# GETTING THE PRICES RIGHT IN PJM
## A Summary: April 1998 through September 1999

October 30, 1999

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*The connection between prices and operating decisions often receives cursory treatment in the electricity restructuring process. Market participants want flexibility and choice, but object to consistent pricing as too complex. This is a mistake, and produces only an illusion of simplicity. If customers have flexibility in the choice of generation, spot purchases, bilateral transactions, and so on--then prices matter and competitive prices should reflect marginal costs. In large part, control of operating decisions is moving from engineers motivated by principles of technical efficiency, to market participants motivated by prices and profits. This is a major purpose of electricity restructuring--to change the locus of such key decisions. If we want the market to be guided by prices, and we expect and intend for people to take these prices seriously, it becomes important to follow the usual advice to "get the prices right." The experience developing in the first system in the United States with a consistent market pricing system underscores the point and provides empirical heat to help dispel the fog of confusion covering one of the central problems in electricity markets: pricing to allocate use of scarce transmission capacity.*

## SUMMARY

This graphical summary supplements the more discursive analysis of the pricing experience in the Pennsylvania-New Jersey-Maryland Interconnection (PJM), as found in:

William W. Hogan, "GETTING THE PRICES RIGHT IN PJM. Analysis and Summary: April 1998 through March 1999, The First Anniversary of Full Locational Pricing," April 2, 1999, available through the author's web page; and the earlier discussion in the Electricity Journal, September 1998.

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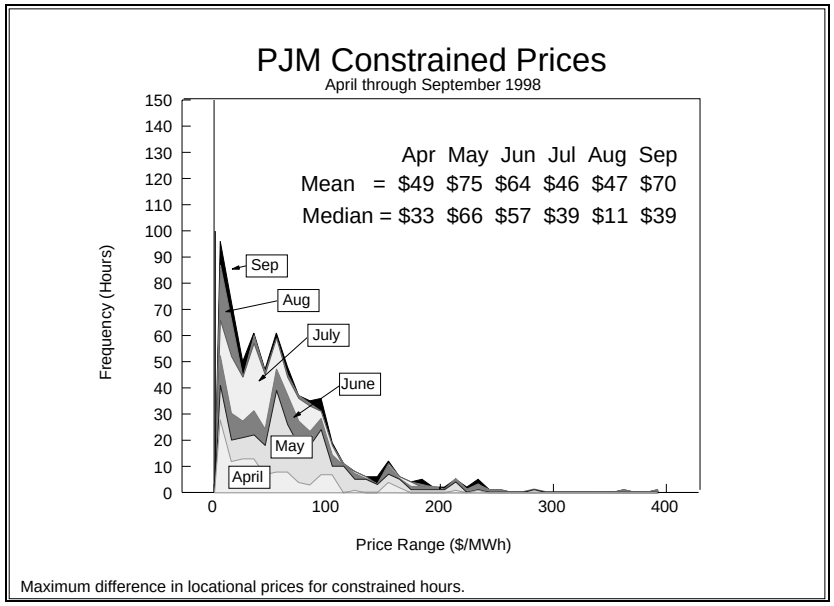
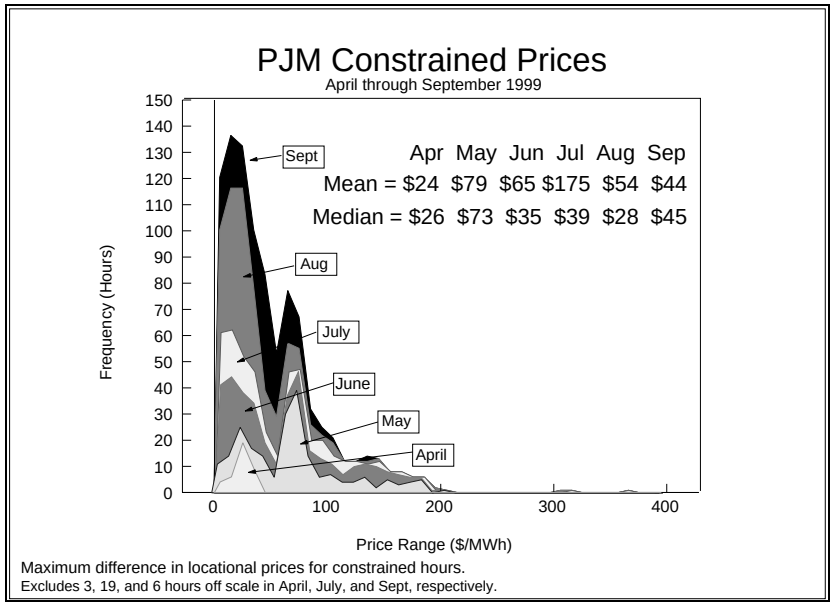
## April through September, 1999

