
"LEVERAGING":

THE KEY TO THE EXERCISE OF

MARKET POWER IN A POOLCO

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Introduction

In many states throughout the country, the concept of a *poolco*¹ is being proposed as one of the best means of providing electricity consumers, producers, and utility shareholders with the potential benefits that a competitive generation market is believed to be able to yield². While the poolco model is in the early stages of development in the U.S., and details regarding its operational and pricing practices are still being formed, we are concerned about a potentially serious problem related to the inherent market structure of a "pure" poolco, namely a poolco in which there would be no bilateral contracts between an electricity supplier and a consumer³. Our most pressing concern with regard to the viability of a poolco is the potential for electricity suppliers to exercise market power through what we refer to as the "leveraging" effect⁴ - suppliers would manipulate market clearing prices in order to capture large profits on *all* of their dispatched plants. As we discuss at length in this article, in regions where a pure poolco is implemented, this theoretical concern could very well prove to be a real problem because sellers may minimize the number of bilateral contracts they sign if they can make higher profits by simply bidding into the poolco. We conclude, then, that poolcos appear to have a major inherent flaw that could prove insurmountable.⁵

Before we begin explaining our primary concern about the poolco structure, it is important that we first clarify a few points that have been raised by our peers⁶. First, we use the term "leveraging" to

¹ In the United States, the primary author of literature on poolcos and the myriad of issues related to electricity markets is William W. Hogan, Thornton Bradshaw Professor of Public Policy and Management at Harvard University's John F. Kennedy School of Government. Hogan is a leading architect of structural change in the electricity industry.

² States in the PJM power pool are considering proposals to establish a regional "poolco" to facilitate the development of a competitive electric generation services market. California has recently approved a Power Exchange that is a poolco.

³ We will comment later as to how the presence of bilateral contracts would likely affect the pricing behavior of suppliers operating either in or outside of a poolco. Even though all poolcos may have bilateral contracts to some degree, it is worth analyzing the market behavior of a "pure" poolco first.

⁴ The use of term "leveraging" in this article will be explained below. It is important to note that our use of the term is similar, though not identical, to the use of term in the context of anti-trust issues. There, the leverage theory refers to "the basic idea ... that power in one market [could be] used to attain or preserve power in a second market" (NRRI, Antitrust Concerns In The Modern Public Utility Environment, April 1996).

⁵ It is our understanding that market power and inefficient prices have, in fact, caused significant problems in the U.K. where a pool-based electricity exchange has been set up. Please refer to:
Newbery, David M. "Power Markets and Market Power," *The Energy Journal*, Vol.16, No.3, 1995.
Newbery, David, and Green, Richard. "Competition in the British Electricity Spot Market," *Journal of Political Economy*, Vol.100, No.51, 1992.

⁶ This article has benefitted from reviews of an earlier draft by William Hogan, David Moskovitz, Bruce Biewald, and Tim Woolf.

refer to a very specific way in which generation suppliers would be able to exercise market power in a poolco. In this article, leveraging is *not synonymous* with the term "market power" - rather, it is only one *means of exercising* market power.

Secondly, the ability for suppliers to leverage stems directly from the rigid pricing structure used in a poolco, but not so strongly present in other market structures. We agree with William Hogan's statement that "the poolco model does not create or solve the market power problem." Certainly, market power could be exercised by generation owners in many deregulated market structures. However, we firmly disagree with Dr. Hogan's statement that the poolco model "helps mitigate some of the worst aspects of market power." On the contrary, the way in which generation would be priced in a poolco provides the ideal conditions under which generation suppliers can practice leveraging, which seems to exacerbate market power.

Third, in order to understand the potential for generation owners to exercise market power in a poolco by leveraging, we first discuss the issue in the context of the most rigid type of structure, namely a "pure poolco", where there would be no bilateral contracts between electricity suppliers and consumers and where *all* generation sales and purchases would be made through the poolco at the market clearing price. Later, we relax this extreme assumption and consider the case where a poolco would only be used for spot market transactions because all other transactions would likely occur under contract.

Finally, our concerns about the poolco model should not be interpreted to mean that we necessarily believe a "non-poolco" market structure would be preferable, or that we are necessarily against using competitive market forces to provide electric generation. However, a full description of the market power problems that could arise in other electric market structures and the relative advantages that poolcos may have are beyond the scope of this article.

Herein, we describe how a poolco would differ from a traditional "tight" power pool. We then compare a "pure poolco" to a typical competitive market structure for a generic product in order to understand how and why market power, in general, could be exercised in a poolco. Following this comparison, we address the potential for generation companies to exercise market power in a pure poolco specifically through leveraging. We also provide quantitative analyses that indicate the magnitude of the potential impacts of leveraging.

A Poolco Compared to A Traditional "Tight" Power Pool

A poolco would be fundamentally different from a more traditional "tight" power pool in terms of the *pricing and dispatching methodology* utilized for generation. The poolco would perform "*total price*"-based, merit-order dispatch, as opposed to the *variable cost-based*, merit-order dispatch used in a tight power pool. In other words, the order in which generating units would be dispatched would be based on whatever prices suppliers bid into the poolco⁷. Each supplier would submit bids to the poolco in specific time increments (e.g., hourly or half-hourly⁸) for generation that the supplier could make available during each period. The bids would be based on the *total price* that the supplier would be willing to accept in that hour. Generation would be dispatched by the poolco from lowest to highest bid. The highest priced amount of generation bid into the pool for a given hour that would be required to meet total demand in that hour would determine the *single* market clearing price. This price would be paid to *all* suppliers whose lower priced bids for generation were accepted in the pool for that hour. In other words, the market clearing price would be paid to each and every owner of dispatched generation, regardless of the type of generation (i.e., baseload, cycling, peaking) and regardless of the price at which the generation was actually bid.

