DESIGNING COMPETITIVE ELECTRICITY MARKETS

by

Hung-po Chao
and
Hillard G. Huntington

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OWNERSHIP STRUCTURE, CONTRACTING AND REGULATION OF TRANSMISSION SERVICES PROVIDERS

Paul R. Kleindorfer

Introduction

This note considers a number of questions arising out of the EPRI-sponsored MEET Workshop on challenges associated with restructuring of the U.S. electric power industry. Restructuring objectives include transparent and efficient markets for both long-term and short-term transactions, dynamic efficiency and innovation, customer-focused operations, and system integrity. After a brief review of unbundling strategies intended to implement these objectives, I structure and pose some of the key questions (I call them MEET questions) which are currently "center-stage" in the debate. This note focuses primarily on questions related to the ownership structure and regulation of the ISO (and related other institutions such as the Power Exchange), including necessary incentives for the ISO to promote efficiency in financial and physical contracting, as foreseen and partially prescribed in FERC Order 888. The required contracting includes financial instruments (spots, forwards, futures, and performance contracts) encompassing long-term and short-term energy contracts, asset-use and resource supply contracts, ancillary service contracts, investments in generation and transmission assets, load-management and demand-side management contracts, and contracting for other market-mediated services required for the efficient configuration and operation of the power market.
In the transmission area, most attention has been focused in the U.S. on the issue of pricing. However, pricing is arguably less significant than the issues of ownership and decision rights for access to transmission capacity. For one thing, transmission costs are only 10-15% of the total retail costs of power. For another, almost all of these costs are fixed and therefore efficient (i.e., marginal cost-based) prices signals for transmission are hardly noticeable relative to other components of energy cost related to generation and to fixed cost components of transmission, which are driven by investment and contracting decisions of transmission service providers. In any case, transmission is critical in assuring open and non-discriminatory access and with it in enabling wholesale and retail competition in generation and between generation, transmission and distribution. For these reasons, transparency, simplicity and system integrity must the initial guiding principles of transmission service provision and regulation, followed by efficiency in transmission investment and lastly efficiency in short-term pricing. How to achieve a balance among these principles is the challenge which we briefly discuss in the following comments.

**Unbundling and Rebundling**

What gets *unbundled* to promote transparency and competition must be *rebundled* to provide effective power services.

Ownership and contracting are central issues to the efficiency of investment and the transactions costs of unbundling. Unbundling occurs at two physical levels: (1) between generation, transmission and distribution; and (2) within generation, between the provision of energy and various other ancillary services.

In addition there is a separation of physical products and financial services as is apparent from the Figure below. The benefits of unbundling are to clarify for competitive reasons the cost and value of each of the separate elements of the value chain for creating electric power. The problem created by unbundling is that these separate elements must be rebundled, via contracting or spot markets, in an on-going fashion to (re-)create from these elements desired services and end outputs.

Figure 1 provides a snapshot of the physical functions provided by the electric power system and the financial decisions and instruments which complement and parallel the physical. We structure the physical system functions and the financial market decisions/contracts as they occur in 4 time frames, Long-Term, Medium-Term, Short-Term and Real-Time.

**Long-term Functions and Decisions:** Physical: Technology planning and acquisition, human resource planning and development, to build and operate assets to support generation, transmission and distribution (GTD). Financial: Secure required capital, technology and human resources to accomplish the physical functions.

**Medium-term Functions and Decisions:** Physical: Schedule and implement system maintenance of GTD assets. Financial: Forward contracts and bilateral agreements are negotiated for power delivery and contracts for load management, for transmission constraint payments, and for delivery of ancillary generations support are determined.

**Short-term Functions and Decisions:** Physical: Forecast and schedule near-term power demand. Unit commitment decisions and other set-up decisions to enable economic dispatch are made. Financial: Execution of medium-term contracts (e.g., forwards); spot markets and economic dispatch provide clearing mechanisms for residual supply and demand.

