Challenges for Market Monitors

Monitoring Analytics, LLC
Independent Market Monitor for PJM

Harvard Electricity Policy Group
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Market Monitor

Monitoring Analytics

Challenges

- Role of market monitors
- Competitiveness/viability of markets
- Environmental regulations and markets
- Demand side resources
- Buyer side market power
- Interface pricing
- Merger analysis
- Favored technologies and markets

Table 2-42 Components of PJM real-time, annual, load-weighted, average LMP: Calendar year 2010

Element	Contribution to LMP	Percent
Coal	$19.07	39.4%
Gas	$18.12	37.5%
10% Cost Adder	$4.19	8.7%
VOM	$2.64	5.5%
Oil	$1.78	3.7%
NO_x	$0.86	1.8%
NA	$0.57	1.2%
CO_2	$0.40	0.8%
Markup	$0.31	0.6%
SO_2	$0.25	0.5%
FMU Adder	$0.11	0.2%
Dispatch Differential	$0.06	0.1%
Shadow Price Limit Adder	$0.03	0.1%
Municipal Waste	$0.01	0.0%
Offline CT Adder	$0.00	0.0%
M2M Adder	($0.00)	(0.0%)
Wind	($0.02)	(0.0%)
Unit LMP Differential	($0.03)	(0.1%)
Total	$48.35	100.0%

Table 2-7 Annual offer-capping statistics: Calendar years 2006 to 2010

	Real Time		Day Ahead	
	Unit Hours Capped	MW Capped	Unit Hours Capped	MW Capped
2006	1.0%	0.2%	0.4%	0.1%
2007	1.1%	0.2%	0.2%	0.0%
2008	1.0%	0.2%	0.2%	0.1%
2009	0.4%	0.1%	0.1%	0.0%
2010	1.2%	0.4%	0.2%	0.1%

Table 2-8 Real time offer-capped unit statistics: Calendar year 2010

Run Hours Offer-Capped, Percent Greater Than Or Equal To:	2010 Offer-Capped Hours					
	Hours ≥ 500	Hours ≥ 400 and < 500	Hours ≥ 300 and < 400	Hours ≥ 200 and < 300	Hours ≥ 100 and < 200	Hours ≥ 1 and < 100
90%	2	0	0	0	1	13
80% and < 90%	**0**	**2**	**1**	**7**	**8**	**13**
75% and < 80%	0	0	0	0	3	7
70% and < 75%	**3**	**0**	**0**	**0**	**4**	**13**
60% and < 70%	0	1	1	1	0	34
50% and < 60%	**1**	**0**	**0**	**5**	**0**	**22**
25% and < 50%	4	2	4	9	17	41
10% and < 25%	**2**	**0**	**0**	**4**	**2**	**37**

Cumulative real time offer-capped unit statistics: Calendar year 2010

Run Hours Offer-Capped, Percent Greater Than Or Equal To:	2010 Offer-Capped Hours					
	Hours ≥ 500	Hours ≥ 400	Hours ≥ 300	Hours ≥ 200	Hours ≥ 100	Hours ≥ 1
>= 90%	2	2	2	2	3	16
>= 80%	**2**	**4**	**5**	**12**	**21**	**47**
>= 75%	2	4	5	12	24	56
>= 70%	**5**	**7**	**8**	**15**	**31**	**74**
>= 60%	5	8	10	18	34	113
>= 50%	**6**	**9**	**11**	**24**	**40**	**139**
>= 25%	10	15	21	43	76	218
>= 10%	**12**	**17**	**23**	**49**	**84**	**264**

Table 3-36 Proportion of units recovering avoidable costs from energy and ancillary markets as well as total markets for calendar years 2009 and 2010