The PJM system uses a bid-based, security-constrained, economic dispatch for the balancing market. When the system confronts transmission constraints, prices can differ at every location. The prices reported by PJM cover approximately two thousand locations. The data for the constrained hours reveal the sometimes substantial effects of transmission congestion. The focus here is on this transmission congestion and locational differences. However, even without congestion, prices have been volatile; but that is another story.

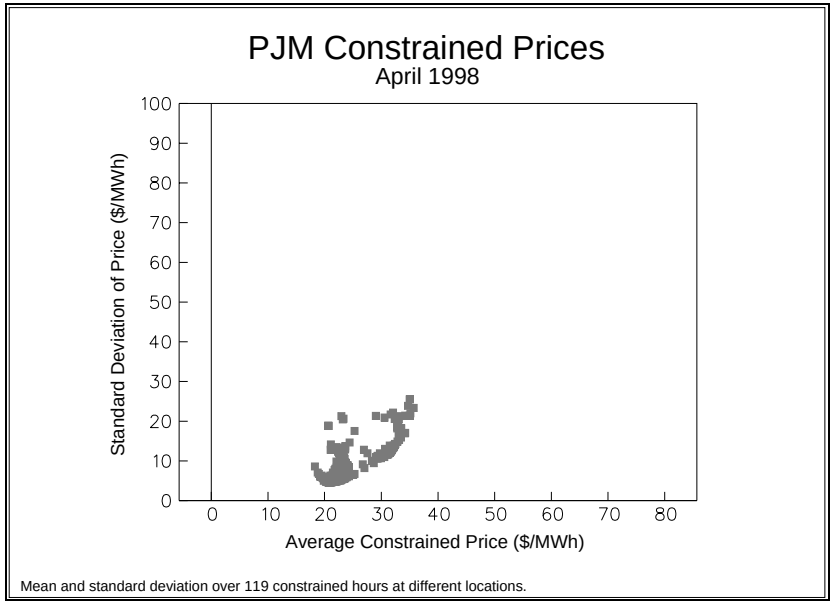
The data for April through September, 1999, reinforce the information from the first year of operations. Although prices and their distribution were not identical with those of the corresponding months in the previous year, they were similar. April was less constrained than a year ago; May and June were about the same as before. July and August were more constrained.