**Real-time Functions and Decisions:** Physical: Network coordination occurs to assure system reliability, security and stability, through spinning reserves, Automatic Generation Control (AGC) and ancillary generation support providing frequency and voltage support. Financial: Execution of medium- and short-term contracts for interruptible loads, VAR contracts and other support services.

![Electric System Time Line: Market and Physical](image_url)

Figure 1: Electric System Time Line: Market and Physical

In terms of organizational boundaries, the natural demarcation is between the organizations controlling long- and medium-term transactions, and those occurring in the short-run or in real-time. The latter transactions are the purview of system operations and organizationally will be the responsibility of the Independent System Operator (the ISO), coupled with a “Power Exchange”, which will also have responsibility for bilateral contracting at various temporal levels (monthly, daily, hourly). The longer-term functions and decisions are the responsibility of Generation, Distribution and Transmission Asset Providers (I refer to the last-named as TAPs). Concerning transmission service and network coordination, the key is the
organization and ownership boundaries of the ISO and the TAPs. I discuss this in the next Section in more detail, but it should be clear right away that two general possibilities exist: either the ISO and the TAPs are brought under the control of one (presumably regulated) company, or the ISO and the TAPs remain under separate ownership and control.

Structure and Ownership of the ISO and TSPs

From the above sketch, the reader should have no problem imagining a number of different approaches to organizing and regulating the ISO and Transmission Service Providers (TSPs) and their relationship to facilitating long-term markets (between Gencos and Discos) and short-term markets (e.g., forward markets and the residual "Pool"). Indeed, a variety of ISO models are technically possible, differentiated in broad terms by the following (inter-linked) factors:

1. Involvement of the ISO in the energy market (e.g., procedures for contracting for reserves and managing congestion costs);
2. The scope of commercial activities undertaken by the ISO, including the extent of support functions bundled within the ISO;
3. Structure (e.g., profit or non-profit), ownership and control of assets by the ISO.

Rather than use the limited space available here for a detailed treatment of this subject, let me just summarize a few of the on-going "experiments" internationally, which show considerable variation in the institutional realization of the above factors (see Table 1) A recent survey of U.S. States and regional power pool approaches and proposals indicates similar variety w.r.t. the dimensions indicated in Table 1. Given this array of existing alternatives, it is natural to pose the following MEET questions:

Question: What are the likely effects on efficiency (including financial performance for TSPs) and quality of transmission service of alternative approaches to ISO structure (e.g., w.r.t. ownership, profit-orientation, rights and responsibilities to contract for ancillary generation support and for wires use and maintenance, etc.)? What has the experience been internationally with various approaches to the ISO and which of the factors (1)-(3) above (or others) are critical success factors?

Question: What should the relationship be between the ISO and the institution/organization responsible for managing price-determination, contracting and settlements in the short-term power market (the Power Exchange in the California Market or the Pool Administrator in the England/Wales Pool)? Are any findings which can be drawn from international experience to date?

Question: What technical, demand and supply factors are likely to determine the looseness or tautness of pool rules relative to approval and acceptance of physical bilateral contracts by the ISO? What findings are there in international experience and in regional power pools to date about what is feasible/desirable in assuring an efficient confluence of (physical or financial) bilateral agreements with the Pool?

To make matters specific enough to go on, I will assume below that the ISO is allowed to enter into commercial transactions related to its primary role in balancing supply and demand in real time and in managing congestion. I will also assume that some flexibility exists for allowing bilateral contracting between supply aggregators/discos and generators, with the Power Exchange or Market Clearinghouse Function being organizationally separated from the ISO. Given these mild assumptions, we now consider questions related to the organization and regulation of the ISO and its relationship to Transmission Asset Providers (TAPs).

Efficient Organization and Regulation of Transmission

Scope and Organization of Transmission Service

Figure 2 illustrates the components of transmission service. At a primary level, generators and loads will gain access to the market through a connection to the transmission grid, and their supply and demand gives rise to the electricity marketplace. Transmission of energy from generators to wholesale customers is the quantity or energy side of the transmission service. The other side of transmission service is the quality or system support side, which is concerned with ensuring security of supply and voltage and frequency standards.

