



Monitoring Analytics

COMMONWEALTH OF PENNSYLVANIA
PUBLIC UTILITY COMMISSION

Public Hearing on the Current and Future Wholesale Electricity Markets

TESTIMONY OF JOSEPH E. BOWRING
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Independent Market Monitoring

I am the Independent Market Monitor for PJM. As of August 1, Monitoring Analytics, LLC was formed as an entirely separate and independent company to serve as the independent Market Monitoring Unit under contract with PJM.

The role of the Market Monitoring Unit is to objectively monitor, investigate, evaluate and report on the PJM Markets, including, but not limited to, structural, design or operational flaws in the PJM Markets or the exercise of market power or manipulation in the PJM Markets.

My purpose is to briefly review the history of prices in the PJM market since its inception in 1999. I will address energy and capacity prices and the net revenues that result. I will review expectations for future prices, based on market information. I will review the implications of all these measures for an evaluation of competition.

Prices are a key outcome of markets. Prices vary across hours, days and years for multiple reasons. In a competitive market, prices are directly related to the marginal cost of the most expensive unit(s) required to serve load. In PJM, short term variations in energy prices are a function of multiple factors including network conditions, short term supply and demand conditions and input costs. Long term trends in energy prices are a function of overall supply and demand conditions and input costs. In both cases, prices convey information about market conditions to which market participants respond.

LMP in PJM: 1999 to 2008

Prices in PJM have risen, although not steadily, since the inception of LMP-based markets with market-based offers from generating units on April 1, 1999. Table 1 shows average real-time annual, load-weighted, average prices from 1999 through September 2008. Figure 1 shows both real-time and day-ahead annual average prices from 1999 through September 2008.

Table 1 PJM real-time, annual, load-weighted, average annual LMP (Dollars per MWh): 1999 through September 2008

	Real-Time, Load-Weighted, Average LMP			Year-to-Year Change		
	Average	Median	Standard Deviation	Average	Median	Standard Deviation
1999	\$34.07	\$19.02	\$91.49	NA	NA	NA
2000	\$30.72	\$20.51	\$28.38	(9.8%)	7.8%	(69.0%)
2001	\$36.65	\$25.08	\$57.26	19.3%	22.3%	101.8%
2002	\$31.60	\$23.40	\$26.75	(13.8%)	(6.7%)	(53.3%)
2003	\$41.23	\$34.96	\$25.40	30.5%	49.4%	(5.0%)
2004	\$44.34	\$40.16	\$21.25	7.5%	14.9%	(16.3%)
2005	\$63.46	\$52.93	\$38.10	43.1%	31.8%	79.3%
2006	\$53.35	\$44.40	\$37.81	(15.9%)	(16.1%)	(0.8%)
2007	\$61.66	\$54.66	\$36.94	15.6%	23.1%	(2.3%)
2008	\$77.27	\$66.73	\$43.80	25.3%	22.1%	18.6%

Figure 1 PJM day-ahead and real-time load-weighted, average annual LMP: 1999 through September 2008