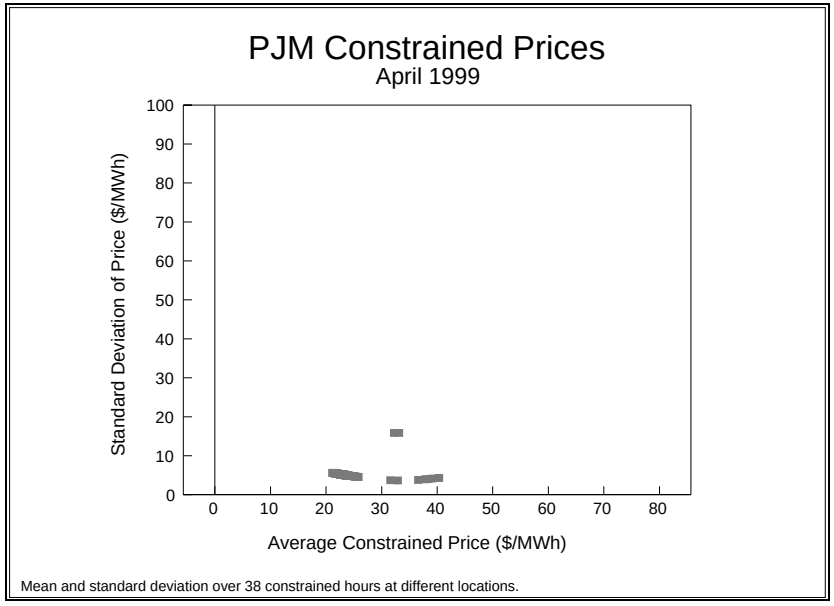


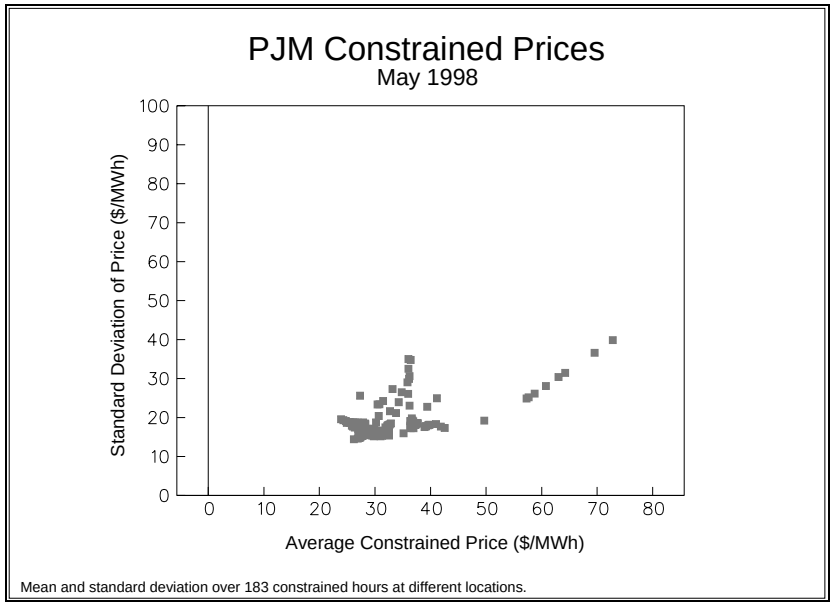
The prices were broadly dispersed. Notably, as of April 1999, generators within PJM were eligible to remove themselves from bid caps, but this did not appear to have much immediate impact on average locational price differences. One simple way to summarize the data is to examine both the average and the variation of prices at different locations during constrained hours. If two locations always have the same prices, then the two averages of prices over the period would be the same and the two standard deviations of the prices would be the same. These conditions would be necessary, but not sufficient, for the prices to be the same at the two locations. Hence, this straightforward calculation gives a lower bound on the number of different locations with sometimes unique prices.

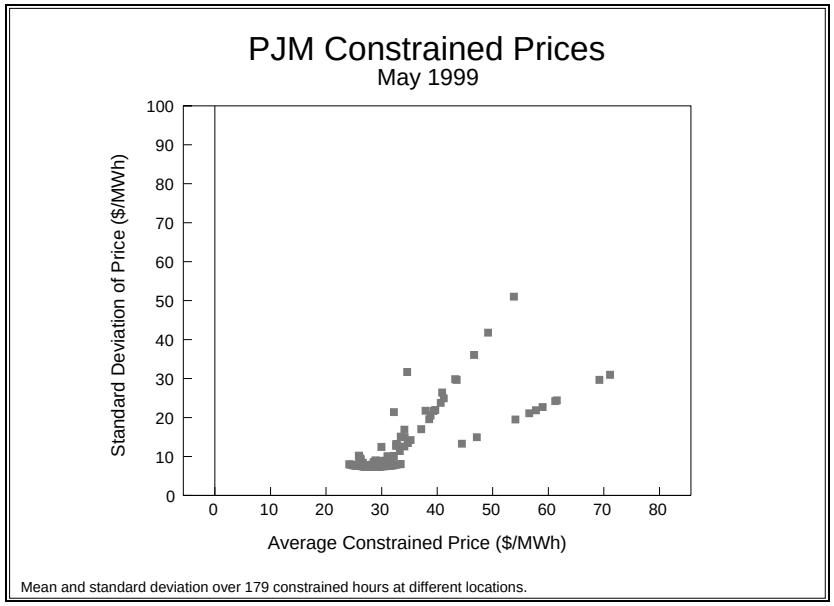
April of 1999 found only 38 constrained hours, with less dispersion in prices than the previous year.