	2009		2010	
Technology	Units with full recovery from Energy Markets	Units with full recovery from all markets	Units with full recovery from Energy Markets	Units with full recovery from all markets
CC - NUG Cogeneration Frame B or E Technology	0%	100%	30%	100%
CC - Three on One Frame E Technology	**54%**	**100%**	**85%**	**100%**
CC - Two or Three on One Frame F Technology	83%	100%	93%	100%
CT - First & Second Generation Aero (P&W FT 4)	**6%**	**100%**	**32%**	**100%**
CT - First & Second Generation Frame B	2%	100%	22%	99%
CT - Second Generation Frame E	**0%**	**100%**	**42%**	**100%**
CT - Third Generation Aero (GE LM 6000)	16%	100%	32%	100%
CT - Third Generation Aero (P&W FT- 8 TwinPak)	**0%**	**100%**	**33%**	**100%**
CT - Third Generation Frame F	25%	100%	62%	100%
Diesel	**12%**	**96%**	**13%**	**100%**
Hydro	100%	100%	100%	100%
Nuclear	**93%**	**100%**	**100%**	**100%**
Oil or Gas Steam	3%	92%	3%	92%
Sub-Critical Coal	**30%**	**75%**	**52%**	**82%**
Super Critical Coal	35%	82%	50%	82%

