



UNITED STATES OF AMERICA  
FEDERAL TRADE COMMISSION  
WASHINGTON, D.C. 20580

**Before the Commonwealth of Virginia  
Joint Subcommittee Studying  
Electric Utility Restructuring  
Structure and Transition Task Force**

---

**Regarding "Electric Industry Restructuring"**

**SJR-91**

**Comment of the Staff of the  
Bureau of Economics  
of the Federal Trade Commission(1)**

**July 9, 1998**

**I. Introduction and Summary**

The staff of the Bureau of Economics of the Federal Trade Commission (FTC) submits these comments to the Structure and Transition Task Force of the Virginia Legislature's Joint Subcommittee Studying Electric Utility Restructuring (Task Force) concerning electric industry regulatory reform. With the formation of the Task Force, Virginia is joining a growing list of states considering regulatory reforms to bring more of the benefits of competition (lower prices, improved service, and innovation) in the electric industry to its citizens and businesses.

The FTC is an independent administrative agency responsible for maintaining competition and safeguarding the interests of consumers. The staff of the FTC often analyzes regulatory or legislative proposals that may affect competition or the efficiency of the economy. In the course of this work, as well as in antitrust research, investigation, and litigation, the staff applies established principles and recent developments in economic theory and empirical analysis to competition issues.

The staff of the FTC has a longstanding interest in regulation and competition in energy markets, including proposals to reform regulation of the natural gas and electric power industries. Staff has submitted numerous comments concerning these issues at both the federal and state levels.(2) Moreover, the FTC regularly reviews proposed mergers involving electric and gas utility companies.

In the transition to retail competition, the Task Force may wish to consider several competition policy themes to assure that the benefits of competition inure to consumers and businesses in Virginia. The five primary themes of our comment are: (1) both horizontal market power and discrimination against competing suppliers of generation by vertically integrated transmission monopolists may be of concern in the electric industry; (2) there are several factors to consider in a market power analysis, and the Task Force may wish to avail itself of computer simulation models to help examine these factors as well as to evaluate current and prospective horizontal market power;(3) (3) if Virginia determines that it faces likely market power problems in electric generation markets, addressing them through structural remedies may be preferable to relying exclusively on market power monitoring and mitigation; (4) independent system operators (ISOs) of the transmission network within a defined geographic region are potentially attractive institutions for addressing some of the market power issues in the electric industry, particularly if the ISO is formed to avoid the dangers signaled by four key warning signs -- insufficient size, lack of a contingency plan for

generation restructuring, lack of independence, and failure to adequately deal with transmission congestion; and (5) properly developed and operated ISOs may also help address reliability concerns.

## **II. Both Horizontal Market Power and Discriminatory Access to Transmission May Be of Concern in the Electric Industry**

There are two expressions of market power that may concern the Task Force as Virginia considers how to secure the benefits of retail competition for its citizens and businesses: horizontal market power and discriminatory access to transmission. Horizontal market power in this context refers to the ability of one or more electric generating firms to raise prices above competitive levels for an extended period of time. Horizontal market power results in higher prices, inefficient allocations of scarce resources, and distortions of consumer choices.

Concerns about horizontal market power in generation during deregulation were heightened by the pioneering British deregulatory experience. Following the implementation of electric industry restructuring in the United Kingdom in 1989 and 1990, researchers determined that the two private generating firms that dominated the industry were exercising market power. These findings prompted subsequent orders for divestiture of generation capacity.

In addition to horizontal market power, the Task Force may want to examine closely the incentives and ability of a vertically integrated transmission monopolist, whose rate of return is regulated, to evade regulatory constraints in order to earn a higher profit. Its participation in an unregulated market may give it the means to do so, either by discriminating against its competitors in the unregulated market or by shifting costs between the regulated and unregulated markets.<sup>(4)</sup>

Discrimination against competing generation suppliers by a transmission monopolist results in consumers paying higher prices when more efficient entrants into electric generation and sales have been blocked or face higher transmission costs than would prevail without the discrimination. The discrimination strategy involves complementary products and takes advantage of difficulties in monitoring discriminatory conduct. The monopolist controls others' access to its regulated product in ways that permit it to earn supracompetitive returns in its own operations involving the unregulated complement. Discrimination could appear as a subtle reduction in quality of service, the effects of which would be more difficult to identify and measure than outright denial of access. For example, an integrated transmission monopolist might afford other generation sources access to its transmission services on terms that raise others' costs and permit the monopolist to protect supracompetitive profits in the generation market.