A Pure Poolco Compared to A Typical Competitive Market Structure for a Generic Product

In many markets, buyers sign bilateral contracts with sellers at various times for different amounts of a given product to be delivered at various times in the future. In a perfectly competitive market, if the product is completely uniform (i.e., each unit of the product is identical to every other unit), the price of the product at any given time should only vary due to the set of specified contract terms. For example, the unit price might vary due to the number of units bought, the amount of lead-time until the first delivery date, the schedule of deliveries, etc. However, the price under identical contract terms entered into by different sellers and buyers should be almost identical in a workably competitive market.

In such a competitive market, each buyer signs a set of contracts to purchase a given product under a range of delivery dates. Presumably, to minimize risk, some contracts are short term (e.g., deliveries range over only a few months or years), and some are long term (e.g., deliveries range over many years). Thus, in any given month, a buyer takes delivery of the product based on his set

⁷ Under some poolco models, *all* regional suppliers of generation, including generation under bilateral contracts, would be required to bid into the poolco and be dispatched through the poolco. In this situation, each customer would pay the poolco the market clearing price for generation and each generator that was dispatched would receive the market clearing price from the poolco. Buyers and sellers who had entered into bilateral contracts for generation would use "contracts for differences" to adjust for any difference between the market clearing price and the contract price. Thus, the net effect would be that the buyer would only pay the contract price and the seller would only receive the contract price. This process is referred to as "virtual direct access". Under other poolco models, regional generation suppliers would not be required to bid into the poolco and be dispatched through the poolco. This is referred to as "real direct access", namely where generators would bypass the bidding process of the poolco and wheel power directly to retail customers.

⁸ For the purposes of this paper, we use the term "hour" to refer to the time increment.

of different contracts, each of which could have different unit prices for the product. The lower the average price for deliveries in any given month, the better-off the buyer is. The important point here is that since different buyers purchase a product through different mixes of contracts, each buyer likely sees a different average price relative to what other buyers see in any given month. At the time of delivery, then, there is not a single market clearing price, or a single marginal cost, even in a fully competitive market. The single market clearing price or marginal cost exists only at the time contracts with the same specifications are signed.

In contrast to the more typical competitive market described above, a pure poolco would provide a market structure which, in essence, would collapse the contract-signing time and the delivery time into the same point in time. The contract terms would be the prices and quantities bid by suppliers into the poolco. Bids would be made in hourly increments, and until the total electricity demand for that hour were known (i.e., until deliveries of electricity had been made), the price for electricity in that hour would not be known. Furthermore, as we stated earlier, the market clearing price for electricity demand in any given hour would be based on the highest priced bid that was accepted in that hour in order to meet demand. All accepted bidders would be paid the same market clearing price. This is quite different, then, from many other markets where wholesale customers typically pay different prices for the same product delivered at the same time.

Another key difference worth highlighting is the fact that in a pure poolco a buyer could not take time to hunt around for the best deals when he/she was interested in lining up electricity purchases for a given hour, nor could a buyer negotiate the lowest price by playing one seller off against another. The "contract price" would simply be defined by the highest priced amount of generation bid into the poolco that was required to meet total demand in each hour.

Electricity is somewhat of a unique commodity in that electricity buyers' ability to influence their own aggregate demand from hour to hour is very limited -- there is little load control or load management technology built into the supply/demand system for electricity. Therefore, in a pure poolco, if the prices in certain hours were typically higher than most buyers would be willing to pay, these buyers could not suddenly decide to buy less, or no, electricity for delivery in those hours. Yet, in markets for other types of goods, if the prices offered are higher than buyers want to pay, then they can often wait to buy the product for significant periods of time, or at least until they have a chance to try to negotiate with several suppliers to see if they can bring the selling price down.

One way in which prices can often be moderated in typical markets is for the buyer to commit to buying under a long-term contract. Often the price for a product under a long-term contract with a particular delivery date is less than the price under a short-term contract for the same delivery date, though occasionally the reverse can be true. In addition, in a typical market, committing to buy more of a product can sometimes reduce the per unit cost. This will depend on whether the aggregate level of demand is at a point where the marginal cost of producing more of a product is lower or higher than the last unit produced. These types of factors can be weighed by buyers prior to making their purchasing decisions in typical competitive markets. Again, a pure poolco is different. By definition, the marginal cost of supply in a pure poolco always increases with increasing demand, so the buyer can *never* lower his per unit cost by buying more electricity.

Furthermore, in many typical competitive markets, buyers can moderate their demand for a product if the price gets too high by switching to a substitute product. Electricity, in contrast, has no substitute for most of its end uses, and switching to another energy form, where possible, often requires significant lead-time and / or making a major capital investment. Thus, if fuel switching does occur, it occurs slowly and fairly infrequently for any given customer. A final point is that most other products can be stored in larger proportions of total demand than electricity can be. The ability to store a product means that supply and demand are more likely to stay in equilibrium, and therefore prices are not as apt to be subject to extreme volatility.

