An Alternative Approach to Contracting Power: Lessons from the Brazilian Electricity Procurement Auctions Experience

An innovative methodology to contract capacity employs an index designed to allow comparison among the expected generation costs of electricity from different types of fuel sources. An analysis shows, however, that the methodology presents distortions that favor the competitiveness of power plants with higher variable costs, and also that it is subject to endogenous choices of the auctioneer, with huge differences between auction numbers and performed numbers.

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I. Introduction

Market capacity has proven to be the most controversial element in electricity restructuring models (Cramton and Stoft, 2007, p. 43), and so there are different approaches in how to find equilibrium between security, reliability and the economic efficiency of the system. Percentage of avoided cost, portfolio theory, assigning a fixed diversity or a relative weight for fuel diversity are some of these approaches. Using a method that is closer to percentage of avoided cost, Brazilian power procurement auctions adopted a scoring rule based on the

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expected generation cost of electricity (fixed plus variable costs) from different types of thermoelectric sources by the application of the Benefit Cost Index (BCI).

II. Basic Principles and Literature Overview

Just and Weber (2008, p. 3,199) argued that, in general, markets for capacity are complex due to the option to book capacity in advance and the ability to randomly dispatch, potentially several times in real time. Furthermore, this feature is reflected in two pricing mechanisms: price for capacity and price for its effective use of energy. Chan *et al.* (2002, p. 1,397) supported the analysis carried out by Just and Weber (2008), stating that the efficient dispatch and scheduling cannot be done in real time.

Cramton and Stoft (2007, p. 53) also believe that market capacity is needed in most restructured electricity markets, because the current electricity markets are unable to sell reliability, and high administered prices of shortage, needed to induce a reliable level of capacity, are generally suppressed by the various mitigation measures that have market power. When restoring the remuneration for peak power capacity, markets attempt to create incentives for efficient investment.

Furthermore, Tishler *et al.* (2008, p. 1,626) also pointed out another concern in the design of markets: consumers do not accept high price volatility. The stability of the market (low price volatility) is clearly a benefit for consumers because it reduces the cost of capital and the price for capacity. Market instability (high volatility) is clearly bad for consumers because it increases both the cost of capital and the price for capacity (Stauffer, 2006, p. 75).

One way to quantitatively determine this diversification is by means of portfolio theory

Tishler *et al.* (2008, p. 1,626) argued that in pursuit of stability, regulators and politicians tend to keep the regulated electricity sector with sufficient electricity generating capacity and stable prices, or strongly intervene in a competitive electricity market. So, regulators also face the problem of how much to achieve equilibrium among security, stability, and price i.e. how much power and electricity to derive from each available source.

As the variable cost of a thermopower plant is essentially the cost of the fuel; hence, when purchasing electricity from a thermopower plant the question must be addressed of how to compare different sources of fuel i.e. a coal-fired power plant (high fixed cost and low variable cost) with an oil-fired power plant (low fixed cost and very high variable cost).

One way to quantitatively determine this diversification is by means of portfolio theory. Different electricity generation technologies and fuel are characterized by a certain cost, together with a standard deviation on that cost (risk). Correlations between different types of costs can be determined. So, it is possible to define optimal portfolios, the efficient frontier is found by solving one of two optimization problems: minimize risk or minimize cost, and adding a restriction on either a fixed cost or risk (Delarue *et al.*, 2011, p. 12).

The portfolio theory was first laid by Markowitz (1952), and applications of this theory to the electricity sector, even with different model formulations, were presented by Awerbuch and Berger (2003), DeLaquil *et al.* (2005), Jansen *et al.* (2006), between others, and the latter used a cost-based approach, which an application was described by Delarue *et al.* (2011).

Another approach, by sorting for prices based on the ''percentage of avoided cost,'' is opposed by Stoft and Kahn (1991), which claims that this method is anti-economically biased against projects that operate at the base, because it neglects the effects of duration of the dispatches, and so

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