Cross-subsidization or cost-shifting strategies harm competition when inputs purchased by the regulated portion of the firm are used in the production of both regulated and unregulated products. Costs of the shared inputs, which in the electric power industry might include promotion and general overhead, are assigned in a biased manner (i.e., with additional costs assigned to the regulated side of the business) so that the regulated entity can justify higher cost-based rates. This biased assignment of costs, which is often difficult for regulators to detect and remedy, distorts competition and produces inefficiencies in the unregulated business as well.

Controlling the discrimination and cost-shifting strategies of a monopolist with monitoring and regulation is difficult. Both strategies, however, can be defeated most effectively by preventing the regulated monopolist from entering the unregulated business or, in the case of a transmission monopolist with generation assets, by implementing operational unbundling through an ISO, thus eliminating its ability to distort competition in the unregulated market.

Consistent with economic theory regarding competition concerns of this nature, numerous independent producers and large industrial users have alleged discriminatory conduct in the operation of transmission facilities.<sup>(5)</sup> Likewise, this behavior is consistent with the evidence cited in the Supreme Court's Otter Tail Power decision.<sup>(6)</sup> Although we have not performed an empirical study of the presence of either horizontal market power or transmission discrimination in Virginia, we can provide some insights into the process of making such an assessment and developing remedies if market power is a concern. The remainder of the comment summarizes these insights.

### **III. There are Several Important Factors in the Evaluation of Horizontal Market Power**

Economic analysis of market power includes five primary areas: market definition, market structure, likely competitive effects of the structure or of changing the structure, entry conditions, and efficiencies. The DOJ/FTC Merger Guidelines describe these factors.<sup>(7)</sup> In addition, FERC adopted the DOJ/FTC Merger Guidelines as its framework in reviewing electric utility mergers. The DOJ/FTC Merger Guidelines can be found on the FTC's website ([www.ftc.gov/bc/guidelin.htm](http://www.ftc.gov/bc/guidelin.htm)).

#### **A. The Task Force May Wish to Use Computer Simulation Models to Help It Assess Horizontal Market Power and Structural Remedies for Market Power**

Recently, computer simulation models of generation and transmission that may facilitate analysis of market power issues have become more widely recognized and tractable.<sup>(8)</sup> State and federal agencies as well as utilities are making use of these models in long-range planning, policy development, and operations. Our experience in evaluating the PacifiCorp/Peabody merger evidences the potential usefulness of computer simulation models for the analysis of market power and potential structural remedies.<sup>(9)</sup> For example, by simulating various price increases by individual generators or groups of generators and their effect on pricing in the relevant market(s), computer models can be used to determine relevant geographic markets in a merger analysis or to ascertain whether an entity is engaging in anticompetitive behavior. The Task Force may wish to consider making use of such computer simulation models, if it has not already done so, to help it assess existing generation market power and potential structural remedies for such market power.

#### **B. The Task Force May Wish to Examine the Sensitivity of Market Power Analysis to Prospective Technical Changes**

Although existing market power conditions are important, a market power analysis also should focus on the duration of market power. If market power is transitory, it is generally of less concern and may serve as an important signal for investment. One factor that can make market power short-lived is changes in technology. A good example is the effect of changing technology on entry conditions.<sup>(10)</sup> Technological and regulatory changes over the past decade have tended to ease entry obstacles in electricity generation markets.

Entry analysis of electric generation markets considers two principal forms of entry. The first is new or expanded generating capacity within the existing product and geographic market.<sup>(11)</sup> The second is enhanced access to existing generating capacity by virtue of new or expanded transmission capacity. Increased transmission capacity that permits additional suppliers to compete frequently enlarges the relevant geographic market, and consequently tends to reduce concentration in the relevant market(s), even if no additional generation capacity is installed. The Task Force may wish to distinguish in its analysis of market power between present market power and one or more future market power scenarios. Further, it may wish to facilitate the emergence of competitive supplies of electricity by assuring that existing regulations and procedures governing new or increased transmission capacity are not unnecessarily restrictive, costly, or time consuming.