Figure 2: Transmission Service
### Table 1a: Transmission Issues for Selected Electric Power Markets

<table>
<thead>
<tr>
<th><strong>Country</strong></th>
<th><strong>Types of Transactions, i.e., Pooling vs. Bilateral</strong></th>
<th><strong>Involvement of the ISO in the Commercial Market</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina²</td>
<td>GENCOs can either sell into a pool or enter into private contracts with customers whose load exceeds 1 MW; buyers (i.e., large customers or DISCOs) pay a contractual price, or a seasonal price, and/or spot price which is then used by the Power Exchange (CAMMESA) to reimburse generators.</td>
<td>The NIS coordinates the generation, transmission, and distribution of electricity. CAMMESA is responsible for managing the Wholesale Electricity Market (WEM), for publishing seasonal and spot prices, and for performing least cost dispatch. Balancing is performed using an hourly spot price.</td>
</tr>
<tr>
<td>Australia (New South Wales)³</td>
<td>Generally pooling, though about 10,000 customers with annual consumption in excess of 160 MWh per annum will be eligible for retail access in July 1998. Spalding reports that there are proposals in place for full retail access beginning July 1999.</td>
<td>Transgrid (Market and System Operator) is responsible for both managing the commercial market and for performing the role of a system operator, i.e., least cost dispatch.</td>
</tr>
<tr>
<td>Chile⁴</td>
<td>Both, even though contractual amounts might be satisfied via a combination of actual generation and spot purchases. Bilateral contracts are generally limited to customers with a demand for capacity of greater than 3 MW.</td>
<td>Two CDC's perform economic dispatch in two interconnected systems, SIC and SING. The CDC's compute seasonal and hourly spot prices to enable balancing by GENCOs for deliveries that are different from contractually agreed upon amounts.</td>
</tr>
<tr>
<td>New Zealand⁵</td>
<td>Voluntary pooling through the market tends to be generally dominated by bilaterals.</td>
<td>EMCO is responsible for managing the market; EMCO and Transpower are responsible for performing least cost dispatch.</td>
</tr>
<tr>
<td>Norway⁶</td>
<td>Generally voluntary pooling with bilateral contracting between sellers and buyers.</td>
<td>Norepot (50% owned by STATNETT) is responsible for managing the commercial market and overseeing daily (i.e., spot), weekly (i.e., hedging instruments), and balancing (i.e., deliveries different from contractual amounts) markets. STATNETT is responsible for ensuring reliable delivery of power to the final destination.</td>
</tr>
<tr>
<td>Peru</td>
<td>Identical to Chile, except that customers with demand in excess of 1 MW can enter into bilateral transactions.</td>
<td>Identical to Chile; two dispatchers in two interconnected systems, i.e., SICN and SIS.</td>
</tr>
<tr>
<td>UK (England &amp; Wales)⁷</td>
<td>Voluntary pooling with bilateral contracting allowed for (large) customers.</td>
<td>The National Grid Company (NGC) is responsible for: a) managing the market, i.e., pool operations; b) operating the 275kV and 400kV transmission system; and, c) for performing least cost dispatch.</td>
</tr>
</tbody>
</table>

