

Understanding Competitive Pricing and Market Power in Wholesale Electricity Markets

Discussions of competition in restructured electricity markets have revealed many misunderstandings about the definition, diagnosis, and implications of market power, including the common myths that it is present in all markets and that it must be present in order for firms with significant fixed costs to remain profitable.

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In the brief period of time that the restructured California electricity market has been operating, a number of issues have arisen that relate to the competitiveness of the wholesale electricity market in the state. There have been lively debates over the need for price caps in the California Power Exchange (PX) day-ahead market and the California Independent System Operator's (ISO) real-time and ancillary services markets. These debates have raised the question of whether the high prices that have been observed at times are a natural result of peak demand times or whether they

have been exacerbated by strategic behavior by some firms attempting to manipulate market prices. The debate about the appropriate treatment of reliability must-run (RMR) plants has likewise focused attention on the possibility that some producers may attempt to supply power in ways designed to influence market prices. The questions raised in these discussions are central to judgments about the need for intervention by the PX, ISO, or government regulatory institutions to alter the operation of the wholesale electricity market.

This article discusses what market power is, how it is often con-

fused with competitive behavior—particularly competitive peak-load pricing—how it can be distinguished from competitive behavior, and the implications for wholesale electricity markets.

I. The Behavior of Price-Taking Firms and Competitive Markets

A firm exercises market power when it reduces its output or raises the minimum price at which it is willing to sell output (its offer price) *in order to change the market price*. A firm that is unable to exercise market power is known as a price taker; the firm makes decisions taking the price it faces for its output as given, believing that the actions it takes cannot change that price. Common examples of price-taking firms are wheat, rice, corn, or soybean farmers; gold, silver, or platinum mining companies; and natural gas producers. Many industry observers suggest that producers of oil are price takers, while others argue that the Organization of Petroleum-Exporting Countries (OPEC) is able, as a group, to manipulate oil prices. OPEC has certainly tried to do this, but frequently has had difficulty dissuading its members or other non-OPEC producers from responding individually to higher oil prices by increasing their production.

A price-taking firm is willing to sell output so long as the market price (which it believes that it cannot profitably influence) is above the firm's marginal cost of producing and selling the output, properly calculated. In the electricity industry, the marginal cost of production will

include variable costs due to fuel and the other variable operating and maintenance costs, i.e., all costs that actually vary with the quantity of power that the plant produces. Costs that don't vary with the quantity of power the plant produces in the given time period, such as fixed costs of operating and maintaining the plant, are not part of the marginal cost and are thus irrelevant to the firm when it makes its short-run production decision.

A price-taking firm is willing to sell output so long as the market price is above the firm's marginal cost.

Still, the cost of selling a unit of electricity can be greater than the simple production costs if the firm has an *opportunity cost* that is greater than its production cost. An opportunity cost is the revenue the firm would get from putting the power to an alternative use, such as selling it in a different location. For instance, a power producer in the northwestern United States can sell power (1) into California, (2) in its own location, or (3) in some other location in the Western Systems Coordinating Council (WSCC). If the producer expects that it can earn \$21/MWh selling the power in another location, and

if transmission were available and no more costly than transmission into California, then it would not be willing to offer power in California for any price less than \$21/MWh. This would not indicate market power: The firm is not raising its offer price in California in order to raise the California market price. It is simply choosing to sell power where the price is highest. The marginal cost that a firm faces for selling power is the greater of its marginal production cost and its opportunity cost. Of course, a high price in an alternative market can reflect market power in that market, resulting in high prices that are then transmitted across markets by the response of competitive suppliers.

It is important to understand that a price-taking firm does not sell its output at a price equal to the marginal cost of each unit of output it produces. It sells all of its output at the market price, which is set by the interaction of demand and *all* supply in the market. The price-taking firm is *willing to sell* at that market price any output that it can produce at a marginal cost less than that market price.

In markets run as uniform-price auctions, such as the day-ahead market run by the PX, a price-taking seller that wishes to maximize its profits would bid its power into the market at its own marginal cost. That is not the price it would receive for its power. It would receive the price that equates the entire supply and demand in the auction. It would then be awarded sales exactly equal to the quantity of power that it could produce at a

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