A second example of the likely effects of technological change on competition is time-of-day metering for consumers, as well as for additional businesses. While no one knows what will be the effects of expanded time-of-day metering, it is likely that consumers will shift their use of electricity to take advantage of lower rates during off-peak periods and to minimize their use of electric power during peak periods.<sup>(12)</sup> Hence, as retail prices come to more closely reflect transmission congestion conditions, demand peaks and troughs are likely to be moderated. Reductions in peak power consumption should reduce transmission congestion and associated localized market power in generation.

A third example of technological change that can affect competition is a change in the techniques used for detecting and measuring market power. We note this type of technical change with respect to the Task Force's expressed

concern about transmission constraints. Computer simulation models can be effective in examining the location, extent, and consequences of existing transmission constraints. In addition, such models can be used to anticipate the effects on transmission congestion of new generating facilities, new load configurations, and new transmission capacity.

In summary, if the Task Force determines to perform an assessment of existing market power, the DOJ/FTC Merger Guidelines provide an appropriate set of factors to consider, and computer simulation models may facilitate a fuller understanding of existing market power risks. Because the ability of incumbent generating firms to exercise market power may well change over time, the Task Force may wish to supplement a market power analysis with an assessment of how likely technical or regulatory changes will alter the ability of firms to exercise market power. Computer simulations may materially assist in this effort as well. If present market power problems are likely to differ significantly from future market power problems, the Task Force may wish to design its remedies to take account of these expected changes.

#### **IV. If the Task Force Determines That It Faces Likely Market Power Problems in Generation, Addressing Them Through Structural Remedies May Be Preferable to Relying Exclusively on Market Power Monitoring and Mitigation**

Market power in generation prevents potential price, quality, and innovation benefits to consumers from being realized through retail competition. Imposing new rules and regulations to curtail such market power is one potential solution, but one with substantial drawbacks. In our February 1998 comment to FERC on market power monitoring and mitigation proposals of the New England Power Pool (NEPOOL),<sup>(13)</sup> we stated that structural remedies may be more effective and less restrictive in the long run. Accordingly, Virginia may wish to avoid relying exclusively on such behavioral rules to curtail generation market power.

We summarize the drawbacks to relying exclusively on a behavioral approach in four points. First, it is likely to be difficult to detect and document the exercise of market power in many instances (NEPOOL Comment at 5). The need to balance supply and demand in electricity markets continuously and precisely makes electricity trades vulnerable to subtle and short-lived anticompetitive actions that are likely to go undetected because monitoring is complex and costly. Second, behavioral rules for market power mitigation will not eliminate incentives to exercise market power (id. at 6). Third, market power monitoring and mitigation rules create a risk that competitive behavior will be misidentified as anticompetitive behavior, thus chilling competition and increasing administrative and litigation costs (id. at 5). Fourth, focusing on behavioral remedies may divert attention from structural remedies that have the potential to address market power with greater certainty and lower costs to consumers (id. at 6). The NEPOOL Comment to FERC can be found on the FTC's website ([www.ftc.gov/be/advofile.htm](http://www.ftc.gov/be/advofile.htm) (V980002)).

#### **V. ISOs Are Potentially Attractive Institutions for Addressing Many Market Power Issues in the Electric Industry**

Both horizontal market power and transmission discrimination concerns can be addressed by independent system operators (ISOs). ISOs can be organized to reduce potential horizontal market power by including a broad geographic area with many separate generation firms. By eliminating "pancaked" transmission rates<sup>(14)</sup> and embracing an enlarged geographic area, ISOs can broaden the effective geographic market and thereby reduce market concentration in generation and consequently the likelihood of generation market power. A broader geographic market will not necessarily solve all the generation market power problems, but it can provide a major step in that direction.

If it is truly independent in its governance and operations, the ISO also eliminates transmission discrimination incentives by removing control of transmission assets from the hands of firms that own generation facilities. In addition, the ISO may have stronger incentives than traditional vertically integrated utilities to address generation market power in load pockets<sup>(15)</sup> that arise during periods of transmission congestion.<sup>(16)</sup>

If Virginia becomes involved in forming an ISO, it may wish to consider four danger signs warning of risks to competition in the ISO formation process:<sup>(17)</sup> (1) the ISO is too small; (2) there is no plan for generation restructuring; (3) the ISO is not sufficiently independent; and (4) the ISO plan does not effectively deal with transmission congestion.