### Table 1b: Transmission Issues For Selected Electric Power Markets

<table>
<thead>
<tr>
<th><strong>Country</strong></th>
<th><strong>Ownership and Pricing</strong></th>
<th><strong>Transmission Cost Allocation &amp; Pricing</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>Multiple private owners operating under regulated price; expansion of grid decided and paid for by users</td>
<td>Multiple TAPs. Transmission tolls paid by GENCOs or DISCOs are based on a marginal cost approach and consists of a connection charge, a volumetric charge, and a charge to cover losses. Large users having bilateral contracts with GENCOs pay the DISCOs a toll for transmission.</td>
</tr>
<tr>
<td>Australia (New South Wales)</td>
<td>Generally, the high voltage transmission is state owned and operated. The state is responsible for constructing new transmission.</td>
<td>Transmission pricing is regulated by IPART which determines a total allowable annual network revenue requirement. Generators pay the cost of connecting to the network and common service charges are averaged over all customers. Recovery of costs is based on a 3-part tariff; 50% fixed, 25% demand, and 25% based on energy.</td>
</tr>
<tr>
<td>Chile</td>
<td>Multiple private owners providing access at regulated prices; grid extensions can be funded by any player.</td>
<td>Based on a location based (&quot;zonal&quot;) marginal approach plus additional charges to cover losses and congestion.</td>
</tr>
<tr>
<td>New Zealand</td>
<td>State Owned (Transpower) and operated. Transpower is responsible for constructing new transmission.</td>
<td>Similar in concept with the system in NSW, Australia except that Transpower uses a 2-part tariff (fixed and variable) to recover its allowed revenue requirement from DISCOs (or ESSA's).</td>
</tr>
<tr>
<td>Norway</td>
<td>State Owned (STATNETT) and operated. Statnett is responsible for constructing new transmission.</td>
<td>Transmission pricing is fixed for each local distribution area regardless of the source of the power, i.e., postage-stamp in nature. A Statnett Transmission Charge consists of 4 parts; charges for connection, power, energy, and capacity.</td>
</tr>
<tr>
<td>Peru</td>
<td>Identical to Chile.</td>
<td>Transmission is divided into principal and secondary systems; all GENCOs can access principal lines in exchange for connection and volumetric tolls. Secondary lines are accessible only by certain generators. Pricing is similar to that in Chile.</td>
</tr>
<tr>
<td>UK (England &amp; Wales)</td>
<td>Owned by the NGC which provides all generators with open access. NGC is responsible for expansion of transmission capacity.</td>
<td>Charges for the use of the transmission system are split into two elements: connection, and use of the system. Connection charges are levied on any user directly connected to the transmission system. Use of system charges are paid by suppliers or generators who connect with and use the grid. Charges vary across 14 zones.</td>
</tr>
</tbody>
</table>
As set out in the framework shown in Figure 2, the quality side of the transmission service would include the procurement of Out-of-Merit (OOM) generation services for constraint control and ancillary services from generators (and other suppliers of these services). The provider of transmission service may also acquire the right to interrupt loads and In-Merit (IM) generation through interruptible service contracts. The other key aspect of the quality side of the transmission service is the security or insurance value of the network, which is assured by appropriate network investment and maintenance. The point here is that all participants of the energy market acquire through their transmission grid connection a valuable option to generate or consume electricity. This option is made valuable by the additional investments (e.g., reserve lines) and operational decisions (e.g., scheduling generation reserve) undertaken by the transmission provider. Hence, the transmission grid is both a medium for transportation/trading, as well as a security network. The key MEET question arising from this is the following:

Question: What regulatory or ownership incentives will assure (at least roughly) efficiency for both the quantity and quality sides of transmission service?

In particular, what property and decision rights should be internalized within the ownership boundaries of the transmission provider to assure efficiency?

Given the importance of centralized operations in accomplishing real-time functions, a key question is how many ISOs are needed and what their boundaries should be. Clearly, however the boundaries are drawn, a communication infrastructure and close interaction between ISOs will be required to maintain system reliability and efficient operation. Focusing on a specific ISO, the needs for real-time control strongly suggest that the ISO must be located within the organizational boundaries of a single economic entity. This leads to one obvious classification of possible ownership structures for transmission: (a) either the same entity which houses the ISO owns and operates other transmission assets; or (b) this entity consists only of the ISO and does not own these assets but leases/contracts for these from other transmission asset providers (TAPs); (c) or the TAPs lease their assets directly to the users (generators and loads) and the ISO sets the rules of trade and usage and has responsibility for real-time operational requirements. Using comparative institutional economics, it is not possible to rule out either of these approaches as prima facie inefficient. Approach (a), which sets up a single company, which I call the “TransCo”, would give rise to the problem of providing regulatory incentives through performance-based regulation to assure that the TransCo, a regulated monopolist, undertook its responsibilities in a manner which promoted system-wide efficiency. Approach (b), the ISO+TAPs, could yield clearer information on the value of transmission assets and services (the former provided by TAPs and the latter by the ISO), but would lead to transactions costs between the ISO and the TAPs in contracting for and maintaining transmission assets. A hybrid approach might create a single organizational entity, the TransCo, but require it to have separate divisions, TransCo-Wires and TransCo-ISO, to create transparency in cashflows and value-added resulting from the asset management and system operation functions of the TransCo. Under approach (c), the ISO keeps track of transmission credits and debits and specifies trading rules, but it is the TAPs and market participants who trade these rights in a decentralized fashion, e.g.,

