Putting Competitive Power Markets to the Test

The Benefits of Competition in America's Electric Grid: Cost Savings and Operating Efficiencies

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Abridged Version

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Global Energy Decisions

Putting Competitive Power Markets to the Test

Global Energy independently assessed the benefits of wholesale electric market competition, with the following findings:

1. **Consumers realized $15.1 billion in value from wholesale electric competition in the 1999-2003 study period**. Global Energy calculated the benefits of wholesale competition for the Eastern Interconnection as they occurred. Those results were compared with a simulation of market conditions without the changes in market rules that enabled wholesale competition. Global Energy used its generally available Strategic Planning™ software to replicate the market rules and conditions and calculate consumer benefits. Consumers benefited if the study showed a positive difference between current market conditions and the simulation of the traditional market rules prior to wholesale competition. The results of the analysis are that wholesale customers in the Eastern Interconnection have realized a $15.1 billion benefit due to electricity competition.

2. **Competition dramatically improved the operating efficiency of power plants.** Global Energy conducted an analysis and review of the North American generation fleet operations to assess improvements and efficiencies attributable to competitive forces. This analysis was based on a study period of 1999-2004. Global Energy uncovered strong evidence indicating the electric utility industry has improved its operations and efficiencies, largely due to competitive forces. Some of the power plants with great gains in efficiency had been auctioned off by their prior owners and had historically been relatively poor performers. But the skill of experienced fleet operators, the standardization of procedures and maintenance, and the combined buying power for fuel, equipment, and supplies have produced dramatic improvements in capacity factors and plant performance. The cost savings and energy efficiency resulting from reduced refueling outages, improved capacity factors, and reliability are continuing to provide substantial benefits to consumers.

3. **Opening the PJM Interconnection to more electric supply competitors produced $85.4 million in annualized production cost savings during 2004 for wholesale power customers.** The benefits of expanding the PJM wholesale power market with the addition of Commonwealth Edison (ComEd), American Electric Power (AEP), and Dayton Power & Light (DPL) in 2004, produced $85.4 million in annualized production cost savings for Eastern Interconnection customers. The expansion reduced transmission seams and provided for the entry of new competitors in the Midwest, resulting in a more efficient regional power market. The study showed that PJM wholesale customers weren't the only ones to benefit; rather, wholesale customers throughout the Eastern Interconnection realized a savings. These annual production cost savings should continue year after year.

Report Summary

The Benefits of Competition in America's Electric Grid: Cost Savings and Operating Efficiencies

Introduction

The competitive policies adopted by Congress and implemented by FERC are unequivocally producing consumer benefits.

- Electricity customers in America's Eastern Interconnection power markets saved more than $15.1 billion in energy costs from 1999 to 2003 as a result of competition in wholesale power markets.
- Overall industry improvements in nuclear power plant operations produced enough additional energy to power more than 10 million residential households for one year.[1] Comparable operating efficiency improvements occurred in power plants fueled by coal, which created enough additional energy to power more than 25 million residential households.
- The benefits of expanding the PJM wholesale power market in 2004 provided $85.4 million in annualized production cost savings for Eastern Interconnection wholesale customers through the reduction of transmission seams and entry of new competitors.

Global Energy was asked by a prominent group of electric power generators, marketers, and suppliers to perform an independent analysis of wholesale competition at work today to identify and quantify the existing and foreseeable consumer benefits of competitive electricity markets.[2] This report, titled *Putting Competitive Power Markets to the Test*, is the result of that independent analysis.

Congress created the legislative framework that enabled competitive power markets to meet the nation's growing energy needs. The Public Utility Regulatory Policies Act of 1978 (PURPA) opened the door for competitive power markets with requirements that utilities buy energy from qualifying cogeneration and renewable resource facilities. PURPA demonstrated that power plants could be developed, financed, built, and operated independently of the traditional utility's rate base. Congress expanded wholesale competition in the Energy Policy Act of 1992 (EPAct), creating an entire new class of "exempt wholesale generators" (EWGs) that had more contractual and regulatory flexibility than those under PURPA. The EWGs were authorized to build and operate power plants supported by sales into competitive energy markets, rather than relying upon traditional cost-of-service rate base returns to finance power plant construction. Indeed, the motivation behind these changes was to shift the risk of future power plant construction costs from utility ratepayers to investors in these projects. Ultimately, they became known as "merchant" power plants.

Competitive power markets have flourished by allowing energy companies to make sales using market-based rates (MBR) instead of traditional tariff rates, as allowed by the Federal Power Act (FPA). FERC's implementation of open access and MBR led the initiative to create wholesale power markets that ensured just and reasonable wholesale rates.

FERC has been progressively using its FPA authority to implement and foster wholesale power market competition through a series of orders and market initiatives. FERC's push to establish Regional Transmission Organizations (RTOs) and organized spot markets in order to ensure nondiscriminatory

[1] Based upon average residential customer annual usage of 10,803 kWh per year.
[2] The sponsors of this Global Energy analysis are: BP Energy Company, Constellation Energy, Exelon Corporation, Mirant Corporation, NRG Energy, Inc., PSEG, Reliant Energy Inc., Shell Trading Gas and Power Company, Williams, and Suez Energy North America. The Electric Power Supply Association served as project manager on behalf of the sponsors.

transmission and market access has met with fierce resistance in some parts of the country, namely the Southeast and the Pacific Northwest. Despite that resistance, RTO membership continues to grow. The PJM RTO, which serves the Mid-Atlantic and some Midwestern states, has seen rapid expansion, is integrating its energy markets with those of the Midwest Independent System Operator (ISO), and is collaborating with NYISO and ISO-NE to create a large and growing seamless wholesale power market. The Midwest ISO itself successfully launched its formal market operations on April 1, 2005. Further growth continues to occur with the formation of the Grid West independent transmission organization. Thus far, it has 87 members, has adopted developmental bylaws, and is seating a developmental board of directors.

The growth in the PJM RTO is one aspect Global Energy evaluated for this study because it enables a comparison of consumer benefits in organized RTO markets with traditional markets that do not have the market access afforded by RTOs.

Regional power markets, especially those organized under RTOs now have a proven track record over eight years. However, discussions about the cost and benefits of RTO formation continue among key market participants and regulatory authorities. This study can be viewed as a contributor to that discussion.

Study results show wholesale competition in America's electric power markets is working. When the subject of competition in the electric power industry is discussed in public, often the report card on how competition has performed is told in the context of the California energy crisis or the problems of Enron. No credible study of wholesale competition can be done without recognizing this "elephant in the room." However, the real standard by which competition should be measured encompasses all economic and non-economic factors (e.g., operating efficiencies). Further, the economic comparison should measure today's market prices against the regulated prices that would have occurred, absent any competitive initiatives. Now, 13 years after Congress passed EPAct, it is time to look at how wholesale competition in the electric generation sector of the industry is doing—and whether electricity customers are benefiting from the wholesale competition that the 1992 EPAct envisioned.

The results of Global Energy's analysis of the Eastern Interconnection (an area that comprises two-thirds of the U.S. population and electricity demand, three-quarters of the nation's electricity control areas, and eight of the ten North American Electric Reliability Council's regional councils) are that wholesale competition is working as Congress intended. The FERC regulations and decisions in fostering the creation of regional transmission markets are working to create effective competitive energy markets. Customers are realizing the benefits of wholesale competition in the form of lower wholesale costs for their electric suppliers, more options from renewable resources, better opportunities to manage risk and wider competition from more market participants.