Figure 5-1 History of capacity prices: Calendar year 1999 through 2013

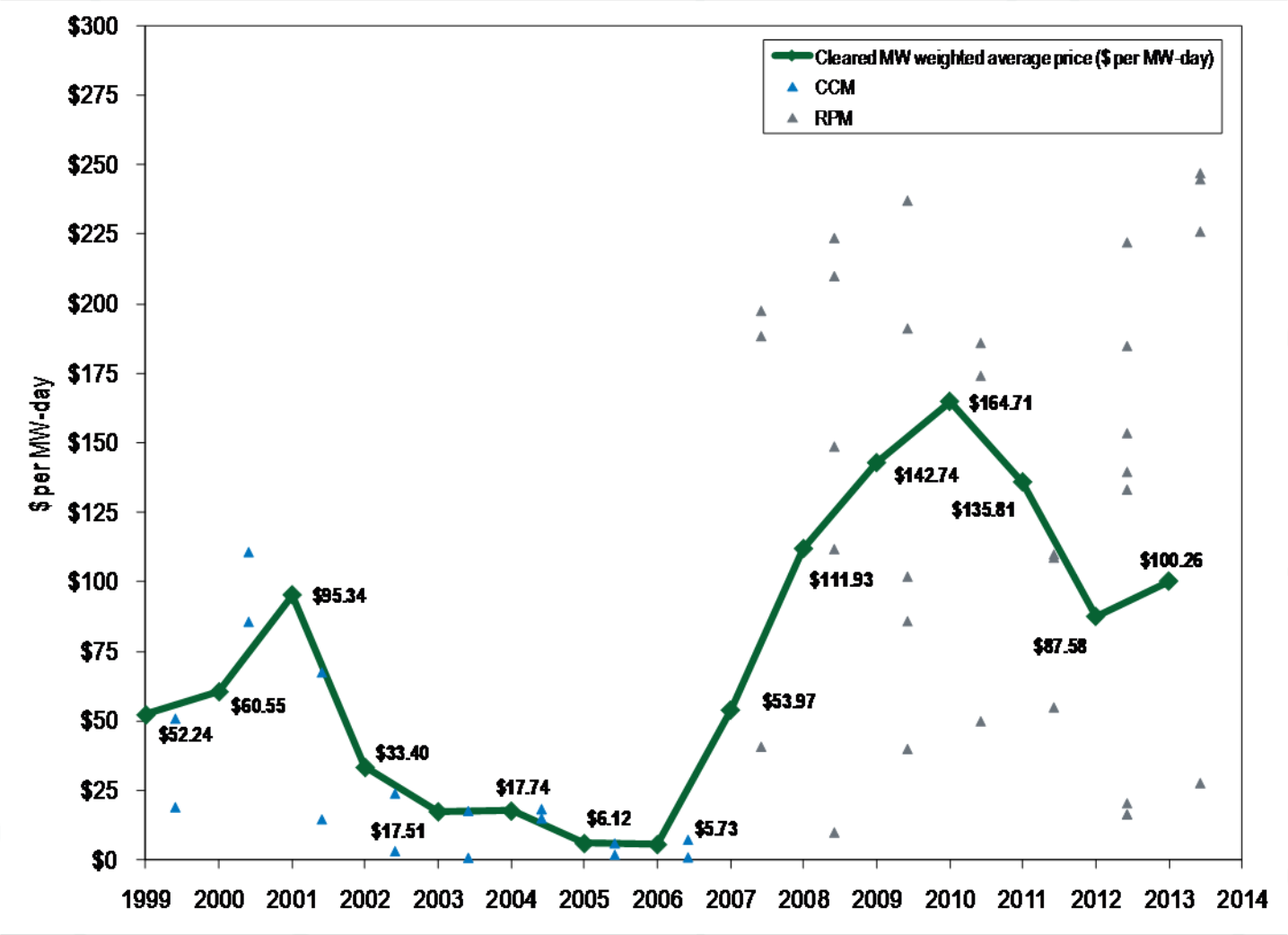

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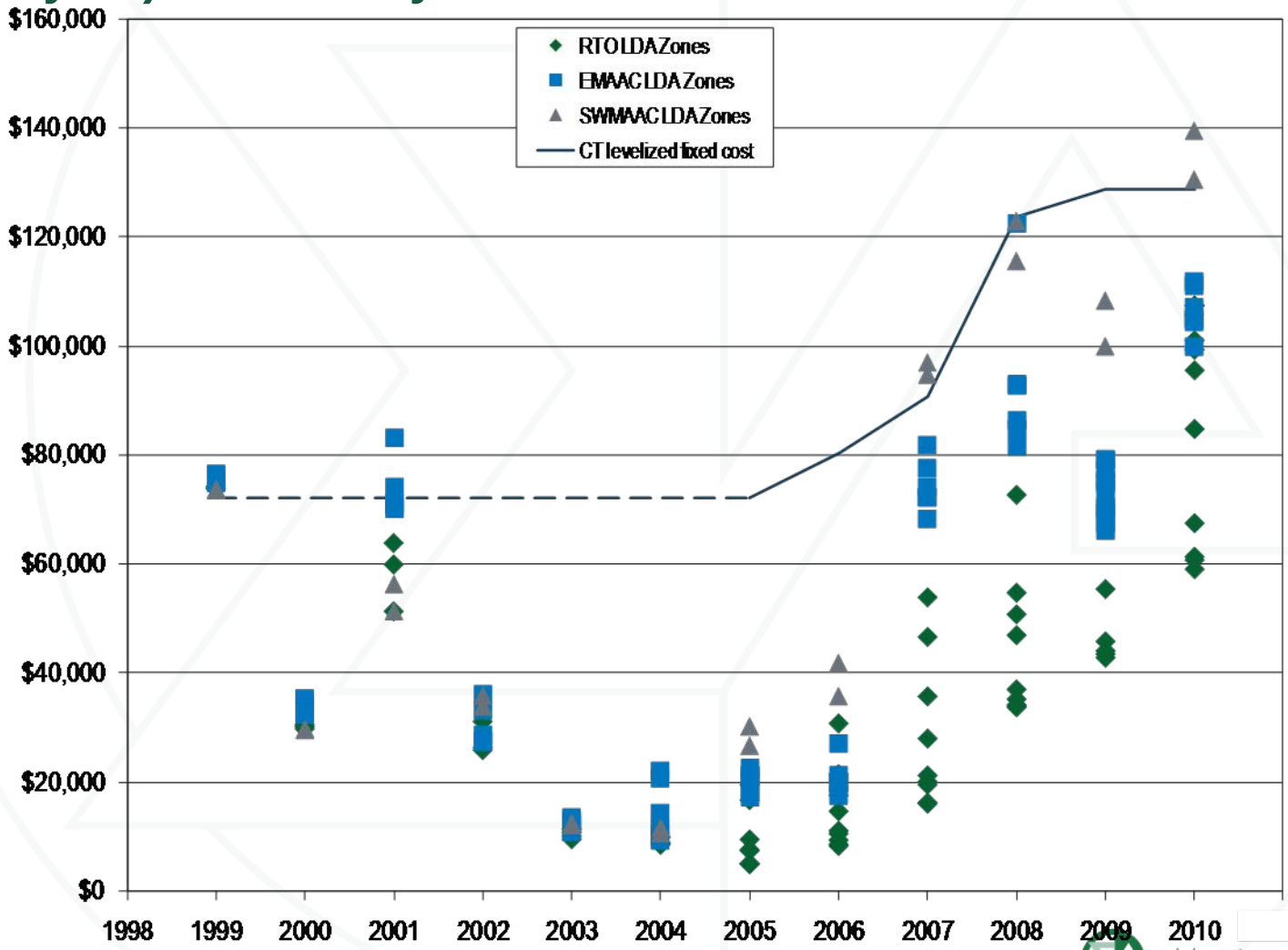
Figure 3-5 New entrant CT real-time net revenue and 20-year levelized fixed cost as of 2010 by LDA (Dollars per installed MW-year): Calendar years 1999 to 2010



