SHORT-TERM ELECTRICITY PRICE IN BRAZIL: CURRENT LIMITATIONS AND THE BENEFITS OF A TRANSITION TO A MARKET PRICE FORMATION MODEL

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Overview

In the Brazilian electricity market, the price that better represents a spot price is the Settlement Price for the Differences (PLD), that is the price at which the differences between the actual amount of energy produced or consumed and contracts are settled at the Electric Energy Trading Chamber – CCEE. This price, however, is not defined by the market, but calculated through centralized models, which are the same models used by the Brazilian Electric System Operator (ONS) for operation planning and system dispatch. Although these models simulate the system operation considering the expectations of electricity supply and demand, the price they calculate is often substantially different from the marginal cost of electricity production, which results in an inefficient signaling to producers and consumers.

Methods

This paper analyzes the main limitations of this artificially calculated price, that are mainly related to the quality of the input data used by the models and the differences between the operation planned by the models and the real operation. The differences between the prices and the real operational costs are also evaluated. After this analysis, a transition to a market price formation model is proposed and the potential benefits of this transition in terms of efficient operation and investment are evaluated.

Results

According to the analysis, the data used by the models for price formation have several limitations. The demand and supply projections considered in the models may be significantly different from the reality. As they represent official expectations, the demand projected is frequently higher than the observed. Another problem is that higher demand during peak hours in summer is not well represented in the models, leading to the need of expensive thermal generation while the prices are kept low. Demand is also assumed to be price-inelastic, despite an approximation of a demand curve is considered in the models. Moreover, the information about supply is frequently overestimated. This is particularly true when considering new capacity additions to the system. The review of capacity expansion projections in the models to represent a more realistic supply has led to sharp increases in prices and thermal generation. Another limitation of using these models to calculate prices is that the real operation may be different from the operation determined by the models. As the system operator tends to adopt a more conservative operation, given its aversion to risk, it may determine additional thermal generation to increase energy security, which is not considered in price formation. Once the same models used to operation planning are also used to expansion planning, the economic signaling to an efficient expansion has the same limitations than that represented by the artificial prices to system operation. Considering all these limitations, this paper presents a proposal for a transition to a market price formation model for electricity in Brazil and evaluates the potential benefits of this model. It is proposed that the transition occurs in two stages. In the first stage, the system operator continues to determine the generation of hydro and thermal plants, including the additional dispatch for energy security, but the thermal generation represents only a reference to the market. After that, producers and consumers post their orders to buy and sell electricity to the different periods of the next day. The market price is then determined by the balance of supply and demand. At this stage, thermal generation is settled by the market and consumers may buy and sell electricity according to the prices, which is not allowed under the current model. Another difference is that the secondary energy, i.e., the additional amount of hydropower that is distributed among hydro producers is traded at market prices. Many benefits of market price formation can already be verified at this stage. An important signaling to energy efficiency occurs when thermal generation is determined by the market and consumers can increase or reduce the amount of energy they use according to market prices. In the second stage of the proposed model, the system operator becomes an independent operator that only coordinates the generation and transmission system, and hydro and thermal generation are included in market price formation, completing the transition to a market price formation model. At this stage the supervision of market regulators to avoid the exercise of market power is crucial. There are several benefits of this

transition. The participation of all players in market price formation may result in a significant evolution from the centrally calculated prices. The bids and offers of all agents represent the expectations of the whole market, which contains a much larger amount of information than the currently used to calculate prices and can thus lead to more efficient and representative prices. In the market model, the short-term operation can become substantially more efficient. Once the prices represent the marginal costs of electricity production, they result in an important incentive to energy efficiency for consumers and to increase or reduce production for power generators. This will be particularly important with the introduction of smart grid technologies in the Brazilian market. In the medium and long-term, efficient market prices may induce more efficient investments. In the Brazilian system, with increasing hydropower production in plants without reservoirs that generate most of their energy during the wet season, this may represent an important incentive to investment in flexible thermal plants and wind and biomass plants that are complementary to hydropower plants and produce more energy during the dry season. Also, the increasing demand during peak hours may lead to investments in capacity increase in existing hydropower and distributed solar power generation.

Conclusions

The main conclusions of this paper are that the short-term electricity price in Brazil has several limitations that may lead to an inefficient operation and investment. The transition to a market price model, proposed to occur in two stages, may result in an important incentive to energy efficiency and the investment in a more efficient system expansion, which includes flexible thermal generation and wind, biomass and solar power.