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A theoretical analysis of procurement auctions for tertiary control in Germany

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ABSTRACT

As far as energy policy is concerned, the design of the regulatory framework for energy transmission and distribution is a key issue. Consequently, also the embodiment of balancing power markets drives mainly the effectiveness of political implications for the energy sector. Initially, tertiary control in Germany was solely offered by transmission system operators of the respective power control areas and their associated power plant. The recast of the Energy Industry Act of 2005 led in last consequence to a common procurement auction for the supply of tertiary control, which starts on December 1, 2006. Admittedly, the reform has fallen short of expectations so far, first concerning the intensification of market entry of tertiary control providers as well as the desired decline of the price level. Hence, this article examines the effects of the changeover on observable demand charges. In order to identify attributes of the common procurement auction for tertiary control hampering market entry of providers, giving stimuli to collusion and strategic behavior, reducing intensity of competition and encouraging an upswing of prices, we analyze the design under an auction theoretical approach and deduce empirically whether structural components of the auction design have to be touched up again.

1. Introduction

Energy policy is part of the sectoral policy—which can be divided into economical–structural and environmental policy—in order to control the energy sector. Therefore, energy policy encompasses all stages of energy supply, starting with the production of energy followed by storage, transportation, transmission and distribution and ending up at the adhesive waste disposal. The scope of energy policy changed extremely over the last few decades. However, one common accepted aim is the sustainable usage of energy and production of energy under low risk as well as the cost-effective allocation and distribution of energy supplied. Energy policy in a narrower sense can be seen as the regimentation of a technical, social and legal framework in order to reach the previously mentioned aims. For the German electricity sector the design of an efficient and appropriate regulatory framework is a key component for adequate energy policy. Herein, the embodiment of the legal framework concerning energy transmission and distribution as well as the adherent markets at which the good—electricity or energy—is traded, have to be mentioned. In this article the German balancing power market and its effective operation build the center of our analysis. Herein, we analyze the existing procurement auctions for tertiary control from a theoretical as well as empirical point of view in order to shed light on problems and potential improvements for future energy policies.

Since electrical energy cannot be stored, the maintenance of balance between supply and demand in the grid is one major task of the transmission system operator. His duty is to estimate beforehand how much electricity will be injected in or withdrawn from the network. Due to the increasing share of energy sources with variable output and the adjacent support schemes for renewable energy sources, the real time balance becomes an increasingly difficult task. An efficient and appropriate designed market is a necessary component in order to assist the balancing management. This holds especially for the German power market, which constitutes the largest consumption and also the most important transit market in the center of Europe. Initially, transmission system operators of the respective power control areas and their associated power plants were the only supplier of tertiary control in Germany. Before the tendering procedure for tertiary control was established in 2001 and 2002, the system balance had been provided by bilateral contracts between transmission operators and affiliated power plants.

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In 2001 and 2002, the Federal Cartel Office prescribed the implementation of separate procurement auctions for the distinct power control areas. According to the Energy Industry Act of July 7, 2005, and the corresponding orders, the framework for acquisition and use of tertiary control has changed. The adjacent consensual concept passed on August 29, 2006. Herein, the basis for a common tendering procedure was found. Since December 1, 2006, the transmission network operators offer a joint tendering procedure for tertiary control, which is supported by a web-based (electronic) platform (www.regelleistung.net). Among this, the regulator set uniform provisions, specified publication obligations and limited the supply of tertiary control transmission system operators are allowed to purchase within their own power control areas. Moreover, the timing of auctions, submitting of bids and the selection of providers in merit orders were defined. However, the reform, which targets the encouragement of the market entry of tertiary control providers and the decline of the current price level, has not led to the desired outcome, yet. Certain characteristics of the new auction design are held responsible for these defects.

In order to identify attributes of the common procurement auction for tertiary control hampering market entry of providers, giving stimuli to collusion and strategic behavior, reducing intensity of competition and encouraging an upswing of prices, this paper analyzes the design under an auction theoretical approach. We examine features that have remained unchanged since 2001/2002 and elements that were subject to modification in 2006 separately. Supplemented with some empirical evidence we want to deduce whether structural components of the auction design have to be touched up again.