How the Study was performed by Global Energy. The study was conducted by Global Energy using its Global Energy Reference Case, an independent, transparent analysis of electric and natural gas market supply and demand fundamentals updated twice yearly and used widely by credit rating agencies, investment banks, energy companies, utilities and the engineers, consultants and attorneys who serve them. Global Energy used its own independent data sources and market leading **EnerPrise™ Strategic Planning** *powered by MIDAS Gold®* software to perform the analysis. The modeling methodologies and approach are consistent with Global Energy's consulting best practice for cost benefit studies. While the

sponsors of the study were involved in helping Global Energy define an appropriate work scope for the project, the assumptions, data, analysis, and conclusions outlined in this report are Global Energy's alone and do not necessarily represent the views of the sponsors.

Consumer Value of Competition

To assess whether wholesale competition is working as Congress and FERC intended, Global Energy assessed the Eastern Interconnection wholesale electric power markets as they occurred in the 1999-2003 study period ("With Wholesale Competition" case). Those results were compared with a simulation, which excluded the regulatory changes, tariff protocols, and market rules that enabled wholesale competition ("Without Wholesale Competition" case).

Global Energy's With Wholesale Competition case divided the Eastern Interconnection into two distinct business sectors. The "Regulated" sector comprised traditional regulated utilities, which have an obligation to serve native load retail customers. The "Competitive" sector comprised the exempt wholesale or merchant generating units, which are at risk, as they are not allowed a regulated return. In this analysis, the sole source of income for the Competitive sector is energy and capacity sales to the Regulated sector.

The Without Wholesale Competition case calculated the consumer cost had the market remained as traditional, vertically integrated utilities operating in a regulated environment without wholesale competition. Global Energy used its generally available Strategic Planning software to replicate the market rules and conditions and to calculate the customer benefits. Customers benefited if the study showed a positive difference (lower costs) between current market conditions and the simulation of the traditional utility market prior to wholesale competition. The results of the analysis are that consumers in the Eastern Interconnection have realized a $15.1 billion benefit due to wholesale competition over what they would have realized under the traditional regulated utility environment.

The valuation method Global Energy employed in the analysis is the minimization of operating expenses for the regulated utility buyer. Under traditional utility cost of service regulation, the minimization of operating expenses provides the greatest benefit to the retail customer. Global Energy assumed all operating expenses were fully recovered in the base revenues of the regulated utility sector. The operating expenses include fuel expenses, energy and capacity purchases from the Competitive market sector, variable O&M, fixed O&M, depreciation, taxes, and operating income.[3]

[3] For the Regulated Sector, Operating Income is defined as rate base times a "fair and reasonable" allowed return on rate base of 8.5 percent.

Figure RS-1 illustrates the Regulated sector's additional operating expenses for the Without Wholesale Competition case. Figure RS-2 illustrates the Regulated sector purchasing energy and capacity from the Competitive sector for the With Wholesale Competition case. In both cases, Global Energy calculated the Regulated sector's fuel and variable O&M expense for serving the Eastern Interconnection load as these expenses change between the two cases.

Figure RS-1
Without Wholesale Competition

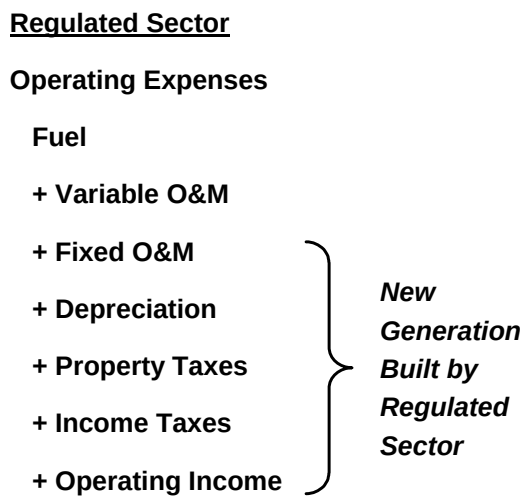
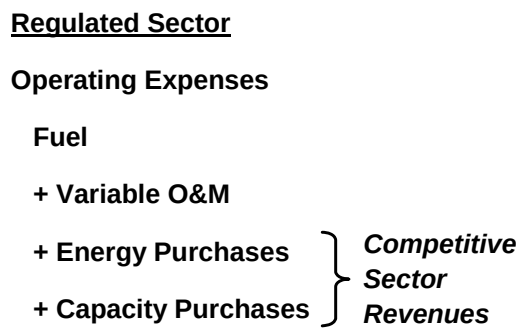


Figure RS-2
With Wholesale Competition



SOURCE: Global Energy.

Defining the Two Cases

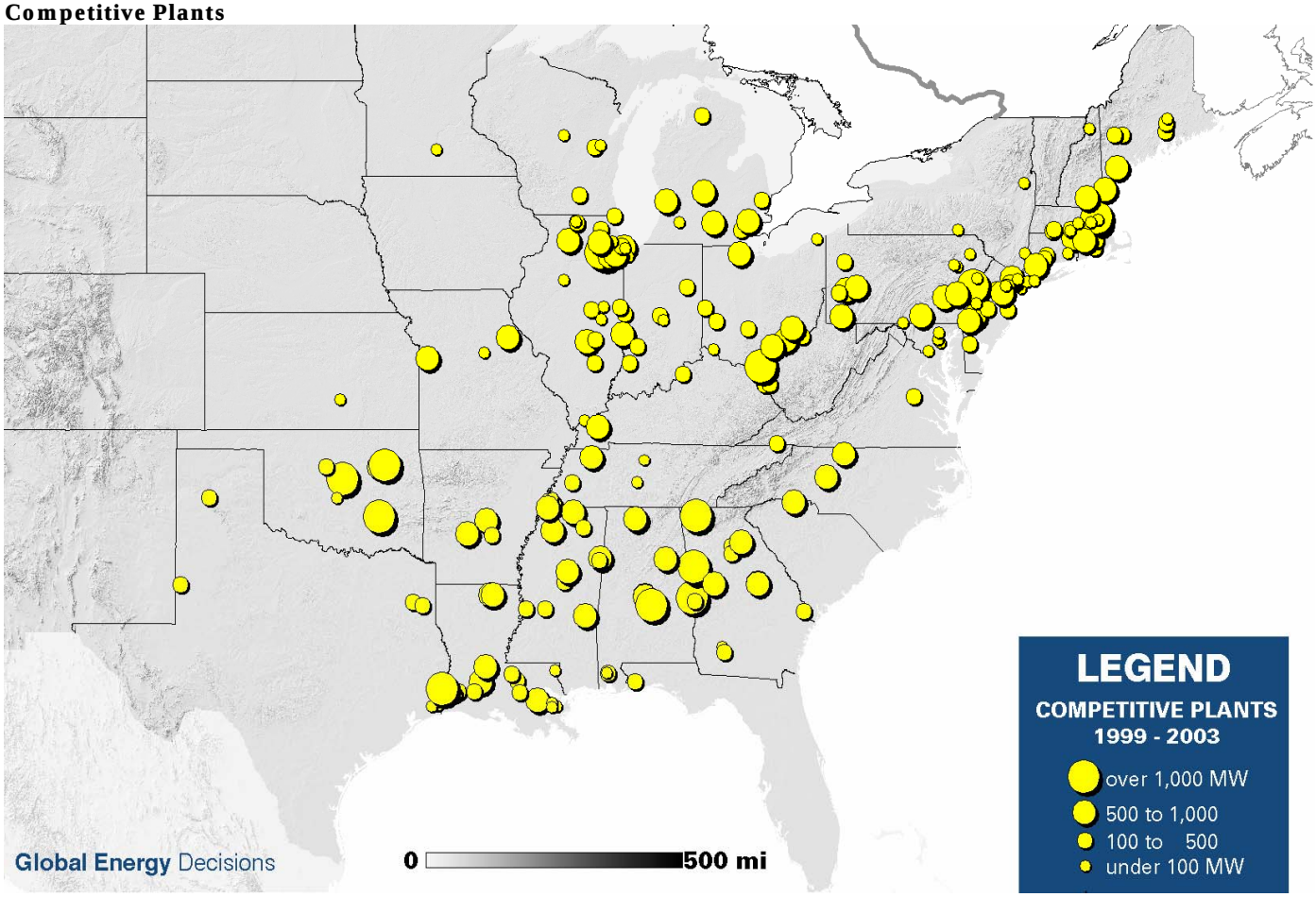
The With Wholesale Competition case differs from the Without Wholesale Competition case in three main areas.

