



## The Brazilian Power Sector

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In Monday's Energy Policy Seminar, visiting Harvard Electricity Policy Group Senior Fellow Mauricio Tolmasquim offered a view of the Brazilian power sector, where hydro plants provide 62% of capacity, other renewables provide 18%, and fossil fuel plants provide only 19% of capacity. Tolmasquim, who is the former President of Brazil's *Empresa de Pesquisa Energetico*, laid out the thinking behind the electricity auction system he developed to meet the country's capacity needs.

The Brazilian system has some challenges that result from its heavy reliance on hydro power. For example, while there may be plenty of capacity in the system, it is impossible to predict with certainty how much hydropower will be available in a given year, since that depends on the amount of rainfall. Further complexity is added by the fact that in a hydro system, decisions made by upstream plants to run or not run impact the amount of water available to downstream plants.

In 2001, Tolmasquim explained, a "rationing crisis" occurred in Brazil's electricity sector, with power dam levels at only 32% of their storage capacity, and the risk of outages above 15%. In response, rationing was imposed on all consumers, requiring them to reduce their consumption by 20%. The result was billions of dollars worth of economic losses and three years of slowed GDP growth, Tolmasquim explained.

Although in a hydropower system, it is tempting to assume that shortages result from lack of rainfall, in the case of the 2001 shortage, Tolmasquim explained, the problem was primarily due to a number of years in which demand grew faster than capacity. Investment in greater capacity was needed—but the government could not afford to make this investment itself, and private investors were not motivated to invest, given the relatively low spot market power prices that prevailed even as the 2001 electricity shortage loomed, and given the uncertainty about future prices that comes with the knowledge that good rainy year might eliminate short term scarcity.

To address the issue of capacity, the Brazilian government undertook a major power sector reform initiative in 2004, Tolmasquim said. Given the reluctance of third parties to invest, the challenge faced by the reformers, Tolmasquim explained, was to find a way to combine the investment-promoting certainty of multi-year power contracts with the consumer benefits of price competition.

Tolmasquim and his colleagues solved this problem by developing a bidding process for energy supply contracts. The contracts themselves provided considerable protections to generators, by guaranteeing power purchases and prices for terms of 15 to 30 years. However, the contracts are awarded as the result of a competitive auction, in which bidders only receive contracts if they offer the lowest prices—and each bidder gets only the amount of their bid, not the clearing price for the whole auction.

The reform, Tolmasquim reported, has been a success in bringing new investment into the power sector—almost 80,000 megawatts of new capacity, including about 60,000 MW of renewables. At the same time, the average prices of new plants have for the most part declined in auctions from 2005-2014, especially for new hydropower plants. Currently, in fact, an economic recession in Brazil means that power demand is below capacity levels. Under the contract arrangements, this demand decline leaves consumers paying for power they do not currently need. However,



Tolmasquim argued, this assumption of demand risk by consumers is what was needed in Brazil to bring new capacity into the system and avoid continued scarcity of supply.

Tolmasquim spoke as part of the Kennedy School's Energy Policy Seminar Series, which is sponsored by the Consortium for Energy Policy Research of the Mossavar-Rahmani Center on Business and Government.