as in Chao and Peck (1997). Since even in this decentralized approach, it will be necessary for the ISO to control real time operations, and therefore to contract for ancillary generation and load balancing assets, we will treat approach (a) as a special case of (b). It should be noted, however, that (c) has additional problems of assuring that the ISO is properly motivated to monitor transmission credits and debits and to establish and operate an efficient and responsive trading center. In any of these cases, note further that the resulting ISO could be for-profit or not-for-profit. Let us consider these options in more detail.

In the single, unified TransCo option, a regulated monopolist would be given responsibility for universal transmission service. To assure clarity in its motives and some incentives for X-efficiency, this TransCo would probably be best structured as a for-profit, regulated monopoly (as in the case of the National Grid Company in the UK). As noted above, it could be required to keep separate books on its ISO and its TSP operations. The TransCo would then face various forms of profit and price regulation. Such regulation should be performance-based to assure an outward-looking (or customer-focused) TransCo as opposed to an inward-looking, asset-directed company. Revenues for the TransCo would come from two types of services:

a. Monopoly or reserved services, such as those associated with managing system operations.

b. Contestable services, such as connecting new loads or generators to the system, which could be provided by a number of third parties.

Ideally, the price and/or revenue for contestable services would not be regulated, but would be determined by an open market in these services. For services of type (a), prices and revenues would be derived from the three traditional elements of transmission pricing (see Feris and Kleinendorf (1997) for details):

- Access charges levied against wholesale customers on either a lump-sum or an energy-supplied basis;
- Energy injection and capacity (or demand) charges levied against generators on the basis of either injections into the transmission system or the total capacity of the generator connected to the grid;
- Energy charges to reflect marginal transmission costs (congestion plus losses).

The total of these transmission charges would cover (for reserved services) asset costs, system operation costs, congestion costs and losses.

Under the ISO+TAPs option, asset providers and TSPs would be separated. Here the ISO must deal with the added complication of negotiating with independent asset owners (the TAPs) for continuing use, enhancement and maintenance of their assets. If, as envisioned in several recent Regional Transmission Group proposals, the ISO itself were set up owned or otherwise not independent of these TAPs, then additional problems of assuring uniform and fair treatment for all owners (including the TAPs) through a committee decision-making process involving all the TAPs presents additional opportunities for transactions costs and organizational inertia. Presumably, the same guidelines on reserved and contestable services would hold for the ISO+TAP approach as for the TransCo.
ownership structure, contracting and regulation

assets and the incremental value of various options for expanding transmission capacity. This is complicated both by the complexity of marginal cost measurement in transmission and the fact that the large proportion of these costs are not variable in the short run, so that break even operations and marginal-cost pricing are in tension. Assessing insurance and quality benefits of assets (e.g., contingency lines) provides further problems in valuation.