**ISO Warning Sign Number One: The ISO is too small.** One disadvantage of an ISO with limited geographic scope is that it may not encompass enough generating firms to mitigate generator market dominance problems.<sup>(18)</sup> With very few, if any, exceptions, a single state is too small for an ISO. An ISO that includes only one utility's service territory warrants even closer scrutiny. Indeed, several participants at FERC's April 1998 ISO Policy Conference testified that reliability and competition concerns might lead to consolidation into as few as three ISOs to cover all forty-eight contiguous states.

**ISO Warning Sign Number Two: There is no plan for generation restructuring even when there is a potential generation market dominance problem.** As a general proposition, a market power monitoring office within the ISO may not be a good substitute for up-front divestiture of generation capacity if market power is present. Several states, including California, have confronted the generation market dominance issue directly and required divestitures of key generation capacity in conjunction with forming an ISO. As noted earlier, antitrust may not be an effective policy tool for addressing existing market power created under past regulation. Hence, the Task Force, other state public utility commissions, and FERC may be in the best position to address this aspect of restructuring as part of the ISO formation process.<sup>(19)</sup>

**ISO Warning Sign Number Three: The "I" part of the ISO is missing or weak.** Independence is a keystone of successfully launching competition through an ISO. For competition to develop, current and prospective industry participants need to have trust in the objectivity of the ISO. If, for example, incumbent vertically integrated utilities can veto expansions of the transmission grid, or limit who may use the grid, the ISO's independence is likely to be at risk.<sup>(20)</sup>

**ISO Warning Sign Number Four: The ISO plan does not effectively deal with transmission congestion.**<sup>(21)</sup> Failure to deal effectively with the transmission congestion problem can threaten system stability, present opportunities for generators to create or protect generation market power, and reduce the overall efficiency of the transmission grid. Other states that have considered this problem have included transmission congestion pricing systems in their restructuring programs.<sup>(22)</sup>

## **VI. Properly Developed and Operated ISOs May Also Help Address Reliability Concerns**

Although the issues of competition and reliability are commonly discussed separately, a major overlap between the two relates to the appropriate size of the ISO. As discussed above, large ISOs can alleviate generation market dominance concerns by broadening the relevant geographic market and by providing unbiased incentives to add transmission capacity to alleviate transmission bottlenecks. Large ISOs can have a similarly salutary effect on reliability difficulties, by increasing the number and diversity of generation and transmission reserves. In addition, a large ISO will have incentives to strengthen transmission links throughout its operating area in order to avoid transmission bottlenecks. Coincidentally, this will enhance the ISO's ability to bring reserve capacity to bear from different areas to meet reliability problems in a particular area.

## **VII. Affiliate Rules and Consumer Protection Considerations**

Above we discussed the likely advantages of operationally separating generation from transmission. Similar issues may arise regarding other vertical arrangements in the electric industry. Both competition and consumer protection concerns are associated with vertical integration between regulated parent utilities and their affiliates operating in unregulated markets. Several states are developing structural and behavioral rules to govern transactions between regulated parent transmission firms and their unregulated affiliates. We addressed these concerns, from both

competition and consumer protection perspectives, in our recently filed comment to the Public Utility Commission of Texas and we believe that it may be of interest to the Task Force. This comment can be found at the FTC's website ([www.ftc.gov/be/advofile.htm](http://www.ftc.gov/be/advofile.htm)).

### **VIII. Conclusion**

Horizontal market power and transmission discrimination issues warrant close attention from the Task Force as it moves to secure the benefits of retail competition for Virginia's citizens and businesses. Use of the factors set forth in the DOJ/FTC Merger Guidelines, together with computer models, may allow the Task Force to draw appropriate conclusions about the extent of generation market power facing Virginia customers. In conducting such a market power analysis, the Task Force may wish to distinguish between present market power and likely future market power, since technological and institutional changes may materially alter generation market power (as they have in the past). A carefully formed ISO may be an attractive institution through which to implement retail competition and enhance wholesale competition. One criterion for an effective ISO is likely to be significant geographic size, with numerous generating facilities and firms. A large ISO of this type is apt both to alleviate generation market power and to enhance reliability.

Respectfully submitted,

---

Jonathan B. Baker, Director  
John C. Hilke, Electricity Project Coordinator  
Bureau of Economics  
Federal Trade Commission

July 9, 1998

### **Endnotes**

(1) This comment represents the views of the staff of the Bureau of Economics of the Federal Trade Commission. They are not necessarily the views of the Federal Trade Commission or any individual Commissioner. Inquiries regarding this comment should be directed to John C. Hilke (303-844-3565).

