac{\partial R(P_i)}{\partial P_i} = c_{el}^0. \quad (3)$$

where ε - relative increase in a fuel consumption [1].

In the competitive electricity market then is determining the supplier behavior strategy usually is used the profit term [3]

$$B(P_i) = \Sigma(R(P_i) - C_{\Sigma}(P_i)), \quad (4)$$

4 THE PRODUCTION PROFITABILITY

The profitability is index of production economic effectiveness, characterizes as income (profit) and charges ratio for the fixed time period. This value is relative and corresponds to the profit which is related to deposited funds

$$K(P_i) = \frac{B(P_i) - C(P_i)}{C(P_i)} \cdot 100\%. \quad (5)$$

5 ACKNOWLEDGEMENTS

This work has been supported by the European Social Fund within the project «Support for the implementation of doctoral studies at Riga Technical University».

6 REFERENCES

- [1] Бартоломей П.И., Летун В.М.: Проблема формирования ценовых заявок. Вестник УГТУ-УПИ. «Энергосистема: управление, качество, конкуренция». Сб. докладов II Всероссийской научно-технической конференции. Екатеринбург: ГОУ ВПО УГТУ-УПИ, 2004. № 12 (42).
- [2] Panikovskaya, T. (2005): The Competitive Electricity Market Influence to the Economic Strategy of Generating Companies. Russia, Vestnik UNTI - UTI, 2005. № 12(64).
- [3] A. Baillo, M. Ventosa, M. Rivier, A. Ramos and G. Relano.: Bidding in a day-ahead electricity market: a comparison of decomposition techniques. Proceedings IEEE 14th Power System Computation Conference (PSCC) Conf., session 07, paper 2, pp. 1-7, June, 2002.

This work has been done by using the material from Bartolomei, P., Gruzdev, P., Panikovskaya T., article “The Bid Prices Modeling in a Competitive Electricity Market”