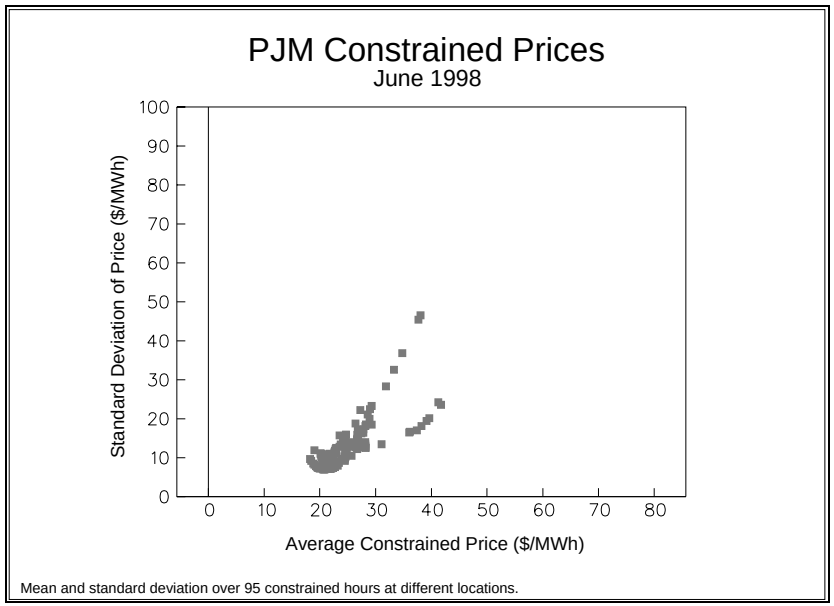



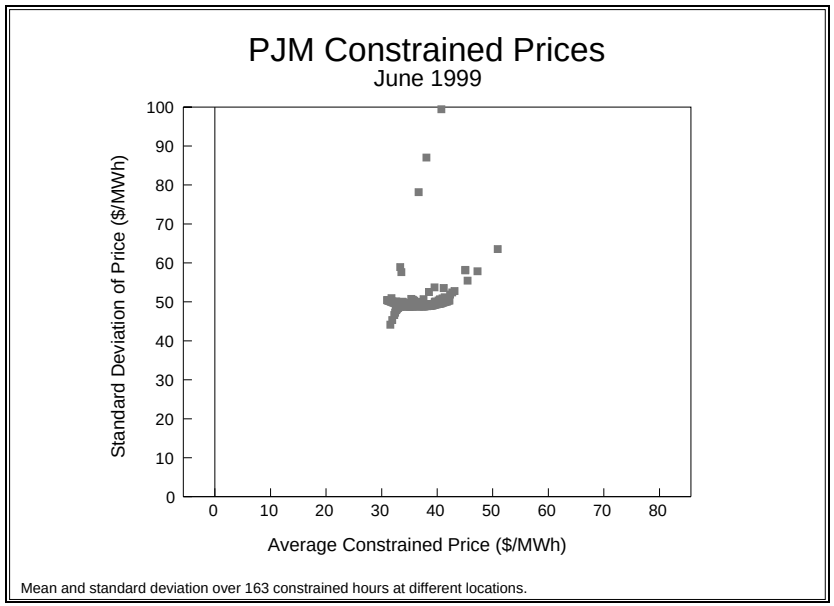
May of 1999 found 179 constrained hours with price dispersion similar to the previous year.