The issue of multiple TAPs and a correct valuing of their assets for quantity and quality of service remain an open issue. It points to the key difficulty with the ISO+TAPs model, the level of contractual transactions costs with TAPs and the related issue of control of asset quality by the ISO. From the TAP's point of view, there are problems of assuring that their assets are valued correctly in contracts with the ISO and that the assets are properly maintained. To the extent that the TAPs jointly own the ISO, there would also be problems of assuring even-handedness in the provision of transmission service to non-TAP users. In all of this, it is also very important to remember that transmission costs are typically only 10-15% of the total costs of delivered retail power. Moreover, as noted in Fernando and Kleindorfer (1997), it is the total price and quality of delivered power (and not the transmission price) to which wholesale and retail customers react. Thus, it is important that transmission pricing and service delivery be kept sufficiently simple to assure transparency and open access for the rebandling process that will provide the ultimate bundled good to consumers—delivered power. The fundamental value of transmission is to connect cheap energy sources to loads and to restrain market power by providing the potential to do so. These considerations give rise to the following MEET questions:

Question: What are the appropriate tradeoffs between transparency, simplicity and efficiency in transmission pricing and regulation? How should Transmission Asset Providers (TAPs) and the ISO be remunerated and who should determine which transmission assets are to be constructed and under what conditions these will be bought on line by the ISO?

Question: What review procedures should be implemented to assure appropriate quality and insurance standards are met by the transmission network, while avoiding overbuilding transmission? How should total system transmission costs (congestion costs, losses and operating and maintenance costs) be measured and monitored and by whom? What incentives will various ownership and regulatory structures provide for the ISO and TAPs to minimize total system transmission costs through their investment, operating and contracting options?

Conclusions

The above sketch of the unbundled electric power industry suggests several critical issues which will need to be resolved in the area of ownership and property rights.
related to the ISO and other transmission service providers and TAPs. The key issue arising from the above discussion revolves around the following summary MEET question:

Question: Will the ISO be only a non-profit market “facilitator” which controls the Network (the real-time functions noted above) and the voluntary pool(s), while contracting for (or buying in spot markets) all assets and support services with other market participants? Or will the ISO be a profit-oriented, regulated commercial entity with some assets (e.g., wires, control systems and possibly generation plants) of its own? Or will some other, e.g., distributed, form of ownership and control develop for the ISO?

Key regulatory issues of transmission pricing, investment, and contracting for services will depend very much on how this question and the other questions in this note are answered.

Notes

1 This note is a follow-up to a meeting of the EPRI-sponsored Workshop “Markets for Electricity: Economics and Technology (MEET)”, Stanford University, March 7-8, 1997. The author acknowledges helpful discussions with Don Anderson, Chitru Fernando, Shmuel Oren, Nagendra Subbakrishna and MEET Workshop participants, none of whom are to be held responsible for the views presented here. Additional details on many of the ideas presented here are available in Fernando and Kleindorfer (1997). For a detailed discussion of issues of governance and contracting in the electric power restructuring area, see also Joskow (1997).

2 For further details on potential alternatives for structuring the ownership, contracting and investment rights of the ISO, see Fernando and Kleindorfer (1997).

3 This statement is based on a survey undertaken for the author by Linda K. Johnson, “Survey of States: Status of Electric Utility Restructuring”, March, 1997. The details of this survey suggest both different perspectives across the States, but also very different stages of readiness to implement unbundling, restructuring and various ISO proposals.

4 As of January 1992, the Argentine Electricity Act divided the electricity industry into three sectors: generation, transmission, and distribution. Though there are multiple owners of transmission, such owners are required by law to provide open access at regulated prices. In addition to its market making responsibility, CAMMESA performs optimal dispatch taking into account the security of the system and the quality of the supply of electricity, and acts as a long term planning agency to plan for the needs of power and energy.

5 Both the New South Wales and Victorian markets in Australia are similar in design. While generation is competitive in both markets, ownership of transmission, dispatch, and market management are in the state domain. Economic dispatch in New South Wales is performed by TransGrid and in Victoria by the Victoria Power Exchange (VXP) using generators bids as the criterion. The markets in both states are designed to allow for both spot and contract trading. The situation in Queensland, which is large and sparsely populated, is quite different as reported in Anderson et al. (1997).

