BETTER PRICING OF THE ENERGY BALANCING MARKET

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Overview

Electricity is different from most products that are bought and sold. You seldom get exactly what your contract specifies. Consider TV sets. Order 24 from your supplier and you get 24, not 23, not 25, and certainly not 24.34. With electricity, a month long contract to buy 24 MW from the local utility may lead to your receipt of any amount of electricity, but seldom 24.00 MW each and every instant of each and every day of the month. The difference has a value and utilities have generally treated each other on a return-in-kind basis, you scratch my back today and I'll scratch your back tomorrow. Now inter-utility competitors include non-utility generators whose only job is inter-utility competition. Return-in-kind doesn't provide non-utility generators with cash for their operations, cash that could be provided by dynamic pricing of imbalances. India has installed a dynamic pricing model for Unscheduled Interchange, which will be explored in this paper. A more advanced dynamic pricing model called Wide Open Load Following (WOLF) is also presented. Now the question is, "What I should pay for the 25th TV set, or what should I get paid for the 24th TV set that wasn't on the delivery truck."

Methods

There is a growing concern about paying for electricity imbalances. This concern exists for the formally structured markets run by the various Independent System Operators (ISOs), such as ERCOT, PJM, New York ISO, ISO New England, California ISO, and Midwest ISO. Recently ERCOT (the Electricity Reliability Council of Texas) alleged that a utility so dominated the imbalance market that the utility's pricing strategy was an abuse of market power. The concern about imbalances also exists for the loosely structured market among the various interconnected entities, whether independent utilities or the interaction of the ISOs with each other and with these utilities. For instance, PJM took 2,978,212 MWH off the grid during prime time hours during the 25 months ending April 2004, an average of 280 MW. PJM did give back to the grid even more energy during the off peak hours, but during some of those hours PJM posted internal prices that were zero or negative.

One way to price these imbalances is a formulary auction. Under a formulary auction, the price for electricity rises and falls based on (A) the concurrent frequency of the system or (B) the Area Control Error (ACE), the latter in the case of either (1) an intra-ISO market or (2) an intra-utility market. Such a formulary auction was effectively described 100 years ago by the French economist Leon Walras. The slope of the formula is highly dependent on how tightly the electric system has been maintaining system frequency or wishes to maintain system frequency. For instance, India has a history of very wide variations in system frequency as compared to most grids in North America. The slope of the pricing formula in North America should thus be several times steeper than the slope of the pricing formula in India.

Imposing a formulary auction on an electric system should decrease the variance the electric system experiences with system frequency (or with ACE). India decreased its Frequency Variance Index (FVI) by a factor of ten when it instituted its Availability Based Tariff (ABT) which included a formulary auction of Unscheduled Interchange (UI). The formulary auction must be monotonic and adjustable. India's UI prices have a ceiling, thus violating the monotonic concept. Nor is India's UI pricing formula easily adjustable. When petroleum prices effectively soared above the ceiling, India experienced a major setback in its FVI, and had no way to reset its UI formula periodically, at least not automatically.

ABT pricing of UI is compared to Wide Open Load Following (WOLF), a formulary pricing mechanism for unscheduled flows of electricity, all unscheduled flows, not just the net flow between me and the local utility, but also (1) the loop flow among utilities, where some electricity comes in the front door and concurrently goes out the back door, and (2) reactive power, the imaginary power flow that increases and decreases local voltage on AC networks.

Results

I show that it is possible to combine the reliability concerns of engineers with the financial concerns of economists. In India, such a combination of economics and physics can be demonstrated by the effect that national petroleum prices have on system frequency, a primary determinant of the reliability of the electric system.

Conclusions

The increased emphasis on competition in the electric industry is making all parties more concerned about energy imbalances, whether a consumer tie-riding on the network or a generator dumping excess electricity. The industry needs a way to price these unscheduled flows of electricity on a dynamic basis, so that the participants experience financially the physical impacts that they are having on others.

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