In short, a pure poolco would be a much more highly constrained, rigid, and deterministic market structure than a typical competitive market. There would be very little flexibility for buyers. At least in the short-run, electricity consumers would be completely at the mercy of the suppliers' bids submitted to the pure poolco.

The Potential for Leveraging in a Pure Poolco

The simple pricing structure of a pure poolco relative to other market structures and the fact that all transactions would be short term would likely make it much easier for generation owners to game their bids in order to exercise market power through what we call "leveraging". (This concept is explained below.) Furthermore, both in the near-term and in the long-term, a poolco might be limited to a relatively small number of owners (e.g., less than ten) each owning a mix of baseload, cycling, and peaking capacity, and together owning the vast majority of generation capacity in any given regional poolco. (This is how most states and regions are currently characterized.)

Even more importantly, the number of owners of existing generating units that could realistically be expected to represent the marginal unit of supply in periods of moderate or high demand might be smaller still, since many units would already be running and thus could not contend to be the marginal unit. New potential suppliers would only enter the market if the average market price that they would likely receive after bidding their new capacity into a poolco were above the fixed and variable costs of providing this new capacity -- it would not be profitable for them to do so otherwise. Therefore, once a certain set of power plants exists, there may not be any new market entrants in the short term that might drive down the market clearing price in any given hour. It might take years for the poolco prices to rise high enough for owners of new generation, particularly owners of new baseload generation, to enter the market. However, in a typical market with bilateral contracts, new market entrants can participate at any time as long as they are able to sign financially sensible long-term contracts for their output that would allow them to recover their costs and make a fair return on their investment.

In theory, in a perfectly competitive poolco (where generating capacity comes in very small increments), a seller would always bid just a little above its variable costs, since the next highest cost seller along the supply curve would have variable costs only slightly higher than the first. If the first seller bid much *above* its variable cost of production, its bid might not be accepted by the poolco if the output of the next seller's plant was sufficient to complete the need to meet total

demand. Also, the difference between the variable cost of each generating unit dispatched and the market clearing price would be used to cover suppliers' fixed costs (including a fair profit). In fact, the sum of these differences over time would determine the value of each plant. Of course, the supplier of the *marginal* generation in a given hour would, by definition, have set the market clearing price based on its bid, and, thus, in that hour there would be little difference between the market clearing price and the variable cost of that supplier's marginal plant, and little fixed cost recovery for that plant in that hour.

In practice, however, there are many other reasons why sellers would want, and would be able, to bid more than "just a little" above their variable costs in actual pure poolco operations. First of all, power plants in a utility system do not have continuously varying variable costs. There are gaps in cost between the plants along the supply curve. This means that to the extent to which sellers could learn the shape of the supply curve by tracking poolco operations, a seller could bid its plant at a price just below the next highest cost unit. Sellers could learn the shape of the supply curve during the pure poolco's early stages of operation by varying their bids in an attempt to search out the curve's shape.

Secondly, near times of peak demand, sellers would necessarily have to bid above variable cost in order to recover their fixed costs. In a poolco, owners of peaking units (especially owners of *new* peaking units) would need to recover a large portion of the fixed costs of these units during peak periods because, by definition, this type of unit does not run nearly as often as other types of generating units do in a typical year. Given that peaking units are dispatched so few hours in a year, the price differential between the true variable cost of each peaking unit and the market clearing price would need to be large enough such that the last few peaking units dispatched in any given peak hour could collect sufficient revenues during the year to cover *all* of their annualized fixed costs. This price differential could easily be as high as ten cents per kWh⁹, even on a real levelized basis.

In fact, on average, generation prices bid into a poolco would be highly *unlikely* to equal bidders' variable costs at *most* levels of demand (most hours of the year), not just during hours defining peak demand. One reason is that if a supplier believed that its unit was likely to be "on the margin" (namely, the unit to supply the last amount of generation dispatched to meet total demand) in a given hour, there would almost never be an incentive for that supplier to bid just the variable cost of the prospective marginal generation because doing so would produce absolutely no contribution to fixed costs, and certainly no profit, if that supplier's generation unit were in fact the marginal generation. Thus, if suppliers believed they were likely to set the market clearing price, they would naturally try to get away with bidding a little higher than their variable cost, while still succeeding at being dispatched. An owner would do this at each and every demand level (i.e., in each and every hour) for his prospective marginal plants, *regardless* of how many or how few of his *other* plants had already been dispatched at that same demand level. Through trial and error, suppliers would determine how high a bid they could get away with in any given hour, versus the chance of not

⁹ For example, $\$0.10 / \text{kWh} = (0.1 \text{ real levelized fixed charge factor} * \$300 / \text{kW new peaking capacity}) / (300 \text{ hours per year})$.

being dispatched, in order to maximize their fixed cost recovery for each individual marginal plant. While this tendency would serve to raise average market clearing prices in a pure poolco, the price increase would not likely be a big effect due to these considerations alone. The bigger effect of this bidding practice by owners of marginal units would be that **all owners of generation units that were dispatched in a given hour would receive extra profits¹⁰ because of the bidding behavior of owners of generation units near the margin.** "Leveraging" refers to this ability to earn extra profits on plants already dispatched by exercising market power on the margin of the poolco dispatch.