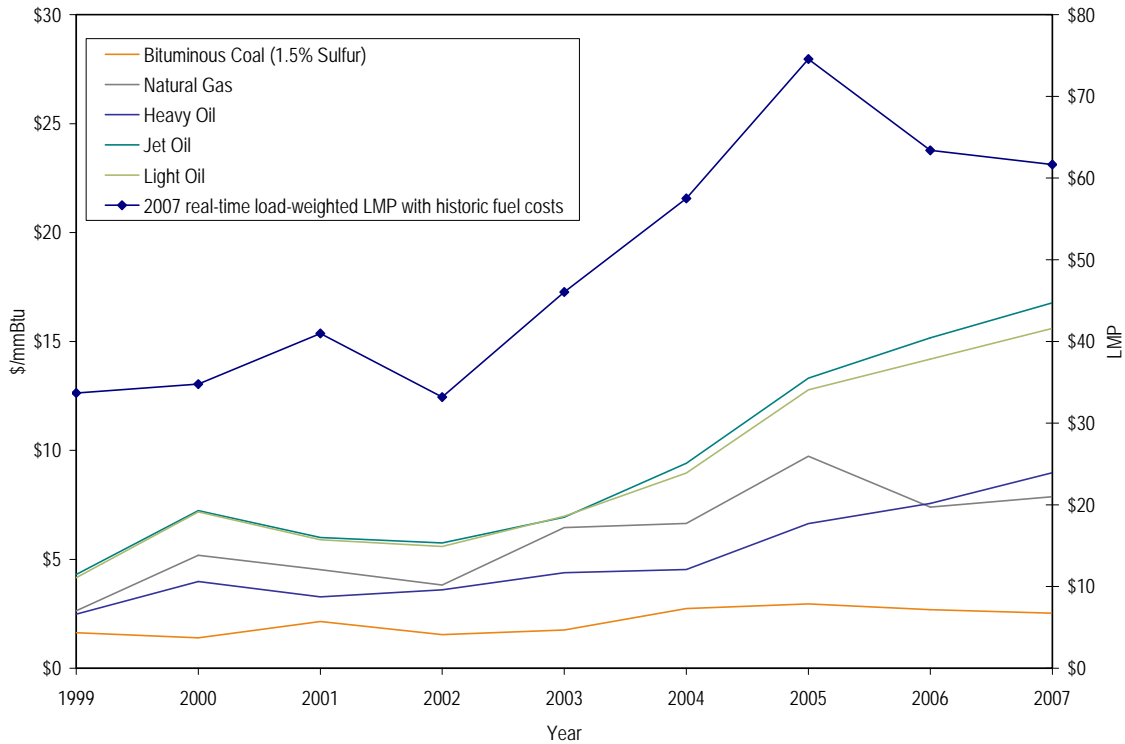


Prices have risen for a number of reasons, but the most fundamental is the price of fuel. Fuel costs comprise between 80 and 90 percent of the marginal cost of generation and are the most significant input cost for power generation. Fuel costs explain the bulk of annual price increases since 1999. Table 2 shows what the 2007 load-weighted LMP would have been using the fuel costs for each year from 1999 through 2007. For example, if fuel prices in 2007 were the same as in 1999, LMP would have been \$33.68 in 2007 instead of \$61.66. Note