(2) The staff of the FTC has commented on electric power regulation to the Federal Energy Regulatory Commission (FERC) in Docket No. PL98-5-000 (May 1, 1998)(ISO Policy Comment), Docket Nos. ER97-237-000 and ER97-1079-000 (February 6, 1998)(New England Power Pool (NEPOOL) Comment), Docket No. RM96-6-000 (May 7, 1996)(Merger Policy Comment), Docket Nos. RM95-8-000 and RM94-7-001 (August 7, 1995) (Open Access Comment), and Docket No. RM85-1-000 (1985). Comments to state agencies have been submitted to the Public Utilities Commission of Texas, Project Number 17549 (June 19, 1998); to the Maine Department of the Attorney General and Public Utilities Commission, "Interim Report on Market Power in Electricity" (May 29, 1998); to the Louisiana Public Service Commission, Docket No. U-21453 (May 15, 1998); to the California Public Utilities Commission, Docket Nos. R.94-04-031 and I.94-04-032 (August 23, 1995); and to the South Carolina Legislative Audit Council (February 28, 1994).

(3) These factors are described in the U.S. Department of Justice and Federal Trade Commission, Horizontal Merger Guidelines, issued April 2, 1992, revised April 8, 1997 (DOJ/FTC Merger Guidelines). These Guidelines provide a sound framework for evaluating horizontal market power issues in a merger context, but they are not designed to address existing market power that was lawfully acquired, as might well exist in an industry moving from local regulated monopolies to competition.



(4) See Timothy Brennan, Why Regulated Firms Should Be Kept Out of Unregulated Markets: Understanding the Divestiture in United States v. AT&T, 32 Antitrust Bull. 741 (1987), and Cross Subsidization and Cost Misallocation by Regulated Monopolists, 2 J. Reg. Econ. 37 (1990).

(5) See, e.g., "Petition for a Rulemaking on Electric Power Industry Structure and Commercial Practices and Motion to Clarify and Reconsider Certain Open-Access Commercial Practices," filed with FERC by Altra Energy Technologies, Inc. and others on March 25, 1998.

(6) Otter Tail Power Co. v. United States, 410 U.S. 366 (1973). (Otter Tail Power Company prevented an independent municipal utility, which was surrounded by Otter Tail Power's franchise territory, from buying power from another potential supplier. It did so by refusing to transmit the power over Otter Tail Power's transmission lines, which were the only available transmission lines.)

(7) Although the DOJ/FTC Merger Guidelines provide a firm foundation for analyzing changes in prospective market power resulting from a proposed merger, the analysis does not focus on detecting or measuring market power that may already exist in the market. Further, antitrust enforcement is focused on anticompetitive mergers and unfair forms of competition. From an antitrust perspective, a firm that lawfully acquired market power does not commit an antitrust offense merely by exercising that power, unless it engages in unfair methods of competition to protect that power. Consequently, antitrust enforcement may not be able to reach such market power as a market moves from local regulated monopolies to competition. Hence, if the Task Force finds that horizontal market power problems exist in the generation market(s), it may wish to recommend that the Virginia Legislature (and State Corporation Commission) look beyond antitrust enforcement to considering a structural remedy (i.e., divestiture of generation assets by a transmission monopolist). At the same time, however, if the Task Force is contemplating recommending a structural remedy, such as divestiture, to correct an existing market power problem, an analysis of the remedy under the framework set forth in the DOJ/FTC Merger Guidelines may be useful because structural remedies, like mergers, involve a change in company or industry structure that is expected to have implications for market power. The Guidelines are designed to address changes in market power that result from structural changes.

(8) FERC's Inquiry Concerning the Commission's Policy on the Use of Computer Models in Merger Analysis; Notice of Request for Written Comments and Intent to Convene a Technical Conference, 63 Fed. Reg. 20,392 (1998) ("The purpose of this inquiry is to gain further input and insight into whether and how computer models should be used in the analysis of mergers ...").

(9) Federal Trade Commission, "Analysis of Proposed Consent Order to Aid Public Comment in In the Matter of PacifiCorp et al.," FTC File No. 971-0091, at 4 (February 18, 1998) ([www.ftc.gov/os/9802/index.htm](http://www.ftc.gov/os/9802/index.htm)). (The FTC withdrew from the proposed consent order as of June 30, 1998 ([www.ftc.gov/opa/9807/petapp39.98.htm](http://www.ftc.gov/opa/9807/petapp39.98.htm)).)