1. Competitive Plants
   - In the Without Wholesale Competition case, it is assumed that no competitive or merchant plants would have been built; however, qualifying facilities built pursuant to PURPA requirements were included.
2. Regional Transmission Organization (RTO)
   - In the Without Wholesale Competition case, it is assumed that FERC Orders 888 and 2000 never occurred and that RTOs were not formed. RTO transmission rates are replaced with pancaked transmission rates, which traditionally existed in these areas.
3. Market-Based Rates for Wholesale Energy
   - In the Without Wholesale Competition case, it is assumed that marginal cost-based contracts replace market-based wholesale energy.

Competitive Power Plant Development (With Wholesale Competition Case)

The Competitive sector comprises 88,686 MW of generation added over the five-year study period. The mix of generation is 56 percent combined cycle units (50,106 MW) and 44 percent simple cycle units (38,580 MW). For this analysis, Global Energy estimates that the Competitive sector sold $13.7 billion worth of energy and capacity to the Regulated sector. Figure RS-3 shows the dispersion of competitive plants added in the Eastern Interconnection during the study period.

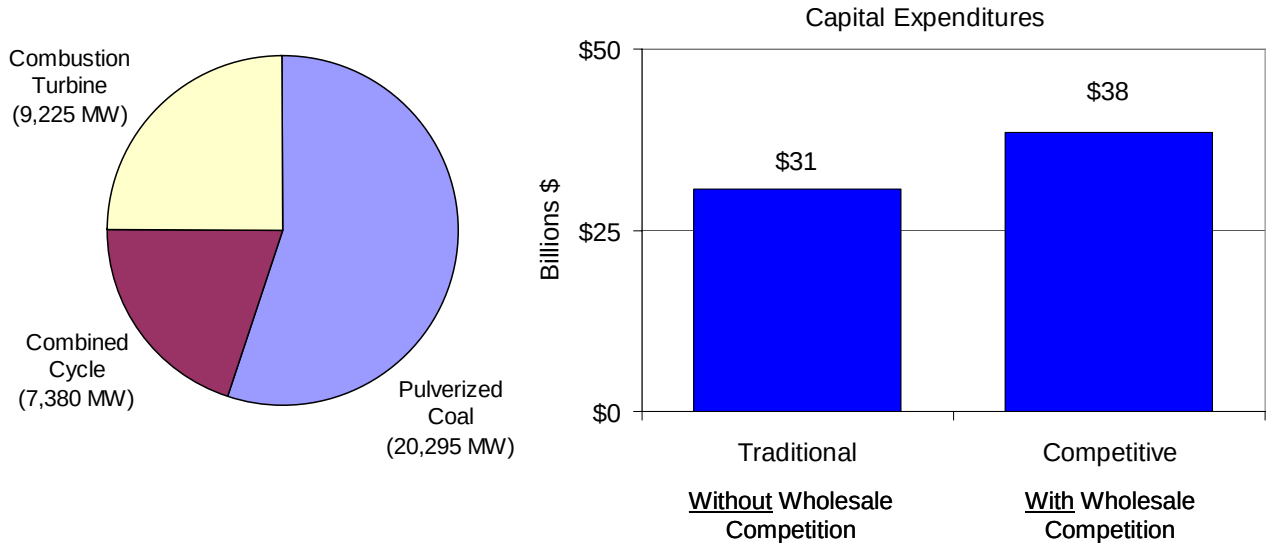
Figure RS-3
Competitive Plants



Traditional Power Plant Development (Without Wholesale Competition Case)

In the Without Wholesale Competition case, Global Energy calculated the level and mix of new generation that utilities would have built to satisfy minimum reserve margins and consumer energy requirements. That electric supply portfolio would have consisted of 55 percent pulverized coal, 20 percent combined cycle, and 25 percent combustion turbines. As shown in Figure RS-4, capital spent by the Regulated sector is $7 billion less than was spent by the Competitive sector.

Figure RS-4
Traditional Generation Supply Portfolio; 1999-2003



SOURCE: Global Energy.

Comparing the Two Cases

The five-year consumer benefit of the With Wholesale Competition case versus the Without Wholesale Competition case was $15.1 billion. A comparative expense breakdown is shown in Table RS-1.

Table RS-1
Consumer Benefit; 1999-2003: Cost of Service Environment vs. Competitive Market

	Without Wholesale Competition	With Wholesale Competition	Consumer Benefit
Fuel (Fossil and Nuclear)	160,979	156,971	4,008
+ Variable O&M	21,902	19,515	2,387
+ Competitive Energy Purchase	-	11,495	(11,495)
+ Competitive Capacity Value	-	2,220	(2,220)
+ Fixed O&M	7,610	-	7,610
+ Depreciation	2,670	-	2,670
+ Property Taxes	931	-	931
+ Income Taxes	3,289	-	3,289
+ Operating Income	7,960	-	7,960
Operating Expenses (millions $)	**205,341**	**190,201**	**15,140**

SOURCE: Global Energy.

The With Wholesale Competition case does not reflect expenses and returns associated with existing utility infrastructure. The Without Wholesale Competition case includes expenses and returns for new generation constructed by the Regulated sector. In essence, Global Energy is quantifying the cost and risk transfer of power plant construction between the two sectors (Competitive and Regulated). Table RS-2 provides a description of each variable of the operating statement.