that this approach changes only the fuel costs and assumes exactly the same dispatch and network conditions in each case. Figure 2 compares these fuel cost adjusted results to fuel costs for the same period.

Table 2 2007 real-time, load-weighted LMP with historic fuel costs

Calendar year	2007 real-time, load-weighted LMP with historical fuel costs
1999	\$33.68
2000	\$34.76
2001	\$40.97
2002	\$33.19
2003	\$46.05
2004	\$57.51
2005	\$74.55
2006	\$63.39
2007	\$61.66

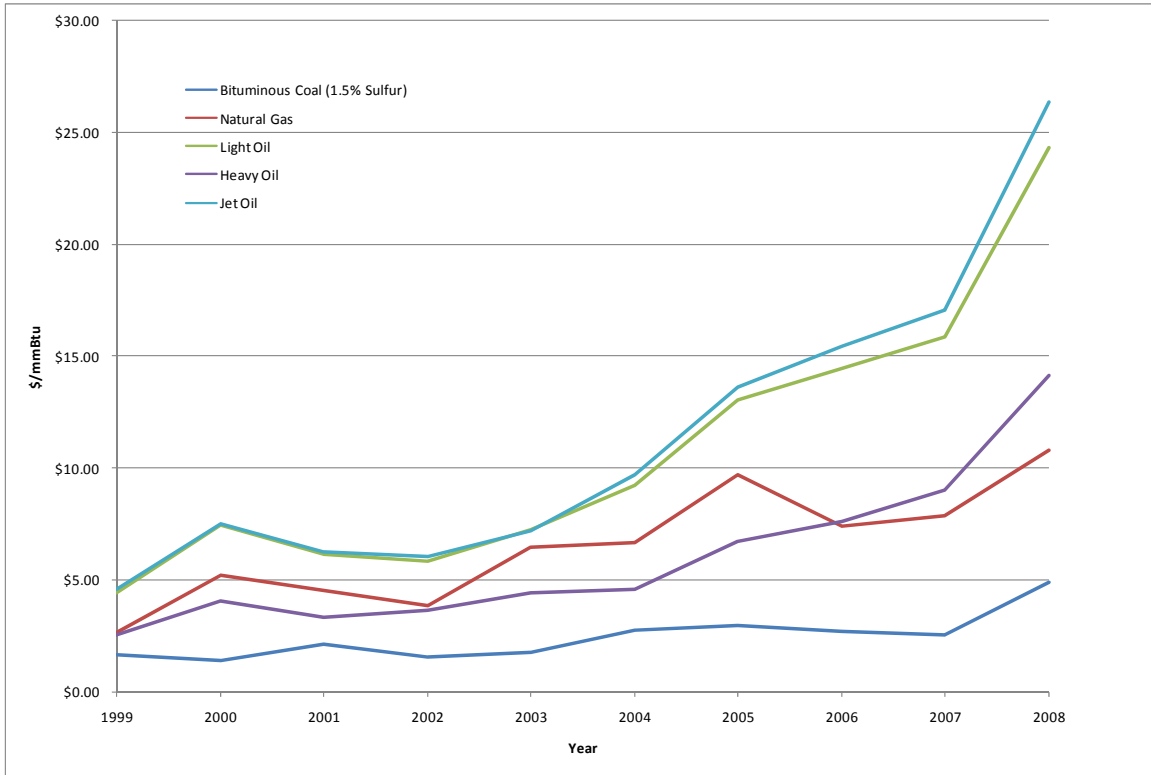
Figure 2 2007 real-time, load-weighted LMP with historic fuel costs