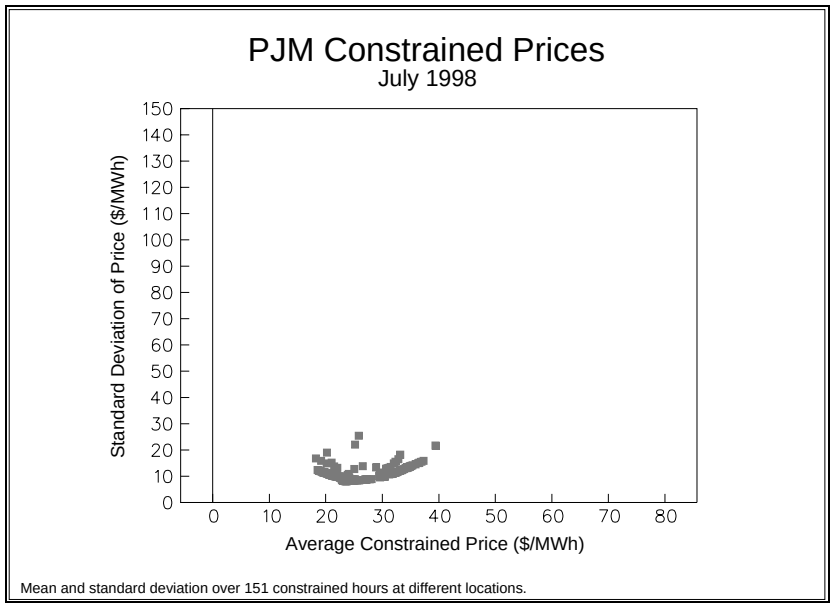



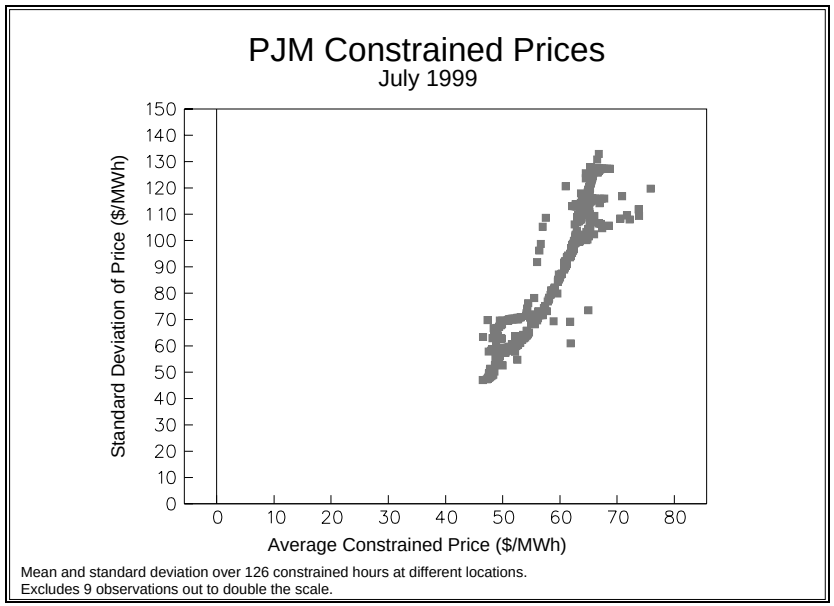
June of 1999 found 163 constrained hours compared to 95 hours the year before. Average constrained prices were higher, and the much higher standard deviation of prices in 1999 indicates greater volatility. The relative dispersion of prices across locations is roughly similar to the previous year.