Thus, the third reason why sellers would want, and be able, to bid above their variable costs is due to a strong "leveraging" effect that exists in poolcos. **A critical aspect of poolcos is that the owner of a marginal unit that was bid above variable cost and set the market clearing price would earn additional profits both on his marginal unit and on any of his units that he bid at a lower price, and therefore that would be dispatched prior to the marginal unit.** In fact, if an owner had many units that he had bid at lower prices, he would have an even greater incentive to raise his bid for the prospective marginal unit quite high because the risk of that unit not being dispatched, and the risk of not recovering some of the fixed costs associated with that prospective *marginal* unit, would be lower than the pay-off in extra profits paid to all of his *non-marginal* units if the prospective marginal unit were dispatched at the higher bid and set the market clearing price. Hence, **this effect would be especially likely for generation owners who own a wide range of different types of generating units (i.e., baseload, cycling, and peaking).** If a generation owner owned units which were well distributed across the supply cost curve, then the owner could try to exercise this high-price bidding strategy at almost any demand level and impact the market clearing price in most hours during the year. Because baseload, cycling, and peaking units basically represent generation in different markets, leveraging allows for the exercise of market power in one market (e.g., peaking) to influence the price of power in another market (e.g., baseload) in a very deterministic way.

Thus, there is a huge potential "*leveraging*" effect on fixed cost recovery that would inform each generation owner's bidding strategy. Again, the "leveraging" derives from the fact that the more generating units an owner has had dispatched ahead of the unit competing to be the marginal unit in a given hour, the greater the potential payoff would be to that owner to bid that unit at a price significantly higher than its variable cost. This is true even if the marginal unit were dispatched less often than it would have been if it had been bid at close to variable cost, as long as the extra cash flow from the dispatched non-marginal units more than compensates for the lost cash flow from the reduced amount of dispatch of the marginal unit.

A generation owner could also exercise market power through leveraging by withholding some of his generation from the poolco's bidding process. If an owner withheld some of his generating capacity, then the poolco operator would need to accept higher and higher bid prices for generation

¹⁰ By "extra" profits, we mean the incremental income that all owners would enjoy on all of their dispatched units when the market clearing price is well above the variable cost of the marginal unit, as opposed to only slightly above the variable cost of the marginal unit.

(i.e., it would need to go up higher on the supply bid curve) in order to meet demand. If the resulting increase in the market clearing price, relative to what it would have been if the owner had *not* withheld some of his generation, were large enough, then the extra profits that the owner would earn on his capacity that he bid and that was dispatched would more than offset the profits that the owner would lose by withholding some of his capacity. For example, let's first assume that an owner bids all of his capacity (1,000 MW) at its true variable cost of 4 cents/kWh, and that the market clearing price he is paid is 6 cents/kWh. His profit would be \$20,000 in one hour (6 cents/kWh less 4 cents/kWh, times 1,000 MW). Now let's assume that the owner only bids 900 MW of his capacity. In order to still earn a profit of \$20,000, the market clearing price must be at least 6.2 cents/kWh (6.2 cents/kWh less 4 cents/kWh, times 900 MW = \$20,000). Therefore, in this case, if the owner can predict that the market clearing will likely increase by more than 0.2 cents/kWh when he withholds 100 MW of his capacity, then he will do this in order to earn higher profits. Thus, this approach to manipulating the market clearing price, namely by withholding some generating capacity from the poolco's bidding process, is another way in which owners could exercise leveraging in a pure poolco.

Finally, in a poolco, market power may also be exercised through *systematic tacit collusion*, “defined as a situation where competitors are able to predict each other’s pricing and production behavior based on past activity and the underlying fundamentals involved in the industry.”¹¹ As we have already mentioned, within a geographic region, the actual number of owners of a significant number of power plants is currently relatively small, and the number of owners of generating units that could realistically be expected to represent the marginal unit of supply in periods of moderate or high demand is smaller still. Furthermore, leveraging benefits all owners of generation simultaneously. Given those conditions and the hourly bidding activity required in the poolco model, it would be possible for “competing” suppliers to observe each other’s operating and bidding practices quite closely and with relatively high levels of predictability at each demand level of the year. Without any overt supplier interaction, the result would be strategic bidding, or the artificial raising of prices across all generation bids, by suppliers who see it in their mutual self-interest to raise their bid prices. This is more likely to occur in a poolco than in more typical markets because of the stronger leveraging effect that exists in poolcos.

In summary, the exercise of market power in a pure poolco would not be qualitatively different from its exercise in a typical market with bilateral contracts, but because a pure poolco would be completely deterministic in its outcome once the bids were submitted, it would be a much less flexible market structure, and thus much easier for suppliers to game. Without bilateral contracts, the inability of buyers to contract ahead of time for power at a given price also would mean that new market entrants to a pure poolco would have to invest in a power plant based solely on their “guesstimates” of what the market clearing prices would be in the future, once they could get a new plant on-line. Of course, by then, the existing plant owners could alter their bidding strategies, effectively moderating their exercise of market power, in order to keep new entrants out of the market for as long as possible. Thus, a new market entrant would probably not risk entering a

¹¹ *The Future of Wisconsin’s Electric Power Industry - Environmental Impacts Statement, Volume I*. Docket 05-EI-114. Wisconsin Public Service Commission Staff, Electric Division, October 1995: page 239.

poolco market until the economics appeared favorable based on the most conservative and cautious assumption that suppliers would bid only their variable costs, except during a relatively few peak hours.