Status of coal units in PJM

- **Coal units comprised 41 percent of capacity in PJM at YE 2010.**
- **Coal units comprised 49 percent of energy output in PJM in 2010.**
- **The MMU's State of the Market Report for 2010 (SOM) includes analysis of the sufficiency of net revenues for new coal units.**
- **The SOM includes analysis of the sufficiency of actual net revenues.**
- **The SOM includes analysis of the potential impacts of new environmental regulations on coal units in PJM.**

Table 3-42 PJM installed capacity (By fuel source): January 1, May 31, June 1, and December 31, 2010

	1-Jan-10		31-May-10		1-Jun-10		31-Dec-10	
	MW	Percent	MW	Percent	MW	Percent	MW	Percent
Coal	68,382.1	40.7%	68,155.5	40.7%	67,991.1	40.8%	68,007.0	40.8%
Gas	**49,238.8**	**29.3%**	**48,991.4**	**29.3%**	**48,424.5**	**29.0%**	**48,513.8**	**29.1%**
Hydroelectric	7,921.9	4.7%	7,923.5	4.7%	7,923.5	4.8%	7,954.5	4.8%
Nuclear	**30,611.9**	**18.2%**	**30,599.3**	**18.3%**	**30,619.0**	**18.4%**	**30,552.2**	**18.3%**
Oil	10,700.1	6.4%	10,649.4	6.4%	10,645.5	6.4%	10,193.6	6.1%
Solid waste	**672.1**	**0.4%**	**672.1**	**0.4%**	**672.1**	**0.4%**	**680.1**	**0.4%**
Wind	326.9	0.2%	409.5	0.2%	481.1	0.3%	610.9	0.4%
Total	**167,853.8**	**100.0%**	**167,400.7**	**100.0%**	**166,756.8**	**100.0%**	**166,512.1**	**100.0%**

Table 3-43 PJM generation (By fuel source (GWh)): Calendar year 2010

	2009 GWh	Percent	2010 GWh	Percent	Change in Output
Coal	349,818.2	50.5%	362,075.4	49.3%	3.5%
Nuclear	**249,392.3**	**36.0%**	**254,534.1**	**34.6%**	**2.1%**
Gas	67,218.9	9.7%	86,265.5	11.7%	28.3%
Natural Gas	65,848.2	9.5%	84,570.1	11.5%	28.4%
Landfill Gas	1,368.5	0.2%	1,695.0	0.2%	23.9%
Biomass Gas	2.2	0.0%	0.5	0.0%	(78.9%)
Hydroelectric	**14,123.0**	**2.0%**	**14,384.4**	**2.0%**	**1.9%**
Wind	5,489.7	0.8%	8,812.8	1.2%	60.5%
Waste	**5,664.7**	**0.8%**	**5,356.6**	**0.7%**	**(5.4%)**
Solid Waste	**4,147.0**	**0.6%**	**4,157.5**	**0.6%**	**0.3%**
Miscellaneous	**1,517.7**	**0.2%**	**1,199.1**	**0.2%**	**(21.0%)**
Oil	1,568.1	0.2%	3,243.2	0.4%	106.8%
Heavy Oil	1,383.7	0.2%	2,748.3	0.4%	98.6%
Light Oil	162.9	0.0%	446.9	0.1%	174.3%
Diesel	14.4	0.0%	32.3	0.0%	123.9%
Kerosene	7.1	0.0%	15.7	0.0%	120.8%
Jet Oil	0.0	0.0%	0.1	0.0%	51.9%
Solar	**3.5**	**0.0%**	**5.7**	**0.0%**	**64.7%**
Battery	0.3	0.0%	0.3	0.0%	18.9%
Total	**693,278.7**	**100.0%**	**734,678.2**	**100.0%**	**6.0%**