Table RS-2
Operating Statement Variable Descriptions

	Without Wholesale Competition	With Wholesale Competition
Fuel (Fossil and Nuclear)	Cost of fossil and nuclear fuel burned by existing utility infrastructure. This line item includes all plants (regardless of ownership) built prior to 1999, new rate base plants built in the 1999-2003 study period, and the 36,900 MW of traditional plants identified in Figure RS-4.	Cost of fossil and nuclear fuel burned by existing utility infrastructure. This line item includes all plants (regardless of ownership) built prior to 1999, plus new rate base plants built in the 1999-2003 study period. The 88,686 MW of competitive plants identified in Figure RS-3 are excluded from this line item.
Variable O&M	This line item includes all plants (regardless of ownership) built prior to 1999, new rate base plants built in the 1999-2003 study period, and the 36,900 MW of traditional plants identified in Figure RS-4.	This line item includes all plants (regardless of ownership) built prior to 1999, plus new rate base plants built in the 1999-2003 study period. The 88,686 MW of competitive plants identified in Figure RS-3 are excluded from this line item.
Competitive Energy Purchase	Not applicable. In this case there are no competitive plants.	Cost of energy purchased from the competitive plants identified in Figure RS-3.
Competitive Capacity Value		Cost of capacity purchased from the competitive plants identified in Figure RS-3.
Fixed O&M	These expenses are associated with the 36,900 MW of traditional plants constructed in the study period.	Expenses were not included for existing utility infrastructure because it would be the same for with and without cases.
Depreciation		
Property Taxes		
Income Taxes		
Operating Income	This line item is the operating income of the 36,900 MW of traditional plants constructed in the study period. The operating income is calculated as rate base times a return on rate base of 8.5 percent.	Operating income was not included for existing utility infrastructure because it would be the same for with and without cases.

SOURCE: Global Energy.

Summary - Consumer Value of Competition

Electricity customers in the Eastern Interconnection benefited by more than $15.1 billion over the five-year study period, in contrast to what they would have been expected to pay under more traditional regulated markets without wholesale competition. Had competitive generators and power suppliers not emerged, regulated utilities would have been required to build rate base generating assets and incur the costs to run them. Under wholesale competition, competitive energy suppliers take the risk of building and operating the power plants and selling the energy output to utility and other wholesale or large industrial customers.

These regulated utilities paid the competitive merchant sector more than $13.7 billion for the energy and capacity in the study period. However, in the Without Wholesale Competition alternative, there would have been an additional $28.9 billion in operating expenses. Thus, the consumer benefit is $15.1 billion when all the costs, including the cost to buy merchant power, were considered over the more traditional

process of allowing utilities to build the assets and incur the increased cost of fuel, O&M, depreciation, taxes, and operating income to run them.

Wholesale Market Competition Dramatically Improved the Efficiency of Power Plants

Global Energy Decisions conducted an analysis and review of the North American generation fleet operations to assess improvements and efficiencies attributable to competitive forces. This analysis was based on a study period of 1999-2004. Global Energy uncovered strong evidence indicating the electric utility industry has improved its operations and efficiencies, largely due to competitive forces. Some of the power plants with great gains in efficiency had been auctioned off by their prior owners as relatively poor performers. But the skill of experienced fleet operators, the standardization of procedures and maintenance, and the combined buying power for fuel, equipment and supplies have produced dramatic improvements in capacity factors and plant performance. The cost savings and energy efficiency resulting from reduced refueling outages, improved load factors and reliability continues to substantially benefit consumers.

The analysis focused on the nuclear and coal-powered generating units for traditional and competitive operators. Traditional operators are best defined as investor-owned utilities, municipalities, and cooperatives that are subject to retail rate regulation. Competitive operators are best defined as independent power producers and other generators that are not subject to retail rate regulation.

Nuclear Generation

Nuclear generation makes up 10 percent of the U.S. installed power generation capacity by fuel and about 20 percent of actual net generation each year.[4] Electric industry restructuring led to consolidation of nuclear operations through the purchase and sale of nuclear facilities across the country by experienced nuclear fleet operators such as Exelon and Entergy. Global Energy's analysis focused on a view of nuclear generation based on the classifications of plants owned and operated by IOUs and competitive plants that were sold and purchased.

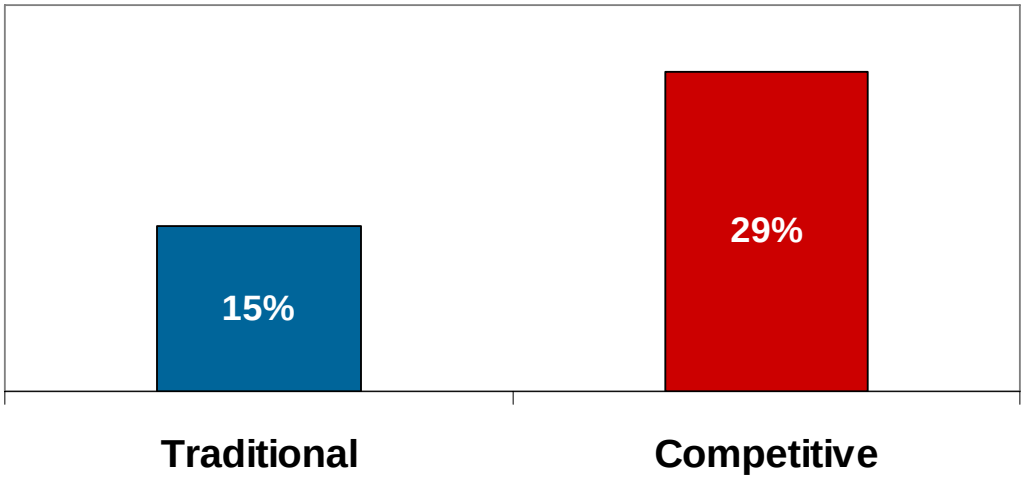
A number of nuclear facilities prior to wholesale competition were considered "troubled" and in danger of being shut down and decommissioned. Under competitive market conditions, many of these nuclear power plants have been sold, or their operation was contracted out to experienced nuclear fleet operators on a merchant basis. Consumers have benefited from the continued operation of these units, in addition to the improvements in operation and efficiencies.

[4] Global Energy Reference Case.

Nuclear Plant Refueling Outage Time Reduced

Global Energy conducted an analysis and review of the (Nuclear Regulatory Commission (NRC) daily unit outage information. Competitive units experienced a 29 percent reduction in the length of refueling outages since 1999. Figure RS-5 depicts the percentage improvement.

Figure RS-5
Percent Reduction in Length of Refueling Outages since 1999



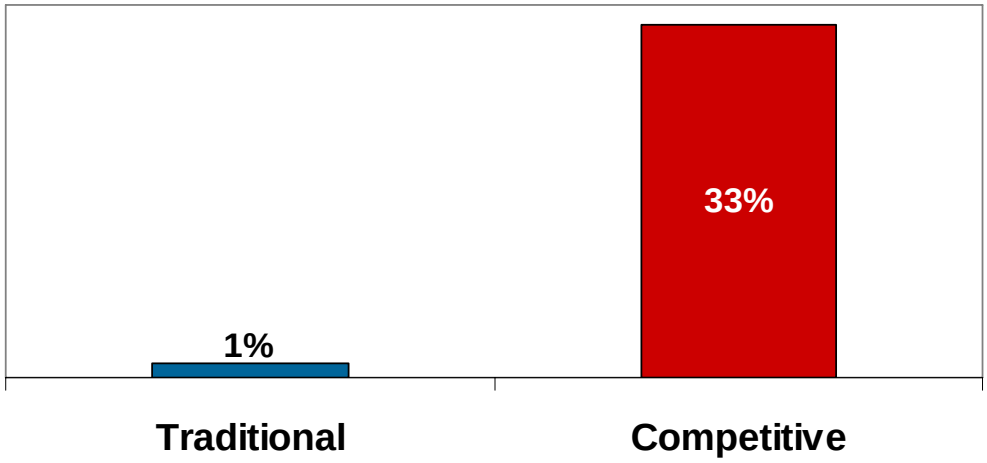
SOURCE: Global Energy.