Quantitative Analyses Indicating the Magnitude of the Potential Impacts of the Leveraging Effect in a Pure Poolco

In this section, we consider the potentially dramatic effects of simple bidding strategies involving leveraging on the generation prices and the owner profits in a poolco, illustrated both qualitatively and quantitatively in the recent testimony and accompanying exhibits of Randall Falkenberg on behalf of the Industrial Energy Consumers of Pennsylvania.¹² Falkenberg performed a computer simulation of the dispatch of a hypothetical Pennsylvania-wide pure poolco using actual data for all existing power plants in that state. (There would be six major owners of capacity in this poolco.) Specifically, he developed a simple simulation technique using a probabilistic dispatch model to determine the extent to which current owners of generation may be able to exercise market dominance and manipulate prices in a pure poolco. This analysis provides a sense of how big an effect leveraging can have on prices and profits, and, as a consequence, how likely it is to occur.

One of Falkenberg's basic points is that even though a hypothetical Pennsylvania-based pure poolco would currently have a reserve margin of 30% due to excess capacity, on any given day roughly 20% of all capacity would be down for maintenance or due to forced outages, leaving about a 10% operating reserve margin. In addition, the Philadelphia Electric Company (PECO), Pennsylvania Power & Light (PP&L), and General Public Utilities (GPU) would control, respectively, roughly 30%, 27%, and 16% of total pool capacity¹³. Therefore, even if all other utilities in the pool were to run their units full out, PECO's control of roughly 30% of total pool capacity would mean that, "in reality, it would be impossible to meet system demand hundreds or thousands of hours during the year without relying on PECO's resources. During such periods, PECO could offer virtually any bid, and the ISO [independent system operator] would have little choice but to accept."¹⁴ Furthermore, during highest demand hours, the dominant suppliers, PECO and PP&L, and even GPU, "could virtually dictate any price. Without their peaking generation, a capacity shortfall would occur. With PECO and PP&L controlling 77% of the peaking capacity on the system, there would be no real competition except, perhaps, to see who might offer the highest bid!"¹⁵

¹² *Direct Testimony of Randall Falkenberg On Behalf of The Industrial Energy Consumers Of Pennsylvania*. Before the Pennsylvania Public Utility Commission, Docket No. I-940032, November 1995.

¹³ Falkenberg's testimony and exhibits are based on actual data for all generating units in Pennsylvania. His primary sources of load and capacity data for each investor-owned utility in Pennsylvania were the utilities 1995 Resource Plans filed with the Pennsylvania PUC, FERC Forms 1 and 714, and utility industry-wide information prepared by the North-American Electric Reliability Council.

¹⁴ *Direct Testimony of Randall Falkenberg On Behalf of The Industrial Energy Consumers Of Pennsylvania*. Before the Pennsylvania Public Utility Commission, Docket No. I-940032, November 1995: p.28.

¹⁵ *Direct Testimony of Randall Falkenberg On Behalf of The Industrial Energy Consumers Of Pennsylvania*. Before the Pennsylvania Public Utility Commission, Docket No. I-940032, November 1995: p.47-48.

Falkenberg ran his pure poolco simulation model for a very simple set of bidding strategies specified for each utility and each unit on the system.¹⁶ In Falkenberg's testimony and accompanying exhibits, he demonstrates the dramatic and significant effects that these very simple strategies of bidding above variable cost would have on the profits of *all* generation companies in a Pennsylvania pure poolco. Most importantly, he shows that *just one company* can have a huge impact on the prices paid to all owners of generation, and thus on the average prices of the pure poolco. In doing so, his quantitative analyses prove our hypothesis about the importance of the leveraging effect.

For example, if PECO were to simply bid all of its coal- and oil-fired generation at 150% of variable costs, and if all other owners bid only their variable costs of generation, PECO would increase its return on equity (ROE) for 1995 alone by more than \$114 million¹⁷ relative to its baseline electric operating revenue requirement of about \$3.575 billion¹⁸ when it bids only 100% of variable costs. If we assume that roughly 9.2%¹⁹ of this baseline revenue requirement, or approximately \$329 million, is the allowed ROE, then PECO's increase in return on equity of more than \$114 million would mean about a 35% increase in ROE. Of greater significance is the fact that total poolco ROE (i.e., return on equity to *all* owners of generation) would increase by \$498 million relative to the base case revenue requirement of over \$10.5 billion²⁰. If we again assume that roughly 9.2% of the baseline revenue requirement, or approximately \$966 million, is the poolco return on equity, then the increase in ROE of more than \$498 million would represent *a 52% increase in profits for all owners, due solely to PECO's bidding strategy*. This example illustrates the tremendous impact that a somewhat higher market clearing price stemming purely from a simplistic bidding strategy can have on the increase in poolco member profits. This example also illustrates that other owners of generation can not prevent this effect from occurring because by bidding their variable costs for all units, they are already bidding as low as is practical in each hour.

¹⁶ *Direct Testimony of Randall Falkenberg On Behalf of The Industrial Energy Consumers Of Pennsylvania*. Before the Pennsylvania Public Utility Commission, Docket No. I-940032, November 1995: p.31-32.

¹⁷ *Direct Testimony of Randall Falkenberg On Behalf of The Industrial Energy Consumers Of Pennsylvania*. Before the Pennsylvania Public Utility Commission, Docket No. I-940032, November 1995: p.38.

¹⁸ "Electric Operating Revenues" for Pennsylvania electric utilities are from the DOE / EIA publication, *Financial Statistics of Major U.S. Investor-Owned Electric Utilities, 1993*, Washington, D.C., January 1995: Table 37, "Statement of Income and Retained Earnings by Major U.S. Investor-Owned Electric Utility within State, 1993", pages 117 and 120. Values were assumed to remain constant between 1993 and 1995.