(10) The competitive implications of market concentration are affected significantly by entry conditions. If entry is likely, timely, and sufficient to undermine efforts to exercise market power, then even high concentration may not have adverse implications for consumers. (See the DOJ/FTC Merger Guidelines, Section 3, for a discussion.)

(11) Future generation technology developments may include economical micro-generators that would further ease concerns about the minimum efficient scale of entry. See, for example, Stuart F. Brown, Here Come the Pint-Size Power Plants, Fortune 64C-64P (1996); Thomas R. Casten, Electricity Generation: Smaller Is Better, 8 Elect. J. 65-72 (1995); and Clyde Wayne Crews, Jr., Electric Utility Reform: The Free Market Alternative to Mandatory Open Access, Competitive Enterprise Institute at [www.electricity-online.com/crews.html](http://www.electricity-online.com/crews.html) (1998).

(12) At present, most residential consumers have few incentives to curtail consumption during peak usage periods when generation and transmission costs are highest because retail rates do not reflect these cost conditions and there is no way to distinguish consumption in peak hours from consumption in off-peak hours. Time-of-day metering will provide more consumers with more accurate signals of the cost of providing service and will allow consumers for the first time to change their patterns of electricity use to reduce their electricity bills.

(13) See NEPOOL Comment, supra note 2. The concerns expressed in the NEPOOL Comment were generalized in our May 1, 1998 ISO Policy Comment to FERC.

(14) Under traditional FERC transmission tariffs, an additional charge is incurred any time the contract transmission path involves more than one firm's transmission system, thus causing rates to be pancaked.

(15) A "load pocket" refers to demand in an area that must be satisfied by generation in that area because transmission congestion prevents utilization of supplies from outside the area.

(16) One potential difficulty with the nonprofit status of ISOs is the lack of profit incentives to operate efficiently and to make economically appropriate investment decisions regarding expansion of the transmission grid to address transmission bottlenecks. ISO governing bodies may be able to design the employment contracts of ISO managers to provide such incentives. For example, if the concern is that the ISO may favor restrictions on transmission, compensation for ISO managers could be designed to increase as transmission activity increases.

(17) Additional guidelines on formation of ISOs have been issued by FERC in Order No. 888, FERC Stats. & Regs. (CCH) ¶31,036 (April 24, 1996) (Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities), and Order No. 889, FERC Stats. & Regs. (CCH) ¶31,594 (April 24, 1996) (Open Access Same-Time Information System and Standards of Conduct).

(18) Another disadvantage may be that it does not provide enough diversity in generation (with respect to number and type of generators) to optimize system reliability. See Section VI below.

(19) Recent Administration proposals respond to this concern by giving FERC authority to require divestiture of generation assets by generating firms that have market power in the context of retail competition. ("Comprehensive Electricity Competition Plan," March 26, 1998 ([www.hr.doe.gov/electric/plan.htm](http://www.hr.doe.gov/electric/plan.htm))).

(20) See James Baker Jr., Bernard Tennebaum, and Fiona Wolf, Governance and Regulation of Power Pools and System Operators: An International Comparison, 382 World Bank Technical Papers (1997) (a report on international comparisons of ISO governance systems written in part by FERC staff).

(21) "Transmission congestion" refers to conditions in which transmission lines are being used to full capacity and additional transmission efforts between a generator and load reduce the efficiency of other transmissions on the transmission grid. Transmission congestion is most likely during peak demand (load) periods.

(22) A variety of transmission congestion pricing systems have been approved by FERC for use by ISOs, and the Task Force may wish to compare the effects of the different systems as more experience is gained. California, for example, opted for a "zonal transmission pricing" approach, albeit with very large zones. Zonal pricing assumes that there are no transmission constraints within the zone and, accordingly, sets a single price within the zone. The Pennsylvania, [New] Jersey, Maryland (PJM) ISO has chosen to address transmission congestion problems with much more narrowly defined pricing zones. PJM's approach is termed "locational marginal pricing" or "nodal pricing." Locational marginal pricing is a transmission pricing system that attempts to take full account of transmission loop flows. Loop flows are a complication of the physics of electricity (electricity follows the path of least resistance) that results in transmission congestion arising in places and at times that are counter to the intuitive, traditional view of transmission as a point-to-point delivery of electric energy. Locational marginal pricing assesses congestion charges based on the transmission congestion caused throughout the transmission system by a particular transaction.