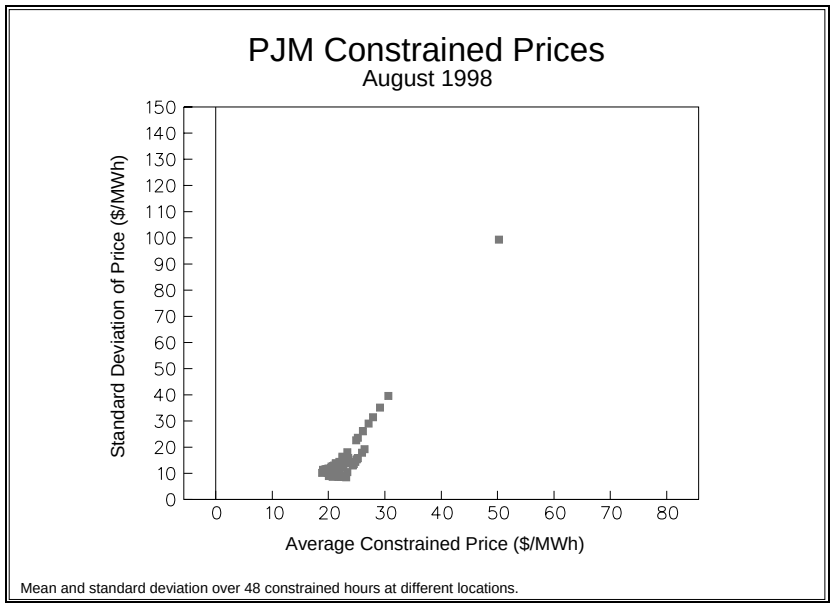
July of 1999 found 126 constrained hours compared to 151 hours the year before.[2] However, again average constrained prices were significantly higher, and the much higher standard deviation of prices in 1999 indicates greater volatility than seen one year before. (Note the change in scale compared to the previous figures.)