¹⁹ DOE/ EIA, *Financial Statistics of Major U.S. Investor-Owned Electric Utilities 1993*. Washington, D.C., January 1995: Table 7, "Ratios Based on the Composite Statement of Income and Retained Earnings for Major U.S. Investor-Owned Electric Utilities, 1989-1993", page 19. The value was assumed to remain constant between 1993 and 1995.

²⁰ Duquesne Light Company: \$1,160,976,000; Metropolitan Edison Company: \$801,400,000; Pennsylvania Electric Company: \$908,280,000; Pennsylvania Power & Light Company: \$2,725,739,000; Pennsylvania Power Company: \$292,084,000; Philadelphia Electric Company: \$3,575,247,000; West Penn Power Company: \$1,084,977,000; Total: \$10,548,703,000.

Even though PECO would control roughly 30% of total pool capacity and PP&L would only control roughly 27%, PP&L would, in fact, be even better situated than PECO to leverage in a pure poolco. This is due to the way its power plants would be distributed over the variable cost supply curve of the poolco. If PP&L were to bid its generation at 150% of variable costs, then it would increase its ROE for 1995 by 56%. Of equal significance is the fact that total poolco ROE would increase by \$690 million in just one year relative to the base case return on equity of over \$966 million. These huge increases in profits imply large increases in electricity rates. The average market price for power in the hypothetical poolco would have increased by 19% in 1995, from the base case price of \$26.7 / MWh to almost \$31.7 / MWh in the case where PP&L bids its generation at 150% of variable costs²¹. Despite this high price, new suppliers may still be unable to enter into the market. Depending on the total levelized generation costs faced by new market entrants *at the capacity factors they would likely be dispatched*, an average price of \$31.7 / MWh, for example, may not be high enough for them to cover all of their fixed and variable costs, as well as a fair return on investment.

It is interesting to note that since it would be easiest to recover fixed investment costs during peak period hours, owners of new peakers would be more likely to enter the market as demand grows than owners of new baseload would. Generally, it would be much more risky for owners of new baseload units (e.g., gas combined cycle plants) to enter the market because it would be much harder to predict exactly when the economics for such units would tend to be favorable²². However, if new peakers were to comprise the majority of the new market entrants for a while, this could potentially perpetuate market power in the hands of existing owners of baseload and cycling plants for many years to come, perhaps a decade or more if pure poolcos were established in many parts of the U.S.

Naturally, the situation would become far worse if *two* companies were to practice a bidding strategy where they bid well above variable cost. When Falkenberg modeled the hypothetical case in which PECO and PP&L both adopted a pricing strategy equal to 150% of their variable cost, he found that they would *each* increase their 1995 ROE by roughly \$300 million²³ relative to their base case revenue requirements of \$3.575 billion and \$2.725 billion, respectively²⁴. This would represent *a 91% increase and a 120% increase to PECO's and PP&L's return on equity*,

²¹ *Direct Testimony of Randall Falkenberg On Behalf of The Industrial Energy Consumers Of Pennsylvania*. Before the Pennsylvania Public Utility Commission, Docket No. I-940032, November 1995: p.38 and 40.

²² Perhaps gas combined cycle plants would be completed in stages (i.e., first the peaking plant, then the waste heat recovery part of the plant).

²³ *Direct Testimony of Randall Falkenberg On Behalf of The Industrial Energy Consumers Of Pennsylvania*. Before the Pennsylvania Public Utility Commission, Docket No. I-940032, November 1995: p.41-42.

²⁴ "Electric Operating Revenues" for Pennsylvania electric utilities are from the DOE / EIA publication, *Financial Statistics of Major U.S. Investor-Owned Electric Utilities, 1993*, Washington, D.C., January 1995: Table 37, "Statement of Income and Retained Earnings by Major U.S. Investor-Owned Electric Utility within State, 1993", pages 117 and 120. Values were assumed to remain constant between 1993 and 1995.

respectively! In addition, total poolco return on equity would increase by \$1,190 million relative to the base case revenue requirement of over \$10.5 billion. This represents a 123% increase to ROE -- clearly a *huge* effect. Of course, there is no reason why *all* generation owners in a pure poolco would not attempt similar bidding strategies, since there would be no downside until new market entrants could undercut their bidding strategies in a systematic way. Furthermore, generation owners would develop much more sophisticated bidding strategies than Falkenberg modeled to maximize profits.

A generation company practicing such bidding tactics (e.g., 150% of variable costs) would find its sales to the poolco somewhat reduced relative to the sales that it would make if the company bid strictly variable costs. Thus, in theory, such a strategy might be assumed to be self-defeating. However, Falkenberg's surprising quantitative results reflect the fact that the *decrease* in average capacity factors for different types of units likely to be on the margin as they move higher in the dispatch order due to the strategy to bid higher than variable costs are much more than offset both by *increases* in average market prices, and also by the lower fuel costs of actually running the units less. For example, by bidding 150% of variable costs in a hypothetical pure poolco, PECO would gain additional profits in 1995: though its sales would decrease by 4,161 GWh (from 36,137 GWh to 31,976 GWh), its fuel costs would decrease by \$73.9 million (from \$353.5 million to \$279.6 million), and its total income would increase by \$114 million.