To achieve this aim, the remainder of the paper is structured as follows. Section 2 reviews the pertinent literature. Section 3 explains the structural characteristics of balancing power and minutes reserve markets as well as the design of procurement auctions for tertiary control in Germany. Section 4 presents the theoretical analysis addressing the consequences of the auction design for market structure and tendering behavior (barriers to market entry and transaction costs, collusion and strategic behavior) and the implications for the price level and price volatility. The resulting outcomes are tested due to their evidence for the German minutes reserve market. Section 5 concludes.

2. Literature review

The literature dealing with balancing power or balancing energy focuses on three different strands. The first strand captures the evolution and efficiency of balancing power markets. This field of research is primary made up of country surveys in which specific markets for balancing power are analyzed. For example, Borenstein et al. (1999) measure the market power in the Californian electricity markets which cover in addition the markets for load balancing and spinning reserve. Another article is provided by Lloyd et al. (2003). They evaluate the success and failures of electricity market reforms in UK, Norway, Canada (Alberta) and the US (California). One of their covered markets is again the balancing power market. For the German market, such an analysis is provided by Swider (2006). He investigates the legal framework, competitiveness and possible strategic behavior in the German balancing market until 2005.

The second field of research concerns the design of the auctions founding the basis for the balancing power market. An auction is a process of buying and selling goods that are offered by a bidder at the bid price. As soon as all bids are collected, the good is sold to the winning bidder at a certain price depending on the auction design. Therefore, an auction can be seen as a non-cooperative multi-stage game.[2] The literature in this area of research analyzes the most appropriate auction design for balancing power with respect to a certain legal framework and country-specific conditions. For California, this topic is discussed by Kahn et al. (2001), whereas Federico and Rahman (2003) examine the auction design for the UK electricity market. Theoretical evidence about the performance of modeling electricity auctions is given in Fabra et al. (2002) and Klemperer (2002).

The third strand combines the two previously mentioned approaches. Herein, the different types of auction awards are considered. The assigned award can be bound on the "pay-as-bid price" or the "uniform price". Oppositional perceptions exist concerning "pay-as-bid" and "uniform prices" and their impact on collusive behavior. In this context, the articles of Goswami et al. (1996), Klemperer (2002), Swider and Ellersdorfer (2005), Wawer (2005) and Swider (2007) have to be mentioned. In a monopoly market on the one hand, the predominant position argues that under "uniform prices" the incentives for collusive behavior increase with available capacity. "Pay-as-bid prices" on the other hand provide incentives for collusive behavior as the individual bid price and not the highest (possible) price is paid. In an oligopolistic market with pay-as-bid auction, the bidder can earn additional profits if he prices minutes reserve close to the expected marginal price of other competitors (as long as his own costs are covered). This leads to strategic behavior because prices are set with reference to the expected behavior of other market participants and is not derived from the original cost function. The opposite is true for uniform prices in an oligopolistic market.

This paper builds on the previous approaches and refines them. German procurement auctions for tertiary control are scrutinized from the perspective of auction theory, particularly with regard to the modification of auction design in December 2006 and its implications.

3. Structural characteristics of balancing power and the German auction design for minutes reserve

As it is not possible to store large amounts of energy, the overall power generation has to match total energy demand in each point in time. However, as production and demand are not constant over time but are rather fluctuating (caused, for example, by station blackouts, stochastic feed-in (wind) or seasonal fluctuations in demand) this balance cannot be guaranteed. Consequently, a market mechanism had to be established in order to assure a certain level of security of supply. This is the so-called balancing power system.

Differences of feed-in and withdrawal from a certain transmission network can be of positive or negative sign. A positive sign indicates that more energy is consumed than produced, leading to a reduction of frequency in the transmission network and in the whole power grid, consequently. In contrast, a negative sign implies that network frequency is too high because more energy is produced than consumed. The market for balancing energy provides a mechanism to avoid this imbalance between generation and load and presents an essential part for the stability of the overall transmission and distribution system, therefore.

Balancing deviations between forecasted and actual feed-in and withdrawal can be substituted by the load-balancing group or by the transmission system operator itself. The traded energy for balancing this system is called balancing power. Balancing power

[2] For further analysis see McAfee and McMillan (1987).