Overall, the industry experienced a decline in total refueling outage days of nearly a year. Competition and industry restructuring have positively influenced the management of nuclear facilities through competitive pricing.

Nuclear Plant Operations & Maintenance Expenses Lowered

Global Energy conducted an analysis of the nuclear facilities' total fixed and variable operations and maintenance expenses. Competitive units experienced a 33 percent reduction in O&M expense on a $/MWh over 1999, as displayed in Figure RS-6. Competitive facilities have consistently reduced expenses over the study period.

Figure RS-6
Nuclear Plant O&M Reductions since 1999



SOURCE: Global Energy.

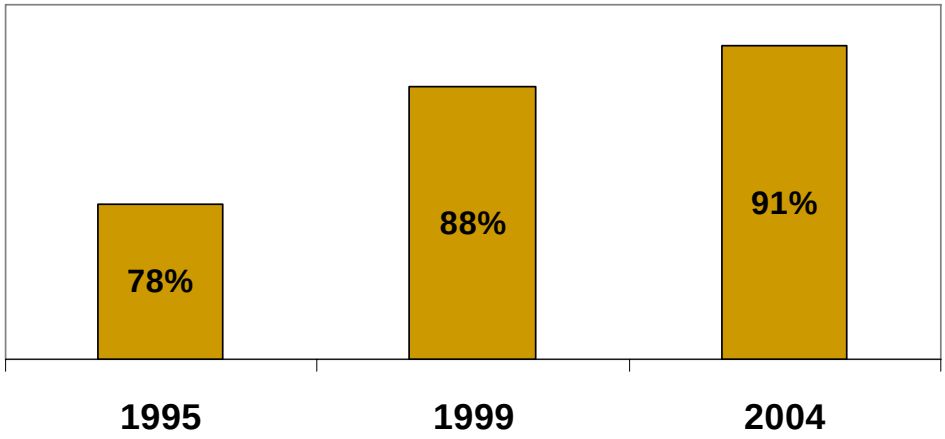
Note that in 1999, competitive nuclear facilities were experiencing costs of almost $15/MWh whereas traditional facilities' costs were around $10/MWh. The disparity is largely due to the fact that the competitive fleet of nuclear plants had a higher cost structure prior to their transfer to, or acquisition by, the Competitive sector. In 1999, the competitive nuclear facilities were relatively poor performers in the nuclear industry in regard to operating costs. However, by 2004, the skill of large scale experienced nuclear fleet operators; the standardization of procedures and maintenance; and the combined buying power for fuel, equipment, and supplies dramatically improved plant costs and performance. Now, the "poor performers" are indistinguishable from traditional facilities, as both have operating and maintenance costs of approximately $10/MWh.

Nuclear Plant Capacity Factors Increased

Nuclear units have relatively low variable costs and are, thus, low dispatch-cost generating facilities. As such, a measurable benefit is a high capacity factor. Prior to competitive forces shifting the management and operation of nuclear facilities to more experienced operators focused on improving plant performance in a competitive market environment, nuclear facilities were often operating at "sub-optimal" levels in 1995. Since 1995, the nuclear units have displayed continual improvement. According to Nuclear Energy Institute (NEI), nuclear plants had record output and stable costs in 2004. U.S. plants generated a record 786.5 million MWh in 2004, breaking the 2002 record of 780 million MWh. NEI's figures put the 2004 average net capacity factor at 90.6 percent, trailing only the 91.9 percent achieved in 2002 and the 90.7 percent in 2001. The slightly lower capacity factor, despite the higher output, occurred because nuclear operators nationwide have been uprating their units.

The nuclear industry experienced a 17 percent increase in capacity factors since 1995. Global Energy also found that since 1995 the increase in capacity factor resulted in enough energy to power more than 10 million residential households for one year.[5] Figure RS-7 depicts the overall capacity factor for the industry.

Figure RS-7
Nuclear Plant Capacity Factors; 1995-2004



SOURCE: Global Energy.

Coal Generation

Coal-fueled generation is the most predominant type of generating resource in the United States. Even with the additional natural gas-fueled generation, coal still represented 51 percent of total net generation in 2004.

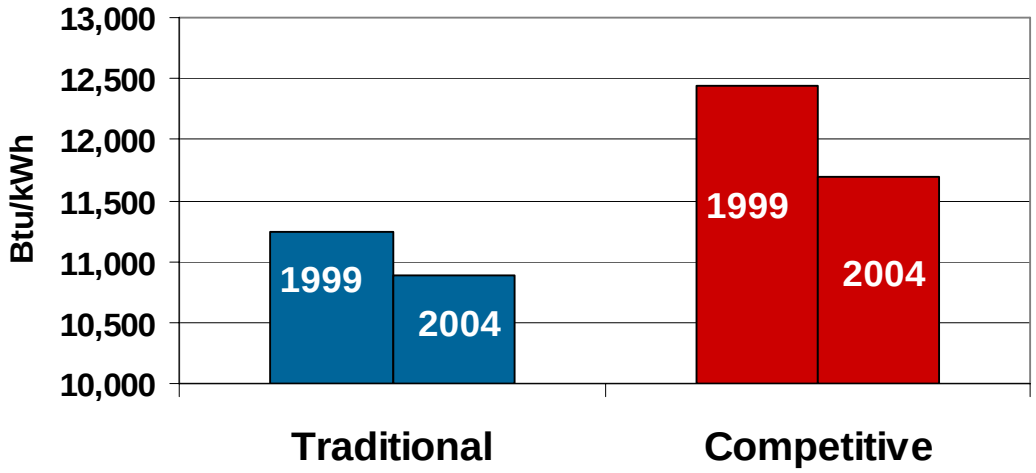
To identify how competitive pressures affected coal generation Global Energy conducted an analysis of coal-fueled generation based on a classification of traditional utility and competitive industry structures. Traditional utility structures represent generating facilities owned by investor-owned utilities, municipalities, and cooperatives that are subject to retail rate regulation. Competitive industry structures represent generating facilities owned by independent power producers that are not subject to retail rate regulation.

[5] Based on average residential customer annual usage of 10,803 kWh per year.

Coal Heat Rates Improved

Heat rate is a measurement of a generating station's thermal efficiency and is usually expressed in Btu/kWh; the lower the Btu/kWh, the higher the efficiency of the unit. Figure RS-8 shows that competitive units improved heat rates by 6 percent, while traditional units improved 3 percent since 1999. Overall, industry-wide heat rates for coal plants improved 4 percent during the study period. The traditional units consist of a more modern fleet, while the competitive units are older, less-efficient performers before they were transferred or sold by the prior owners. Nevertheless, the new competitive owners were able to achieve a 6 percent heat rate improvement. The environmental impact of the heat rate improvement is 12.3 million fewer tons of coal burned each year for the competitive fleet.