Figure 3-11 New entrant CP real-time net revenue and 20-year levelized fixed cost as of 2010 by LDA (Dollars per installed MW-year): Calendar years 1999 to 2010

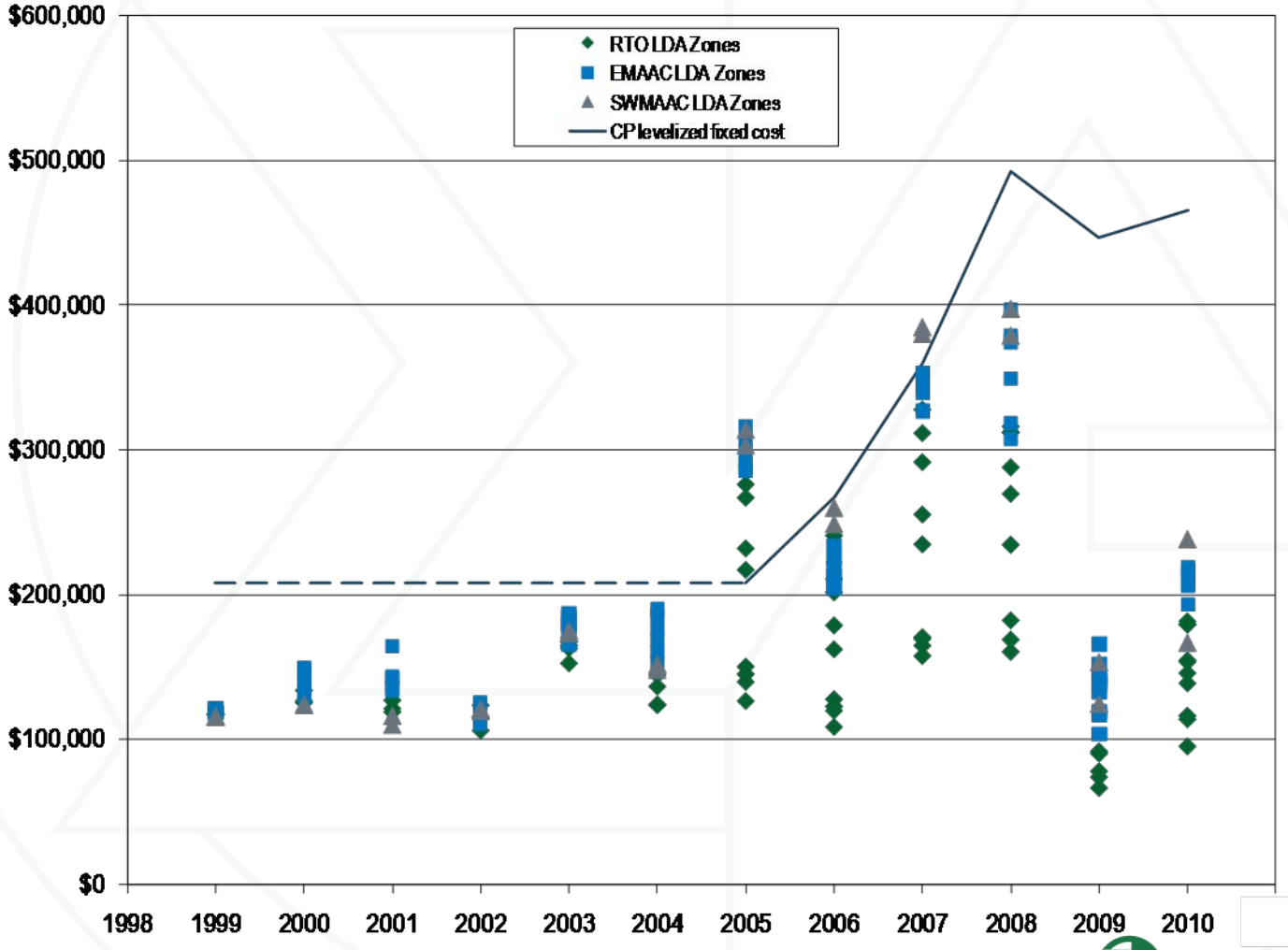