6 By law, generators in Chile can sell their output pursuant to spot or long term contracts; they are also free to determine whether and with whom to contract, the duration of contracts, and the amount of electricity to be sold. The transmission sector consists of companies that transmit electricity at high voltage from generators to distribution companies. The Chilean Electricity Law states that to the extent that a company's transmission assets were constructed pursuant to concessions granted by the Chilean government, open access should be provided to the use of such assets. Economic dispatch of generating resources in each of the two major interconnected transmission regions is coordinated by autonomous generating industry groups. Currently, the Chilean system consists of 5 major private generation owners with about 3,300 MW of generating capacity (predominantly hydro), three transmission regions, and 16 distributors. (Bacon and Thobani, 1996)

7 The Electricity Market Company Ltd. (EMCO), New Zealand's version of a power exchange, reported that as of October 1, 1996, there were 20 registered generators, purchasers, and traders.

8 The current number of players in the Norwegian market include about 94 wholesale and generating utilities owning and operating about 600 power stations with installed capacities of 1 MW or more and about 205 utilities distributing the power from the generators to consumers. The main Norwegian grid is owned and operated by a state enterprise (STATNETT) which also operates the power transmission lines and/or undersea cables connecting Norway with Russia, Finland, Sweden, and Denmark. A subsidiary of STATNETT, NordPool, provides a forum for the sale (by producers) and purchase (by distribution utilities) of electricity in the form of an (hourly) spot market, a weekly market and a regulating market; the regulating market covers adjustments to the sale and purchase of electricity over the grid. EnFO notes that since 1994, contracts for the sale and/or purchase of electricity have been traded in privately owned market places as well. (EaFO, 1997)

9 Newbery (1995) reports restructuring of the electric power industry in England and Wales began with the Electricity Act of 1989 which divided the Central Electricity Generating Board (CEGB) into four units: Powergen, National Power, Nuclear Electric, and the National Grid Company (NGC). These four were vested as public limited companies on March 31, 1990 at the same time as the 12 distribution companies (or Regional Electricity Companies [REC's]). In December of 1990, the NGC was transferred to the joint ownership of the REC's and the REC's were sold to the public. About 60% of National Power and Powergen were sold to the public in March 1991 with the balance sold in 1995. Nuclear Electric continues to remain in the public domain.

10 See Kleindorfer, Fernando and Wu (1997) for a discussion of such contract contracts in the England and Wales context.

11 For an introduction to institutional assessment procedures in the context of network industries, see Crew and Kleindorfer (1986), opus cit., Chapter 7. See also Williamson (1996).
Interestingly, PJM and NEEPOOL are both currently beset with problems related to mechanisms for approving and allocating transmission capacity for execution of bilateral contracts. In the case of PJM, the current system is essentially first-come, first-served with considerable uncertainty and no underlying economic logic. In the case of NEEPOOL (and also of PJM) who has initial property rights to the transmission capacity is currently under dispute at the FERC. In some areas of the country, these issues of transmission capacity allocation and valuation have yet to be structured. Clearly, this is an area very much in need of study if the MTE objectives (of a functioning market) are to be met.

Further complexities on the incentives for efficient investment in transmission are provided in Bushnell and Stoft (1996), Chao-Peck (1997) and Oren (1997). The recent work by Chao-Keck (1997) and Oren (1997) and the earlier work of Hogan (1992) examine a number of possible approaches to value-based allocation, but there are clearly still more questions than answers in this area.

Note also that only a fraction of this 10-15% is variable in the short run so that if single-pair tariffs are used, fixed component markups will typically swamp the SRMC portions of transmission tariffs, whether those markups are added to the transmission tariff itself or are collected as “energy taxes” from generators or distributors. Of course, two-part tariffs can still allow efficient signals to be passed on to customers, but then other complexities enter into the discussion relating to how the fixed charge portion of the two-part tariff is to be collected. See Table 1 for an indication of the gap profusion which international experience has produced on this point to date.

As is apparent from Table 1 at the end of this paper, this has given rise in many jurisdictions to rules such as zonal, marginal-cost based pricing which attempt to provide a balance between the complexity of “true” (i.e., nodal, real-time varying) marginal-cost based transmission pricing and the dictates of full-cost recovery and approximate signals to transmission system users of the congestion and loss costs they cause. See Anderson et al. (1997) for a discussion.

References