Figure RS-8
Coal Heat Rate Improvements



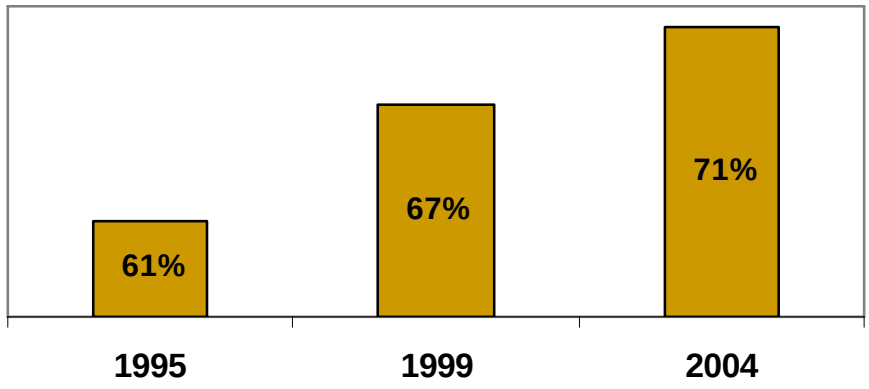
SOURCE: Global Energy.

Competitive pressures have compelled traditional utilities to maintain costs, while improving their overall efficiency. Consumers benefit from the overall improvement in efficiencies of coal generation regardless of whether they are related to traditional or competitive facilities.

Coal Plant Capacity Factors Increased

As with nuclear plants, the fleet of coal plants saw an improvement in capacity factors in the decade between 1995 and 2004. Figure RS-9 demonstrates that coal-fueled power plant capacity factors increased overall by 16 percent, from 61 percent to 71 percent. Because there are three times as many MW of coal-fueled capacity as there are MW of nuclear plant capacity, this increase had the effect of making at least another 50,000 MW of effective generating capacity available for dispatch in 2004 as there was prior to 1995. Furthermore, the increase in capacity factors for coal-based plants was enough electricity to power 25 million residential households for a year.

Figure RS-9
Coal Plant Capacity Factors; 1995-2004

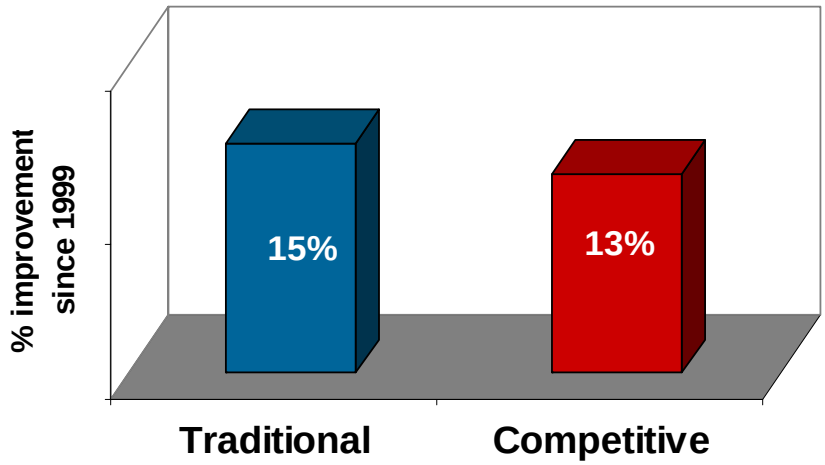


SOURCE: Global Energy.

Coal Operation & Maintenance Expenses Declined

Global Energy conducted an analysis of the coal fleet's operation and maintenance expenses to ascertain any influences of competition on these costs. Overall, coal O&M expense has declined when adjusted for inflation. Figure RS-10 shows that Competitive facilities improved 13 percent, while Traditional experienced a 15 percent improvement.

Figure RS-10
Coal O&M Improvements



SOURCE: Global Energy.

Reductions in the operating costs of base load, lower-cost plants, such as coal, benefit consumers through lower purchased power costs and regulated entities' ability to manage costs such that increases in rates are not necessary.

Summary - Improved the Efficiency of Power Plants

The empirical evidence indicates that the electric utility industry has improved its operations and efficiencies. Competitive utility structures are at the forefront of these improvements, either directly or indirectly, as demonstrated by the dramatic change in operating performance. Nuclear power plant performance improvements, in particular, have turned these plants, once considered to be an albatross around the neck of utilities, into star performers for the Regulated and Competitive plant operators skilled in running a fleet of nuclear plants.

Opening PJM to More Electric Supply Competitors Produced $85.4 Million in Production Cost Savings for Wholesale Power Customers

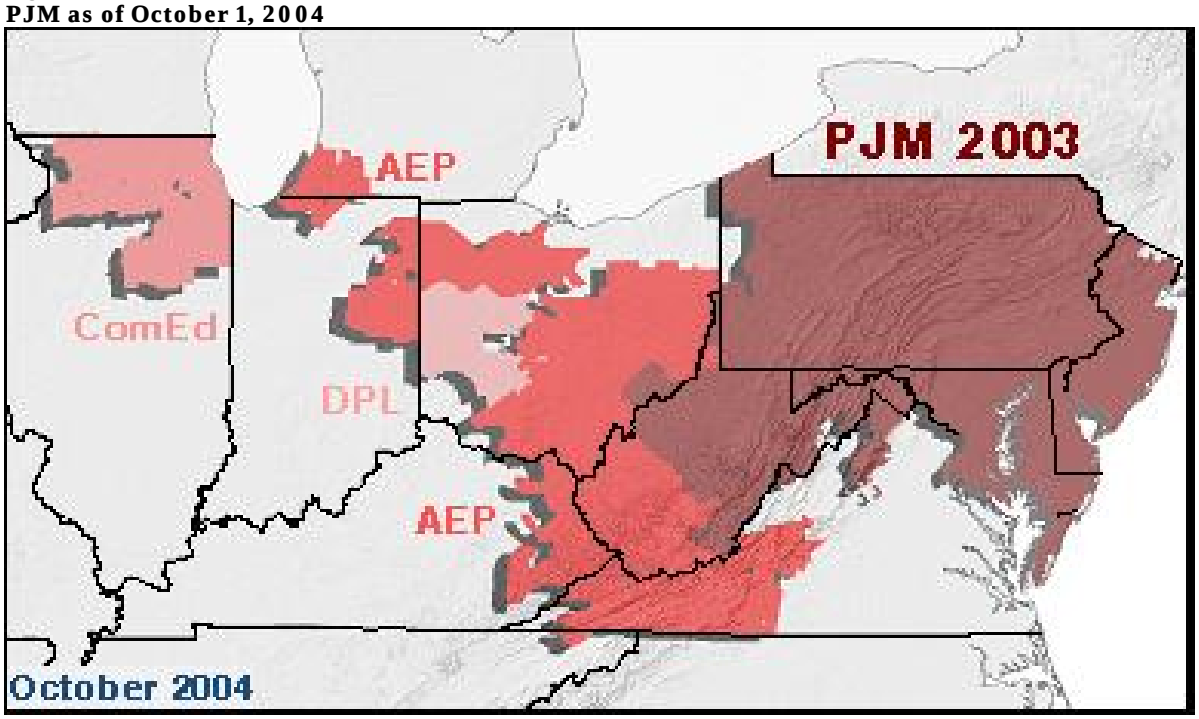
To test the impact of competition in expanded wholesale power markets, Global Energy assessed the impacts of integrating Commonwealth Edison (ComEd), American Electric Power (AEP) and Dayton Power & Light (DPL) into the PJM regional power market. The results of the analysis were that the benefits of expanding the PJM wholesale power market in 2004 produced $85.4 million in annualized production cost savings to wholesale customers in the Eastern Interconnection.