Before we conclude our discussion of Falkenberg's analyses, it is important to understand that the general implications of his findings are not dependent upon the fact that the poolco he modeled was limited to Pennsylvania, though the specific quantitative results would obviously differ for another region. This is true for a number of reasons. First, if the poolco's boundaries were expanded, for example to reflect the entire PJM power pool, the poolco's supply *and demand* would both increase. Because supply and demand are roughly in balance, expanding the poolco's boundaries would not change the fact that the poolco would have to rely on the resources of *all* of the suppliers in that larger region to meet system demand hundreds and even thousands of hours during the year. Though expanding the boundaries would reduce each generation owner's relative ownership concentration of total poolco capacity (e.g., from 30% to 18%), it may not be enough to eliminate the ability to exercise market power. Secondly, regardless of the poolco's boundaries, new market entrants would not enter into a poolco unless they were certain that there would be a demand for their supply such that they could recover their fixed and variable costs and make a fair rate of return on equity. They would not want to enter the poolco and take the risk that the existing suppliers would suddenly bid closer to their true variable costs, if they were previously bidding at higher levels. Therefore, given any pure poolco's variable cost supply curve for any region of the U.S., and given the typical pattern in which generation owners are likely to have their capacity distributed across baseload, cycling, and peaking units, we believe findings similar to those of Falkenberg could be duplicated.

The key question becomes, then, whether or not there are any underlying incentives or mechanisms that would tend to undercut or destroy the ability of a few relatively small firms from collectively exercising market power in a poolco. For example, would starting the entire process off slowly but steadily by raising one's bids prove to be too risky for one of them, not knowing whether or not others would follow with a similar strategy. We think not. Even with only ten firms having

roughly equal market shares, the chances of two or more (which would only enhance the market power effects of just one firm) adopting more or less the same subtle approach to bidding high is extremely likely. The first company or two that attempted to start off the process would only cease the higher bidding behavior if it suffered significant negative consequences.

Yet, we can find no theoretical reason why such negative consequences would occur if the firms were reasonably careful in creating their bidding strategies. In general, each firm would start raising their bid prices very slowly in each hour for each plant (particularly for those plants higher in the dispatch order which have a bigger leveraging effect) until they discovered a point of "diminishing returns", i.e., where the extra profits earned on all their plants in an hour with a given demand level just balanced the lost income due to the fact that by bidding a higher price the plant near the margin would not be dispatched quite as often. On a statistical basis, that balance point should not be very hard to find for each of an owner's plants for each demand level. As long as the owner were to stay toward the low side of that balance point, the owner could then wait a while and test the location of the balance point again. It would be likely that after a while, other owners would also be doing the same thing, which would tend to systematically move the balance point for each plant up in price in each hour.

This approach to bidding would tend to gradually magnify the impact of collective "market power" over time, even if there were many small sized owners of generation in the market. Of course, some owners' plants would not be so well positioned along the poolco's supply cost curve as others would be, so they might not be able to exercise market power through leveraging as effectively as others could in as many hours of the year. Furthermore, it is obvious that the more owners that do *not* attempt this bidding strategy, the harder it would be for others to profit. In the other extreme, if *all* were to play this game, the price of electricity would rise indefinitely until new market entrants could put a stop to it.

Mitigating Market Power Exercised Through Leveraging in a Pure Poolco

The ultimate question that we must address is whether or not market power through leveraging in a pure poolco could be mitigated in the same way that it is mitigated in more typical competitive markets. Below, we consider several options that could potentially reduce the risk of market power through leveraging.

One option that is often put forth is to incorporate *bilateral contracts, accompanied by contracts for differences*, into the market structure. This would seem to be a viable option. First of all, the existence of bilateral contracts, accompanied by contracts for differences (CFDs), could mitigate the risk of market power through leveraging in a poolco by reducing the level of demand a poolco would serve. In other words, bilateral contracts, accompanied by CFDs, would reduce the size of the market where market power could be exercised, namely from a poolco serving *all* demand to a poolco serving "spot" demand. (Note that we do assume in the following discussion that *all* generation would still be bid into and dispatched through the poolco.)

Secondly, if bilateral contracts, accompanied by CFDs, were introduced into a poolco, it seems logical that the leveraging effect would be mitigated to some extent because the prices paid by a consumer for the energy and capacity that he has under bilateral contract would be fixed. Thus, an owner of some generation under bilateral contract would not get paid more for (i.e., would not earn higher profits on) *this generation* by bidding it above variable cost into the poolco. Assuming that the owner bids the generation under contract at true variable cost and that the poolco clearing price is equal to or greater than his true variable cost of that generation, then the owner's contracted generation will be dispatched. After all of the monetary exchanges take place between the owner, the buyer, and the poolco, the owner will be left with the contract price to cover his fixed and variable costs of that generation, as well as a fair profit. Furthermore, assuming that the owner bids the generation under contract at variable cost and that the poolco price is less than his true variable cost of that generation, then the owner's contracted generation will *not* be dispatched. After all of the monetary exchanges take place between the owner, the buyer, and the poolco, the owner will be left with the contract price less the poolco clearing price to cover his fixed costs, as well as a fair profit. (Since his contracted generation was not dispatched, he has no variable costs of that generation to cover). So, the higher the poolco clearing price, the less of a profit the owner can make on the marginal unit. Thus, trying to push the market price higher may cost the generation owner some money in this case.