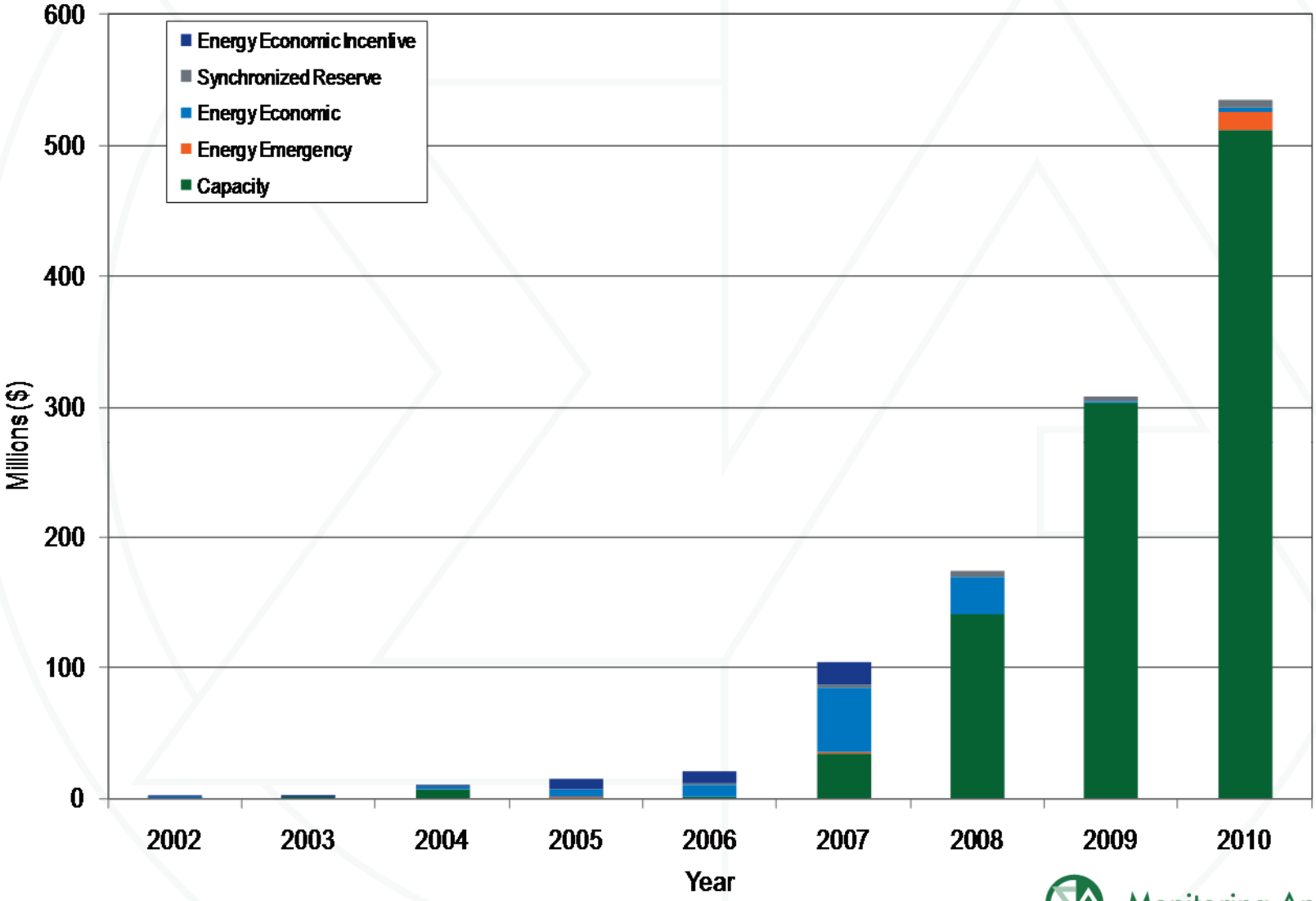
Table 3-39 Coal plants lacking controls for either NO_x emission rates, SO_2 emission rates, or both as of January 2010 (RPM units)