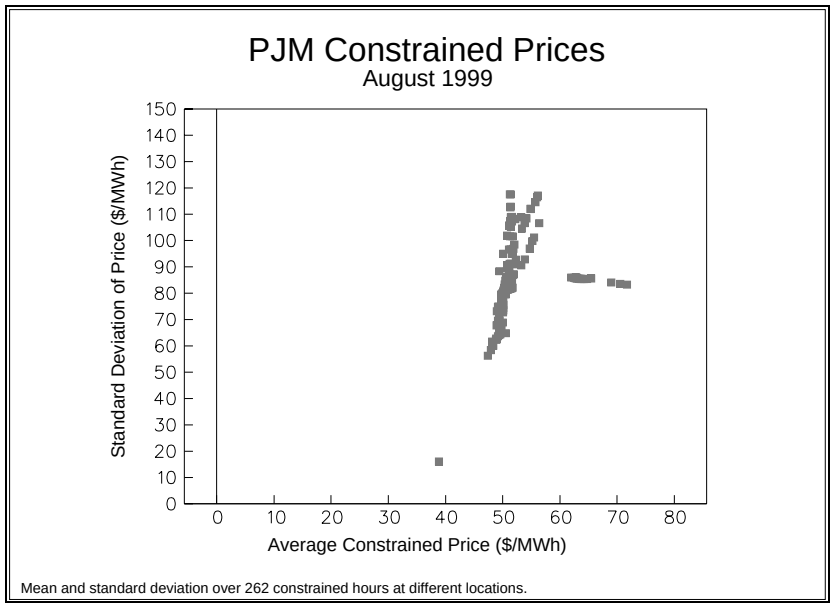


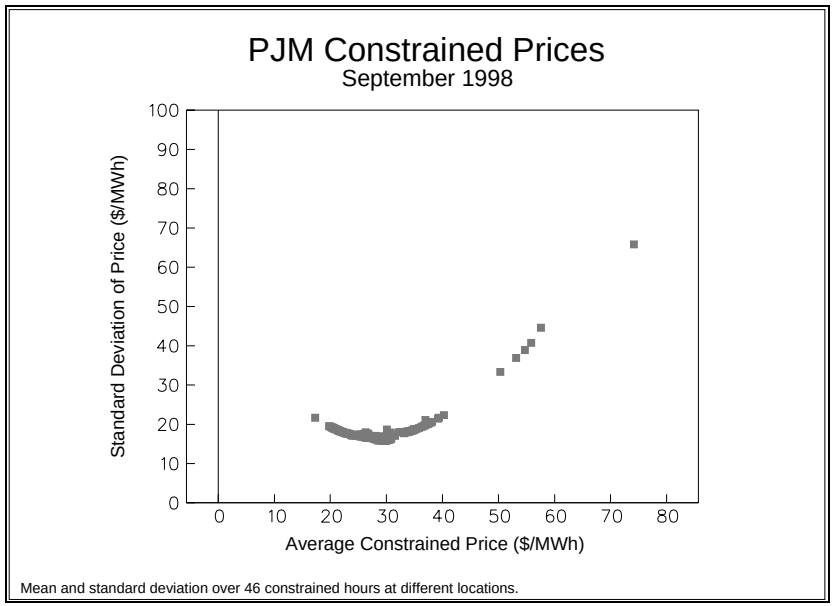

[2] In July 1999, the PJM ISO's responsibilities expanded to include monitoring and control from some additional lower voltage transmission lines. This would increase the likelihood of reporting congestion compared to earlier dates when constraints on the same lines were not included.

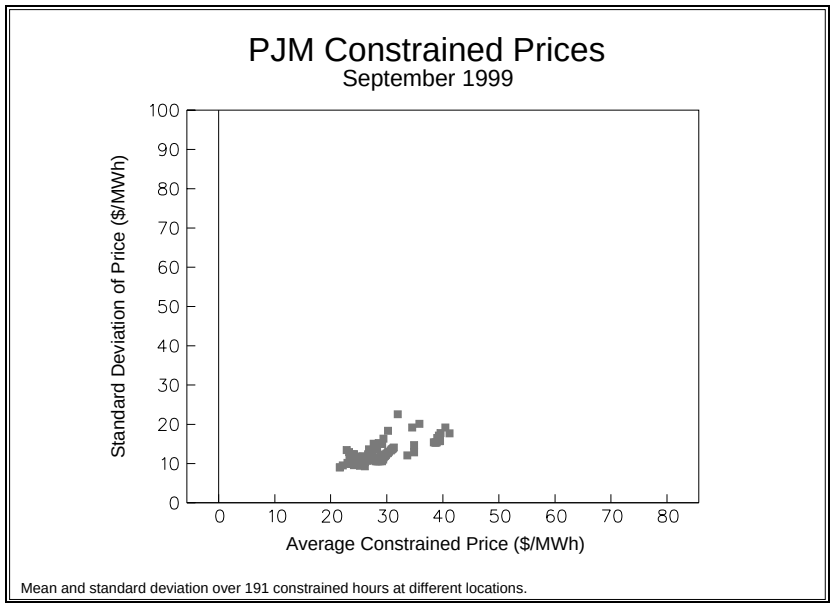
August of 1999 found 262 constrained hours compared to 48 hours the year before. Again average constrained prices were higher, and the much higher standard deviation of prices in 1999 indicates greater volatility. (Note the change in scale compared to the previous figures through June.)



September of 1999 found 191 constrained hours compared to 46 hours the year before.[3] Here average constrained prices were lower than the previous year, and the lower standard deviation of prices in 1999 indicates somewhat lower volatility. (Note here the change in scale back to that of the previous figures through June.)