These savings were achieved through reduced transmission barriers, or seams, and the entry of new competitors to the market. FERC decisions have enabled additional market participants such as Exelon's ComEd, AEP, and DPL to join the PJM market. The results of competitive forces at work was immediate, sending price signals throughout the broader regional power markets where power buyers searching for the lowest-cost supply available found them from a now wider universe of generators, marketers and suppliers.

PJM Case Study

The integration of ComEd, AEP and DPL resulted in significant growth in the PJM market. In 2003, PJM comprised 76,000 MW of installed generating capacity and a peak load of 63,000 MW. By October of 2004, PJM comprised 144,000 MW of installed capacity and approximately 107,800 MW of peak load.

Figure RS-11
PJM as of October 1, 2004



SOURCE: Global Energy.

According to an internal analysis performed by PJM of the locational marginal prices (LMPs) in its energy spot markets, the impact of supply and demand fundamentals on market behavior from 2003 to 2004 translated into lower power prices for PJM. While average PJM power prices actually increased by 7.5 percent from 2003 to 2004, PJM showed that the increase was primarily a result of higher fuel prices. PJM performed a fuel adjustment of PJM prices and determined that fuel-adjusted PJM power prices actually declined by 4.2 percent from 2003 to 2004.

Table RS-3
PJM Load-weighted LMP ($ per MWh); 2003 to 2004

	2003	2004	Change
Average LMP	$41.23	$44.34	7.5%
Fuel Adjusted LMP	$41.23	$39.49	-4.2%

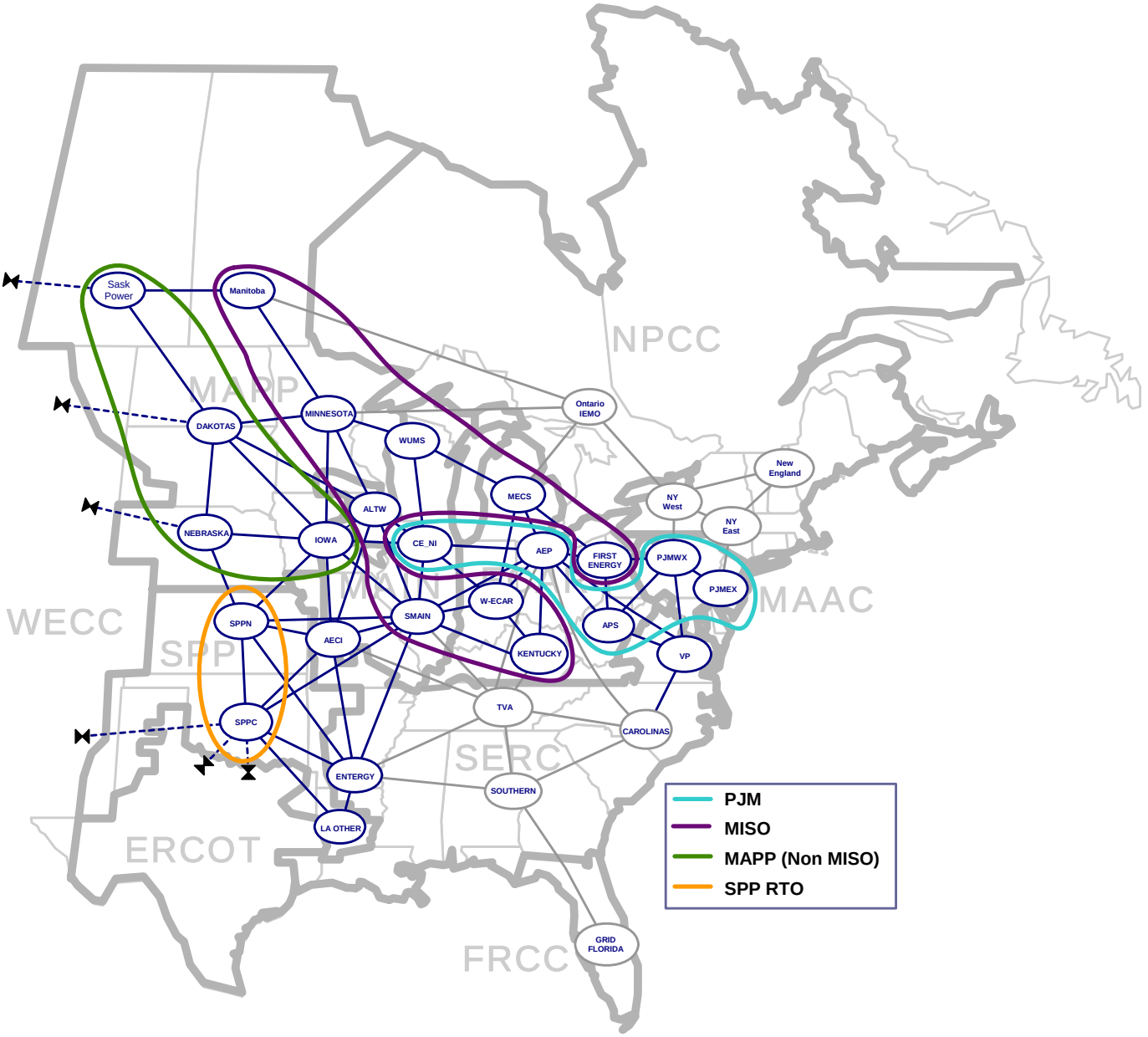
SOURCE: PJM.

Global Energy's PJM Case Study Approach

For this case study, Global Energy modeled the Eastern Interconnection power market to test PJM's conclusions; account for all price determinants not directly related to the integration; and to quantify the impacts associated with the integration of ComEd, AEP, and DPL supply and demand with that of PJM. Global Energy's approach was to analyze and quantify the impact of reducing the seams, in the form of pancaked wheeling charges, between the ComEd, AEP, DPL, and PJM energy markets. By isolating pancaked wheeling charges in its analysis, Global Energy captured the primary structural change to ComEd, AEP, DPL, and PJM's energy market supply and demand.

Global Energy employed a production cost savings model using its **EnerPrise™ Market Analytics** module, which measures production costs, such as fuel and operations and maintenance costs. The study compared the production costs of a "Competition" case, which simulated PJM as it was in 2004, and compared these costs with a "Without Competition" case that would have existed in 2004 if ComEd, AEP, and DPL had not joined PJM. Because Dominion Resources in Virginia did not join PJM until January 1, 2005, it was not included in this analysis.