However, even if an owner of some generation under bilateral contract has no means to make extra profit on *that generation* by bidding it above its true variable cost, he may still have an incentive to earn extra profits on his other generation that is *not* under contract (and therefore, would earn the poolco clearing price) by bidding the generation that *is* under contract above variable cost to drive up the poolco clearing price. In other words, the owner may be able to maximize his *net* profits across *all* of his generation units by using the generation that is under contract to bid up the poolco clearing price, a price that his units not under contract would earn if they were dispatched. Thus, while having bilateral contracts with contracts for differences in a poolco mitigates the incentive to exercise market power to some extent, it by no means eliminates the strong incentive to use leveraging to increase prices and profits.

Finally, to the extent that the leveraging effect is viewed by existing suppliers as an attractive feature of a pure poolco, they may not want to enter into many, if any, bilateral contracts²⁵. After all, it would be in each supplier's interest, independent of the actions of any other supplier, to earn as high a profit as possible on as many of its plants as possible through the leveraging effect. A supplier would be more likely to reap additional profits by participating in the pure poolco, where buyers would be forced to pay the market clearing price regardless of the type of power (i.e., baseload, cycling, peaking) they needed, than through one-on-one negotiations for bilateral contracts, where a buyer would have a better chance of negotiating a price that would be more in-line with the actual fixed and variable costs of the type of power the buyer needed.

²⁵ One exception could be that suppliers may enter into medium-term bilateral contracts in order to get new generating units into the market.

The Traditional Analysis of Market Power

In a typical market with bilateral contracts, the potential for market power is determined by how the market shares are divided up among the existing suppliers. The Department of Justice and the Federal Trade Commission have guidelines for evaluating mergers, in which the *Herfindahl Index* is a determining factor. The Herfindahl Index, a generic measurement of the potential for market power, is calculated as the sum of the squares of the market shares (expressed as a percent) of the firms competing in the market. Thus, an industry with 10 firms each having equal market shares would have a Herfindahl Index of 1,000. The guidelines use the term “moderately concentrated” for a level of concentration between a Herfindahl Index of 1,000 and 1,800, and state that in this range mergers “are unlikely to have adverse competitive consequences and ordinarily require no further analysis.” Levels above 1,800 are referred to as “highly concentrated” and create a presumption that such mergers are “likely to create or enhance market power or facilitate its exercise.”²⁶

Though it is widely used, the Herfindahl Index is a very simplistic indicator of the potential for market power because it does not attempt to capture the impact of the ways in which market power could actually be exercised in a particular market structure within a given industry. (A poolco represents one kind of market structure, and a bilateral market represents another kind.) We believe that simply basing the removal of price regulation of electric generation on establishing a minimum number of competitors, and their maximum allowable shares of the market based on the Herfindahl Index, is likely to be too simplistic an approach to ensuring a lack of market power in the generation market. After all, a supplier's ability to exercise market power through the leveraging effect in a pure poolco is not based exclusively on its total share of the market (e.g., 30% of total capacity) -- it is also based on how well distributed across the supply cost curve its generation units are, and whether other suppliers are in the position to follow their own self-interests in the same way. From Falkenberg's analysis, there is evidence that even firms with only a 10% market share may be able to exercise significant market power through leveraging in a poolco. Duquesne Light Company, with a market share in Pennsylvania of only 10.85%, would increase its ROE by just \$4 million, but would increase the poolco ROE by \$347 million simply by bidding at 150% of its variable costs. It seems plausible that a more optimally chosen set of power plants totalling 10% or less of the poolco capacity could cause much bigger effects than Duquesne's set of plants. This implies that requiring utilities to divest themselves of their generation assets into entities with 10% or less market concentration may not prevent the exercise of market power through leveraging in a pure poolco. Of course, mergers would also have to be prevented.

²⁶ Even at these high levels of concentration, a merger can be approved if it is shown that other factors make abuse of market power unlikely.

Implications

In conclusion, the potential for market power should be analyzed relative to each type of market structure that is being considered for the electric industry under the specific conditions that exist in each region. The potential for strategic gaming under different combinations of a variety of market rules, models, conditions, regional boundaries, and ownership structures must be considered. Qualities unique to the industry must also be taken into account, such as the relative lack of storage in most parts of the country. In the electric industry, "the market" will be defined by physical regions (e.g., multiple states, a single state) and should reflect transmission capacity constraints, the physical location of generation facilities and load centers, the supplies of the different types of capacity (i.e., baseload, cycling, peaking), etc.

A Potential Benefit of Higher Market Prices?

Some commentators have argued that consumers could benefit somewhat from higher market clearing prices in that they would pay less toward a utility's stranded cost recovery as a consequence of higher market clearing prices. This argument is based on the fact that stranded costs are defined as the difference between the competitive market value and the regulated book value of a utility's electric generation assets -- thus, a higher market value would mean a smaller amount of stranded costs. However, this consumer benefit argument is flawed. If a utility is guaranteed 100% stranded cost recovery, then the utility would not have an incentive, relative to stranded cost recovery, to manipulate market prices either up or down. In other words, regardless of the size of the two components (i.e., market price and stranded costs), together they will equal the regulated book value of a utility's electric generation assets. If, on the other hand, a utility must write-off some fraction (e.g., 50%) of stranded costs against stockholder profits, then the utility does have an incentive to increase market prices in order to minimize the amount of stranded costs it writes off. However, as a result consumers pay more, in total, not less, than they would if the market price were lower. In short, then, consumers never stand to benefit from high market prices that result from the leveraging effect, or any other means of exercising market power.