Fuel Costs: 1999 to 2008

The prices of all fuels have risen over the period from 1999 through September 2008. The price increases have been seasonal and long term. Coal and natural gas are the dominant fuels in PJM, as they are the marginal fuels and therefore set the price. Coal prices have increased by more than 200 percent since 1999 and increased by 94 percent in the first nine months of 2008. The price of natural gas has increased by more than 300 percent since 1999 and 38 percent in the first nine months of 2008.

Figure 3 Average annual fuel prices: 1999 through September 2008



LMP and Fuel Prices: 2008

Fuel prices have declined since June 2008. Energy prices have also declined since June 2008.

Figure 4 Average monthly fuel prices: 2007 through September 2008

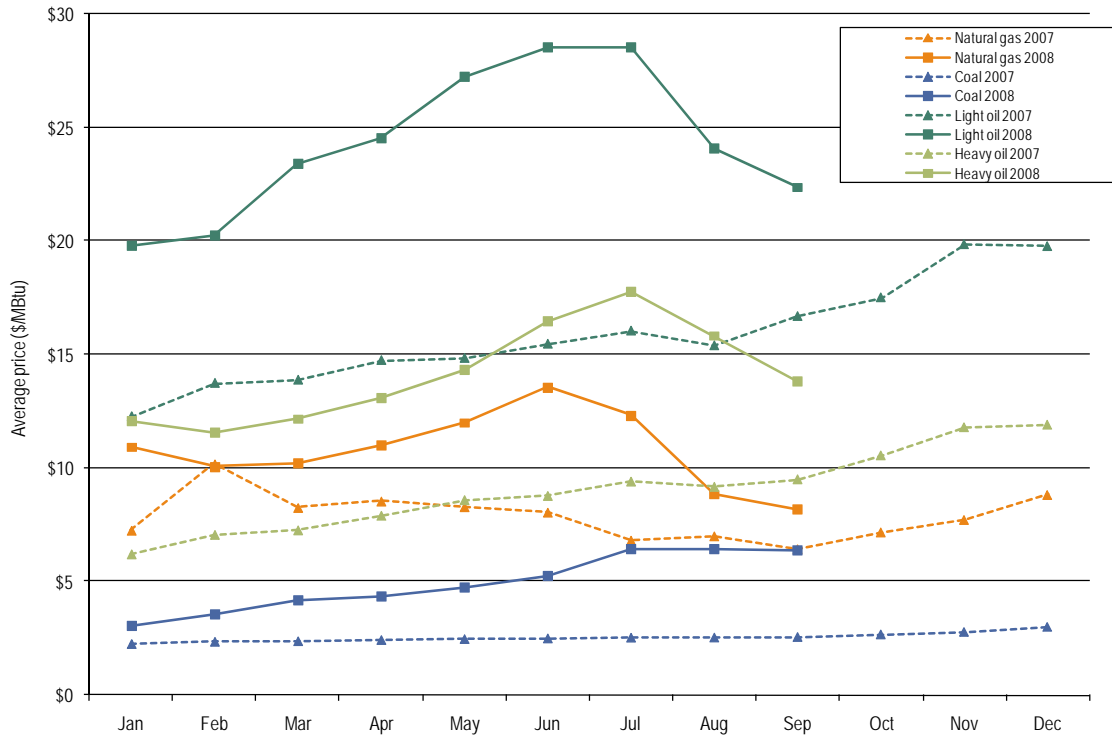
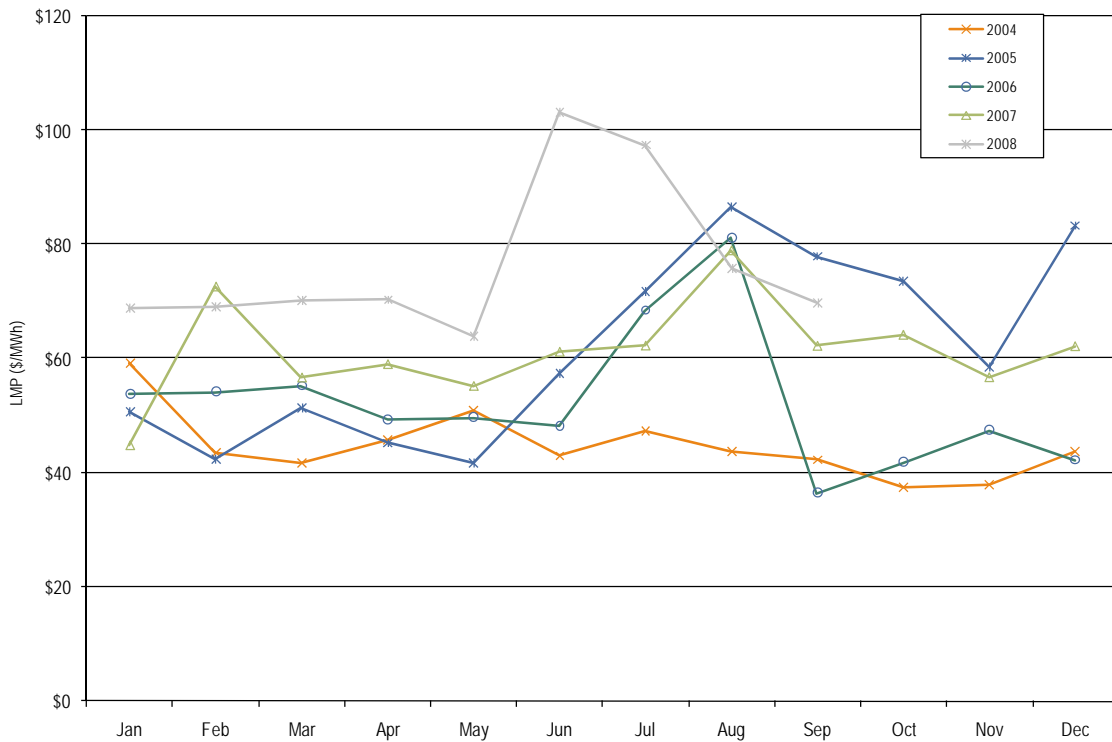


Figure 5 PJM real-time, load-weighted, average monthly LMP: 2004 through September 2008



