OPTIMIZING THE MIX AND STRUCTURE OF SUCCESSOR COMPANIES IN ELECTRICITY MARKET RESTRUCTURING

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Overview

In the last two decades, the electricity market restructuring has been introduced in countries more than half of the world. The reform process spent billions of dollars and years of time to achieve competitive price and market structure. However, after the breakdown and privatization process of the monopoly Generation Company, market power arises as a significant problem that could exercise the electricity price above the competitive level. One of the fundamental steps in creating competitive electricity market is to split monopoly generation company (GenCo) into several competitive successor companies. Joskow (2008) states that one of the key component to create desirable features for restructuring, regulatory reform and the development competitive electricity market is "to create an adequate number of competing generators to mitigate market power and to ensure that wholesale markets are reasonable competitive".

Market power always occurs as a crucial problem in electricity market design (Borenstein et al, 2002; Wilson, 2002; Wolak, 2014), thus we should carefully mitigate the problem since the cure could be more dangerous than the problem itself (Joskow, 2008). In determining optimal configuration of wholesale electricity market from the monopoly electricity market, there are several key issues that should be considered by the government and electricity authority. The configuration of players post generation split should result in minimum market power which needs an ex ante simulation pre-structuring. It is more visible to handle market power problem using ex ante approach rather than ex post. Hence, the government decision in designing configuration of players in the electricity market in the beginning of the reform is important, later adjustment in the middle of market reform is considered more costly and politically challenging.

The traditional measure of market power exercise is Herfindahl-Hirschman Index (HHI), which gives doubtful determination since electricity market model has inelastic demand, significant short-run capacity constraints, extremely costly storage (Borenstein et al, 2002); thus HHI could not capture the dynamics of competition behaviour in wholesale electricity market. Residual Supply Index (RSI) appears as a more attractive method in market power mitigation, initially developed by the California Independent System Operator (CAISO). (Sheffrin, 2001; Sheffrin, 2002; Rahimi and Sheffrin, 2003).

This paper discusses the law and economics of imperfect competition in electricity markets. Market power, indicating the ability to raise price profitably above the competitive level, tends to be a significant problem in the aftermath of electricity market restructuring. In the process of regulatory reform and the development of competitive electricity markets, it seems desirable and practical to establish an efficient number of competitor generating companies. One approach, using a purpose-built algorithm, is to optimize the configuration of generating companies ex ante (i.e. before restructuring) rather than ex post. A simulation of an electric power system accounts not only for multi-plant mergers of generating companies subject to a regulatory measure of market power (i.e. the residual supply index), but also for direct current load flow and the topology of the electric power system.

Methods

This research focuses on the theory of successor companies creation in electricity market restructuring which composed of optimization- Karush-Kuhn Tucker (KKT), Locational Marginal Pricing (LMP), and Direct Current Load Flow (DC LF). The market power index applied to optimize market structure and mitigate the market power is the Residual Supply Index (RSI). We apply LMP and Cournot market modelling on a simple interconnected power system to analyze the optimal market structure.

Results

The price in each nodal could be different if there is a network constraint in the electricity mesh network. In non-constraints network, the zonal price is equivalent for each node although there is a deviation of true marginal

cost between generating firm. Market power (RSI) in electricity market is a function of marginal cost, aggregate linear demand and maximum supplier capacity in the market. Thus, the optimal market configuration is determined by the mix of power plants combination in the market (mix of slope-intercept addition of marginal costs). By designing a proper market structure with the lowest RSI encourage maximum competition in wholesale market and minimum market power exercise. However, the reserve margin of power system determined the RSI nominal, thus the power system availability factor should be considered as an important factor prior generator break up.

Conclusions

Merger step taken by power producer to create optimal market structure was determined not only by generation technology mix in firms, but also determined by installed capacity post-merger. Creating optimal electricity market structure using RSI and merger analysis is an approach to create competition between generation technologies and also to spread big size (pivotal) power plant among competitive players.

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