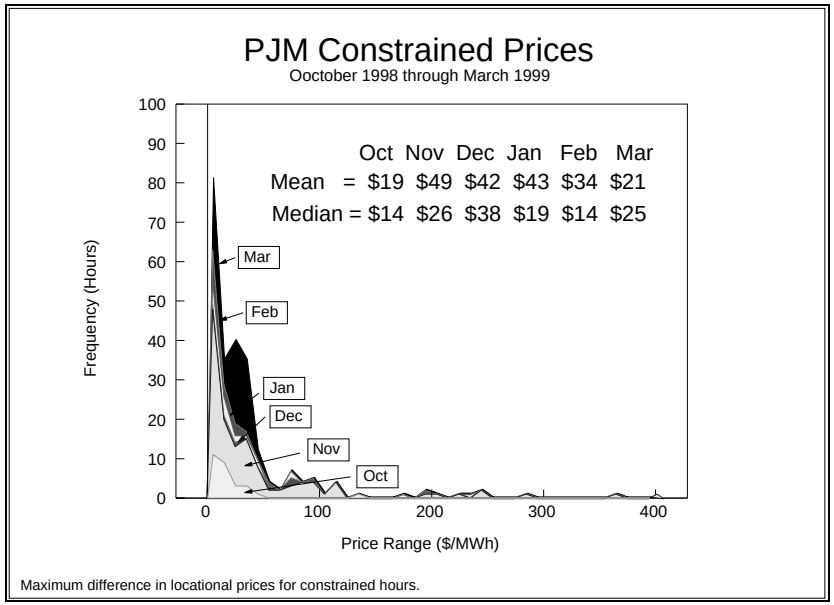



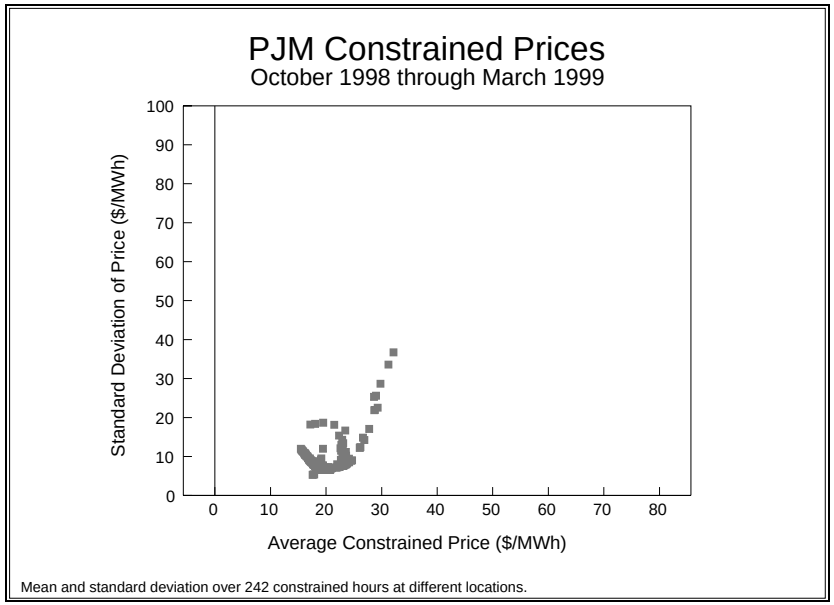

[3] In September 1999, the PJM ISO added approximately 14 new location definitions.

The degree of dispersion gives some indication of the number of "zones" that would be required to capture the real differences in prices. Defining the standard for "close enough" and drawing the boundaries would be contentious, but the controversy may be moot. Using a threshold of $1 per MWh over the month for the maximum difference of average prices or standard deviations across a zone, the required zones would be as indicated in the following table. Note that the zones would not be the same in each month; hence, to have stable zones over an extended period would require at least hundreds of separate zones. This provides no simplification, as has been recognized in PJM. Using the prices for the actual nodes is the simple solution that allows for choice, reinforces market incentives, and provides the opportunity for many other innovations such as financial transmission rights auctioned for the full capacity of the system.

**Required Zones in PJM**

| | Apr | May | Jun | Jul | Aug | Sept | Oct-Mar |
|---|---|---|---|---|---|---|---|
| 1998-1999 | 94 | 83 | 75 | 57 | 52 | 64 | 61 |
| 1999-2000 | 22 | 63 | 60 | 210 | 96 | 62 | |


PJM Constrained Prices
Ooctober 1998 through March 1999
Oct Nov Dec Jan Feb Mar
Mean = $19 $49 $42 $43 $34 $21
Median = $14 $26 $38 $19 $14 $25
Mar
Feb
Jan
Dec
Nov
Oct
Frequency (Hours)
Price Range ($/MWh)
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
Maximum difference in locational prices for constrained hours.


PJM Constrained Prices
October 1998 through March 1999
Standard Deviation of Price ($/MWh)
Average Constrained Price ($/MWh)
0
10
20
30
40
50
60
70
80
90
100
0
10
20
30
40
50
60
70
80
Mean and standard deviation over 242 constrained hours at different locations.

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