LMP and Fuel Prices: Forward Curves

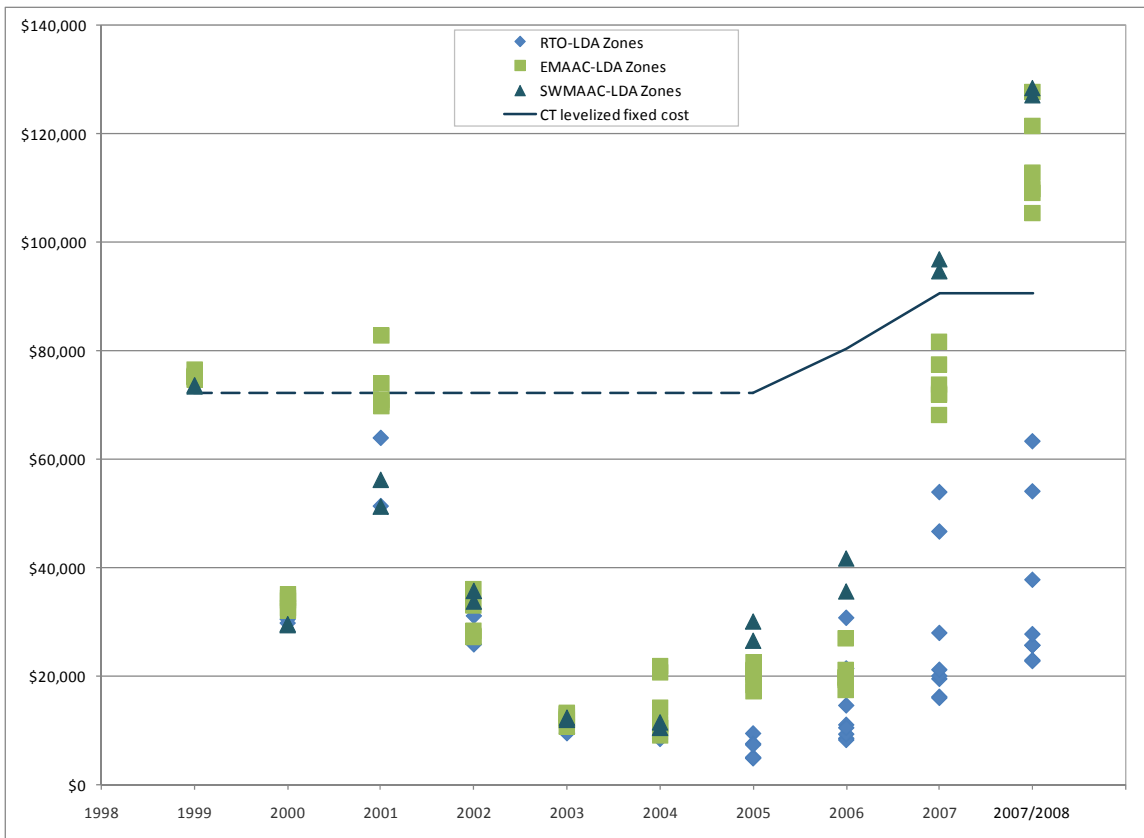
Despite the longer term trend, the prices of fuel have declined from their recent levels and are expected to remain below recent levels. Forward prices for coal are lower than recent coal prices. Forward prices for natural gas are lower than recent natural gas prices. Forward prices for electricity in PJM are lower than recent PJM energy prices.

Net Revenue

Net revenue is an indicator of generation investment profitability and thus is a measure of overall market performance as well as a measure of the incentive to invest in new generation to serve PJM load. Higher prices do not necessarily translate into higher net revenues for generation owners in the presence of higher fuel costs. Net revenue from PJM markets has generally been below the level required to cover the full costs of new generation investment for all unit types for the entire market period prior to the introduction of RPM.

The contribution of revenues from RPM has changed that result for the eastern zones of PJM for the first full year of RPM revenues (2007-2008 delivery year). Figure 6, Figure 7 and Figure 8 show the relationship between zonal net revenues and annual fixed costs for each technology type, combustion turbine (CT), combined cycle (CC) and coal plant (CP).¹ RPM revenues have significantly changed the incentives for new capacity to enter the markets for the eastern zones included in the EMAAC and SWMAAC LDAs. Net revenues in the rest of PJM remain below the level required to cover the costs of new investment.

Figure 6 CT Net revenue from all markets and fixed costs



¹ The MMU calculated the annual, levelized fixed costs for each technology type in 2005, 2006 and 2007. The dotted line in the net revenue figures extends the 2005 levelized fixed cost to 1999 as a reference only.

