



Improved Investment and Market Performance Resulting from Proper Integrated System Planning

Final Project Report

Power Systems Engineering Research Center

*Empowering Minds to Engineer
the Future Electric Energy System*



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Power Systems Engineering Research Center

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Executive Summary

Planning has always been an important component of the electric supply industry because of the size, lumpiness and long lead-times from inception to completion of its infrastructure investments, because the commodity cannot be stored and because it is delivered over a network. Because electricity is also so widely used and modern societies have become so utterly dependent, without second thought, on its uninterrupted supply, managing the required stream of investments to replace deteriorating or antiquated equipment and to meet evolving demand in different places is a severe planning challenge. That is only compounded by the whims of nature, the occasional malefaction of some individuals, evolving social concerns about the environment and sustainability, and the widespread introduction of market allocations.

A plan is described as “a method for accomplishing something” in Webster’s dictionary, and in that context efficient markets should be a big help since they decentralize a great deal of optimization and decision-making that can be useful and believable input to subsequent planning. But markets always work best where the rules are laid out ahead of time, and where any changes in those rules and in the business or physical environment surrounding them are predictable. If there were no congestion now or in the foreseeable future on the electric grid in the United States, establishing efficient markets for electricity would be easy, and potential investors in new generation would simply search for least-cost technologies and locations where they thought they could gain siting approval. Of course constructing and maintaining a nationwide transmission system of this scope and magnitude would be costly, and that is why spatial pricing zones have been established so that those market-based local marginal prices can guide the location of future economic investment in generation and also help to identify potential transmission upgrades that might improve reliability and/or reduce overall system cost.

It is precisely because those transmission investments are likely to upset spatial price patterns, affecting both existing and planned new generation (and also merchant transmission initiatives), that it is essential that system planning be thorough, comprehensive and occur at predictable times. Those planning deliberations and outcomes also need to be completely transparent to all parties. This is why markets and planning are so intertwined, and the object of this investigation is to help them complement each other thereby facilitating investment.

In terms of timing, it is well understood that electric system planning needs to project far enough in the future to reach well beyond the required start date for planning and developing individual generation and transmission projects. Many demand-side investments also look far into the future because of lags in their implementation. But those projections are made based upon forecasts of demand and prices. Why not let market activity inform those forecasts by bringing many more players into the action through forward markets that are financial?

Project Accomplishments

This report accomplishes several objectives.

- It lays out a desired sequence of having some forward markets placed earlier than the earliest commitment lead-time required for physical investment, of having regular subsequent

markets to provide liquidity and to respond to updated expectations (and planning), and of laying out and making transparent the planning process and making explicit the criteria for expanding transmission capacity, where and when.

- It also reviews some of the existing forward procurement markets, showing how particular details of auction structure may lead to anomalous results. A case is made to allow purely financial participation in forward markets, both to increase liquidity and reduce the potential for exercises of market power, up until the latest time when only physical participation will provide adequate assurance that ample steel will be in the ground to keep the lights on. And especially in highly congested regions where significant investment in new generation and/or transmission is likely to alter those patterns of congestion and locational price differences, any subsequent attempt to alter pricing zones must have the process and criteria for change laid out well ahead of time.
- Finally, it is recognized that potential changes in public policy and regulation may be the most unpredictable factor, upsetting both markets and planning. That is why it is important to have a scheduled process in place to consider those potential changes (e.g. whether about the environment, conservation incentives, the use of renewables or about siting criteria and decision-making) as well so they can be factored routinely into planning and market decisions.

Conclusions and Next Steps in Research

Markets always work best where the rules are laid out ahead of time, and any changes in those rules and in the business or physical environment are predictable. It is precisely because transmission investments are likely to upset spatial price patterns affecting both existing and planned new generation (and also merchant transmission initiatives) that it is essential that electric system planning be thorough, comprehensive, occur at predictable times and lead to deliberations and outcomes that are completely transparent to all parties.

Thus far, in economic jargon, electricity markets are still “incomplete”, primarily in terms of not having regularly conducted forward markets that are financial (voluntary and open to anyone). The implementation of such markets, if integrated properly with the system planning process and the decision times necessary to make physical choices and investments regarding the reliable operation of the system (e.g. investment lead-times, minimum start-up times, ramp rates), should be complementary. The shortcomings of existing forward markets and of specific details of their design are laid out here, as are suggested improvements. But prior analyses that should be performed include: 1) experimental tests of different sequencing of announced transmission investment upgrades with forward and spot markets, 2) determine whether aggregation of pricing zones in forward markets can enhance their liquidity and reduce the exercise of market power, and in the long-run, 3) a routinization of the siting process. Longer shots include making advanced meters and real-time pricing available for all retail customers and the implementation of two part pricing schemes, at least for physical buyers and sellers. These steps would make it feasible for customers, or aggregates of customers, to participate fully in markets for energy and ancillary services.