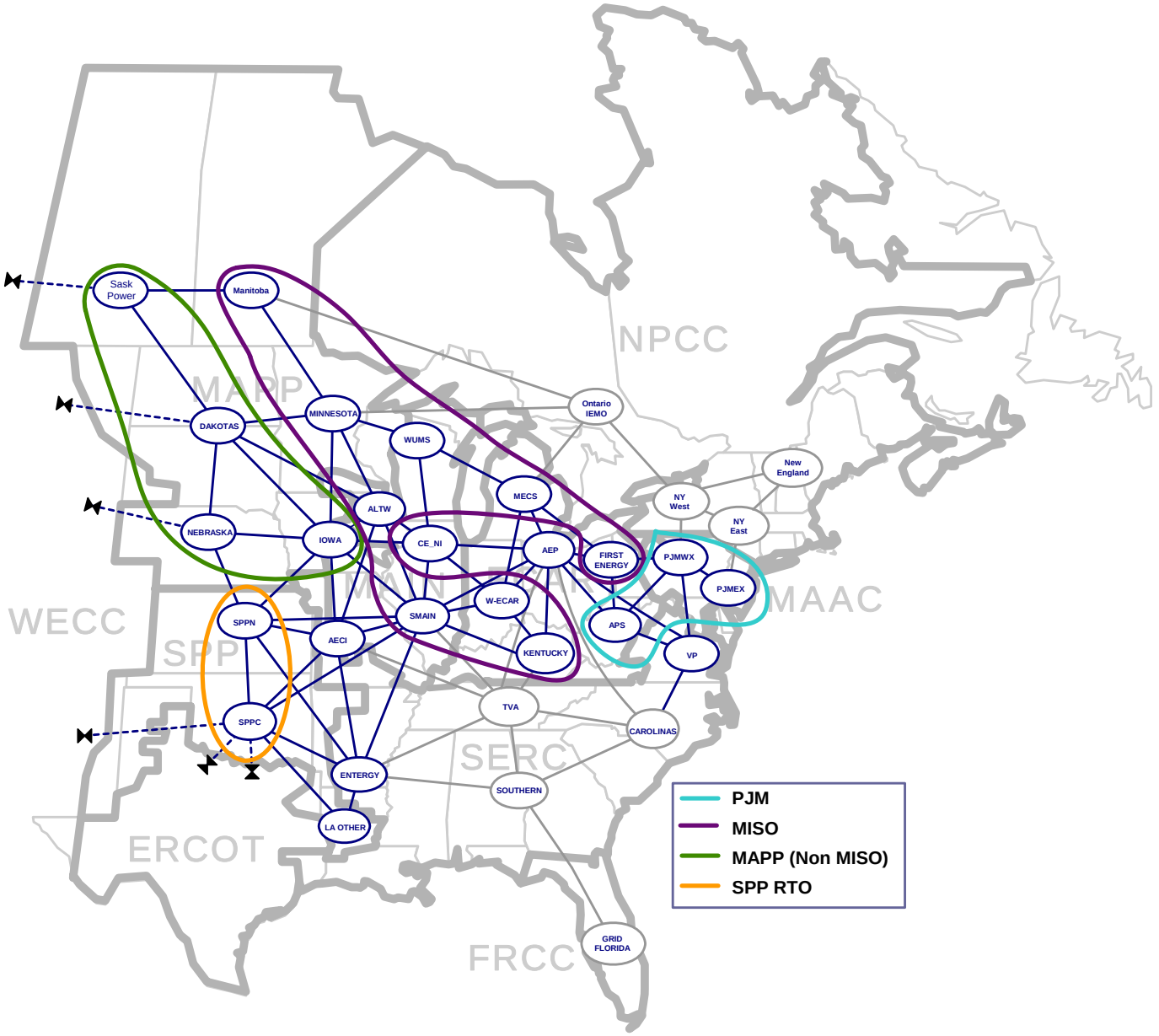
Figure RS-12
Competition Case Market Topology as of October 1, 2004



SOURCE: Global Energy.

In the Without Competition case, the market topology is similar to the Competition case except that ComEd (represented by the CE_NI zone) and AEP and DPL (both represented by the AEP zone) are modeled outside the PJM RTO and pancaked wheeling between the zones is not eliminated.

Figure RS-13
No Competition Case Market Topology for 2004



SOURCE: Global Energy.

Other Potential Benefits of PJM Integration

In addition to the integration of supply and demand in the wholesale energy market, brought about by the reduction of transmission seams between market areas, there are other significant benefits to RTO membership and the integration of energy markets and services in general that were not considered in this study. For example, AEP and DPL are now integrated with APS in a single spinning reserves market.

For regulation services, ComEd, AEP, DPL, and APS are all members of PJM's integrated Western Zone. PJM also coordinates generation and transmission maintenance for the entire RTO, as well as Available Transmission Capacity (ATC). These and other potential benefits are not captured in this analysis.

Summary - Opening PJM to More Electric Supply Competitors Produced Savings

Global Energy's analysis supports PJM's conclusion that, in 2004, changes in supply and demand fundamentals resulted in lower PJM prices in 2004 than 2003. Global Energy quantified the production cost savings associated with the reduction of seams between these ComEd, AEP, DPL, and PJM's energy markets at approximately $29.5 million for PJM in 2004 and $36.4 million for the Eastern Interconnection. Because these savings are based on the actual integration schedule for ComEd (May 2004) and AEP/DPL (October 2004), they represent savings for a partial year of integration in 2004. In order to quantify the benefits associated with a full year of integration, Global Energy performed the analysis as if ComEd, AEP, and DPL joined PJM on January 1, 2004. The estimated annualized production cost savings for PJM and the Eastern Interconnection were $69.8 million and $85.4 million, respectively.

Table RS-4
Estimated Benefits of Energy Market Integration in 2004

2004 Production Cost Savings		
Market Area	Savings based on 2004 PJM Integration Timeline (ComEd in May 2004 and AEP/DPL in October 2004	Annualized Savings (Simulates Integration of ComEd, AEP, DPL on January 1, 2004
PJM	$29.5 MM	$69.8 MM
Eastern Interconnect	$36.4 MM	$85.4 MM

SOURCE: Global Energy.

RTO formation has opened the doors to broad market access for customers, not only to merchant generators and suppliers in a more competitive market environment, but also increasingly to renewable energy from wind and other sources. The annual production cost savings for the PJM expansion will repeat year after year.

Conclusion

Wholesale competition is lowering the costs of providing electric energy to retail customers, just as Congress, FERC, state regulatory commissions, and ratepayer advocates intended. The effect of competition at work has been to shift the expense and risk of building power plants from utility customers to the competitive power plant owner and operator and the competitive power supplier, generally. Electricity customers benefited by more than $15.1 billion over the five-year study period, compared with what they would have been expected to pay under a more traditional utility environment without competition. Had competitive generators and power suppliers not emerged, regulated utilities would have been required to build rate base generating assets and incur the costs to run them. Under wholesale competition, merchant energy suppliers take the risk of building and operating the power plants and selling the energy output to utility players.

These regulated utilities paid the competitive merchant sector more than $13.7 billion for the energy and capacity in the study period. However, in the Without Wholesale Competition alternative, there would have been an additional $28.9 billion in operating expenses. Thus, the consumer benefited by more than $15.1 billion when all the costs, including the cost to buy merchant power, were considered over the more traditional process of allowing utilities to build the assets and incur the increased cost of fuel, O&M, depreciation, taxes, and operating income to run them.

Competitive wholesale energy markets have made substantial progress in giving energy consumers the benefits of competition in lower wholesale energy prices than otherwise would have been available, as well as improved efficiency and better reliability. The change in operating performance between traditional regulated utility power plant performance and competitive generator performance has been dramatic. Nuclear power plant performance improvements, in particular, have turned these plants—once thought to be an albatross around the neck of utilities—into star performers for the utility and competitive plant operators skilled in running a fleet of nuclear plants. Similar performance improvements have been seen in coal-fueled generation, as well.

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Putting competitive power markets to the test resulted in savings of $15.1 billion for consumers over the five-year study period (1999-2003). And given that consumer benefits are tied to merchant power plant investment, the savings will continue to accumulate into the future.