Figure 7 CC Net revenue from all markets and fixed costs

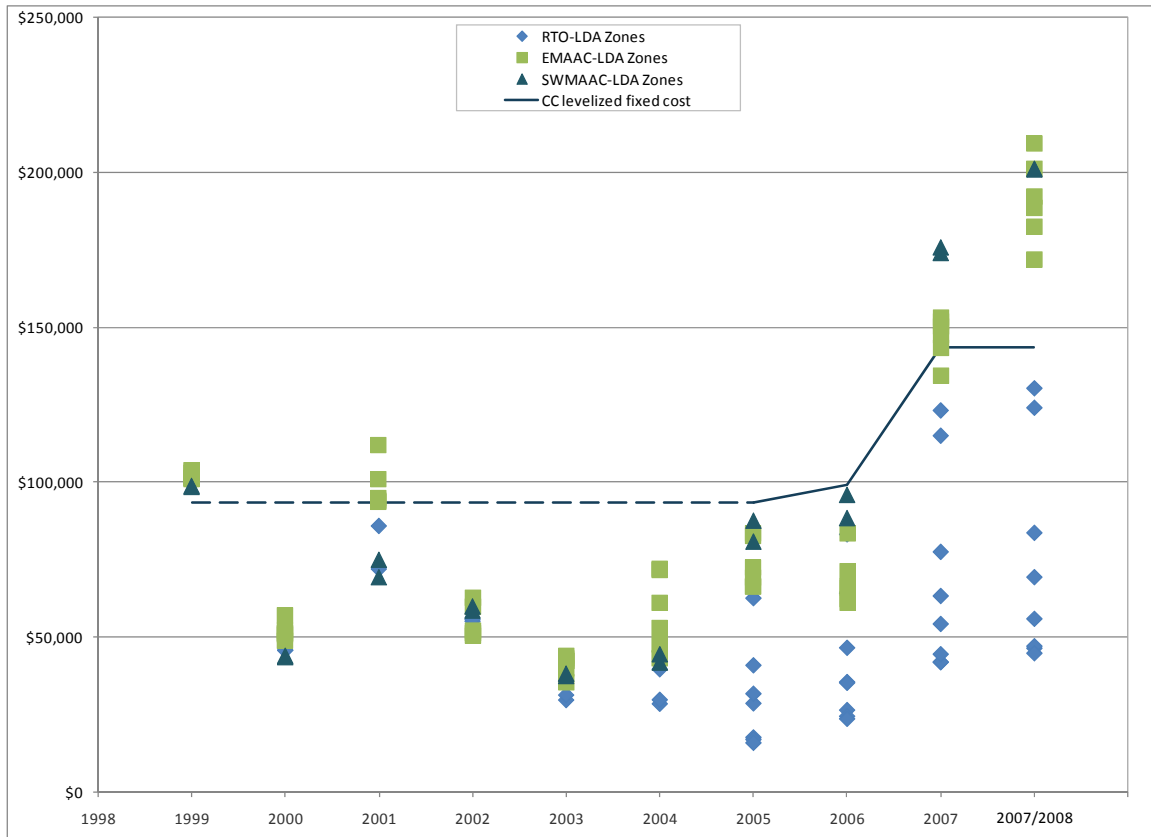
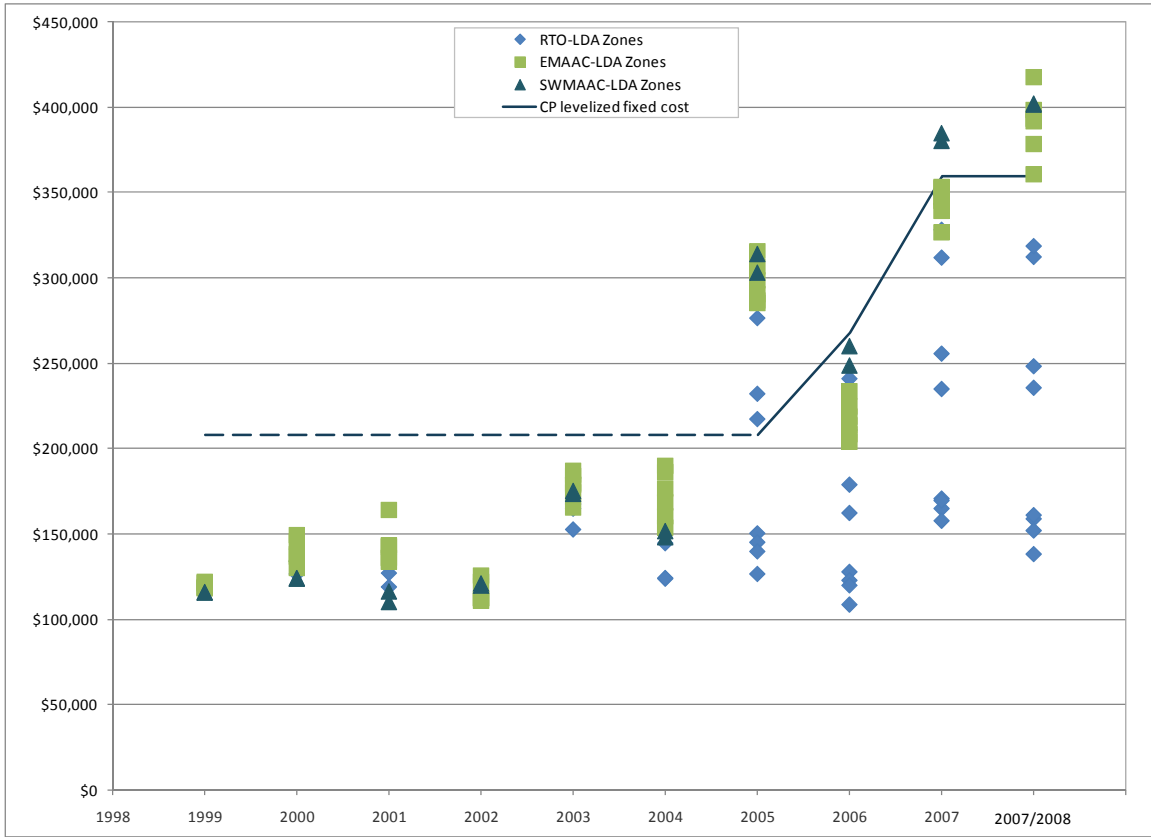


Figure 8 CP Net revenue from all markets and fixed costs



Capacity Prices

Capacity prices in PJM showed a substantial decline from 1999 through the introduction of the RPM capacity market design in June 2007. Capacity prices have been substantially higher under RPM and have shown locational differences.

Table 3 Capacity prices: 1999 through May 31, 2012

	CCM Combined Markets Weighted-Average Price (\$ per MW-day)	RPM Clearing Price (\$ per MW-day)			
		RTO	EMAAC	SWMAAC	MAAC+APS DPL- South
1999	\$52.24				
2000	\$60.55				
2001	\$95.34				
2002	\$33.40				
2003	\$17.51				
2004	\$17.74				
2005	\$6.12				
2006	\$5.73				
Jan 07 - May 07	\$3.21				
Jun 07 - May 08		\$40.80	\$197.67	\$188.54	
Jun 08 - May 09		\$111.92	\$148.80	\$210.11	
Jun 09 - May 10		\$102.04		\$237.33	\$191.32
Jun 10 - May 11		\$174.29			\$178.27
Jun 11 - May 12		\$110.00			

Competition

Given higher fuel prices, higher electricity prices do not mean that there is something wrong with the wholesale power market. In a perfectly competitive market, changes in input prices will change the price of the final product. Nonetheless, all market participants need to be assured that markets are competitive and that higher prices are not the result of the exercise of market power. This includes energy markets, capacity markets and ancillary services markets. The ultimate test of a competitive market design is whether market participants invest in response to incentives endogenous to the competitive market design and not in reliance on the potential exercise of market power. The net revenue data show that net revenues from all markets prior to RPM were insufficient to cover the costs of new generation. That has changed with the introduction of RPM, in particular for the eastern zones of PJM.

The most direct measure of the competitiveness of markets is markup. Markup is the difference between the price of the marginal unit(s) and the marginal cost of the marginal unit(s). If the markup is zero, generation owners are behaving in a perfectly competitive manner. Higher markups are cause for more detailed examination. Markup by a generator with structural market power means something quite different than markup by a generator in the context of scarcity. The markups in PJM markets are generally low. Market results support the conclusion that prices in PJM are set, on average, by units operating at, or close to, their marginal costs. The markups going forward will be reduced as the result of the Federal Energy Regulatory Commission's recent decision to remove the exemption from offer capping for certain units and interfaces. The existence of strong, clear market power mitigation rules is also essential to assuring all market participants that market outcomes are and will remain competitive. PJM's application of the three pivotal supplier test in the energy and capacity markets provides that

assurance. PJM's recent filing to extend the application of the three pivotal supplier test to the regulation market is also a positive development. The development of clear scarcity pricing rules that are explicitly coordinated with the capacity market results will ensure all market participants that high prices reflect actual supply and demand conditions rather than market power.

I continue to conclude that the PJM Energy Market results are competitive and that the PJM Capacity Market results are competitive.