Characteristics	Coal plants without NOx controls in place	Coal plants without SO2 controls in place	Coal plants without NOx and without SO2 controls in place	Total
Number of units	4	63	8	75
Total installed capacity (ICAP)	212	13,543	633	14,388

Table 3-41 Total installed capacity associated with estimated levels of additional revenue needed for recovery of project investment associated with environmental controls

Ranges of additional revenue needed ($/MW-day)	Installed capacity (ICAP) associated base case	Cumulative installed capacity (ICAP) associated with base case	Installed capacity (ICAP) associated with NO_x sensitivity	Cumulative installed capacity (ICAP) associated with NO_x sensitivity
$0	43	43	2,816	2,816
$1 - $99	**121**	**164**	**1,050**	**3,867**
$100 - $199	50	214	1,706	5,573
$200 - $299	**0**	**214**	**1,560**	**7,133**
$300 - $399	1,143	1,357	489	7,621
$400 - $499	**7,554**	**8,911**	**4,352**	**11,973**
$500 - $599	3,420	12,331	815	12,788
$600 - $799	**1,336**	**13,666**	**6,107**	**18,894**
$800 or greater	721	14,388	2,990	21,884

Figure 2-22 Demand Response revenue by market: Calendar years 2002 through 2010



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Impact on PJM of increasing supply in Pepco by 1,719.2 MW UCAP and in PSEG by 2,000.0 MW UCAP at $0 per MW-day: 2013/2014 RPM Base Residual Auction

LDA	Clearing Prices ($ per MW-day)	Cleared UCAP (MW)	Revenue	Clearing Prices ($ per MW-day)	Cleared UCAP (MW)	Revenue
Pepco	$247.14	4,791.7	$432,240,569	$117.70	5,694.4	$244,634,271
EMAAC	**$245.00**	**32,835.4**	**$2,936,305,645**	**$117.70**	**34,206.6**	**$1,469,532,639**
Rest of MAAC	$226.15	30,012.8	$2,477,399,073	$117.70	29,252.9	$1,256,719,210
Rest of RTO	**$27.73**	**85,103.4**	**$861,369,808**	**$21.97**	**83,589.4**	**$670,307,578**
PJM Total		152,743.3	$6,707,315,095		152,743.3	$3,641,193,699

Difference between PJM actual and results of increasing supply in Pepco by 1,719.2 MW UCAP and in PSEG by 2,000.0 MW UCAP at $0 per MW-day: 2013/2014 RPM Base Residual Auction

	Difference Clearing Prices		Difference Cleared UCAP		Difference Revenue	
LDA	$ per MW-day	Percentage	MW	Percentage	$	Percentage
Pepco	($129.44)	(52.4%)	902.7	18.8%	($187,606,298)	(43.4%)
EMAAC	**($127.30)**	**(52.0%)**	**1,371.2**	**4.2%**	**($1,466,773,006)**	**(50.0%)**
Rest of MAAC	($108.45)	(48.0%)	(759.9)	(2.5%)	($1,220,679,862)	(49.3%)
Rest of RTO	**($5.76)**	**(20.8%)**	**(1,514.0)**	**(1.8%)**	**($191,062,230)**	**(22.2%)**
PJM Total			0.0	0.0%	($3,066,121,396)	(45.7%)

Figure 4-4 PJM's footprint and its external interfaces

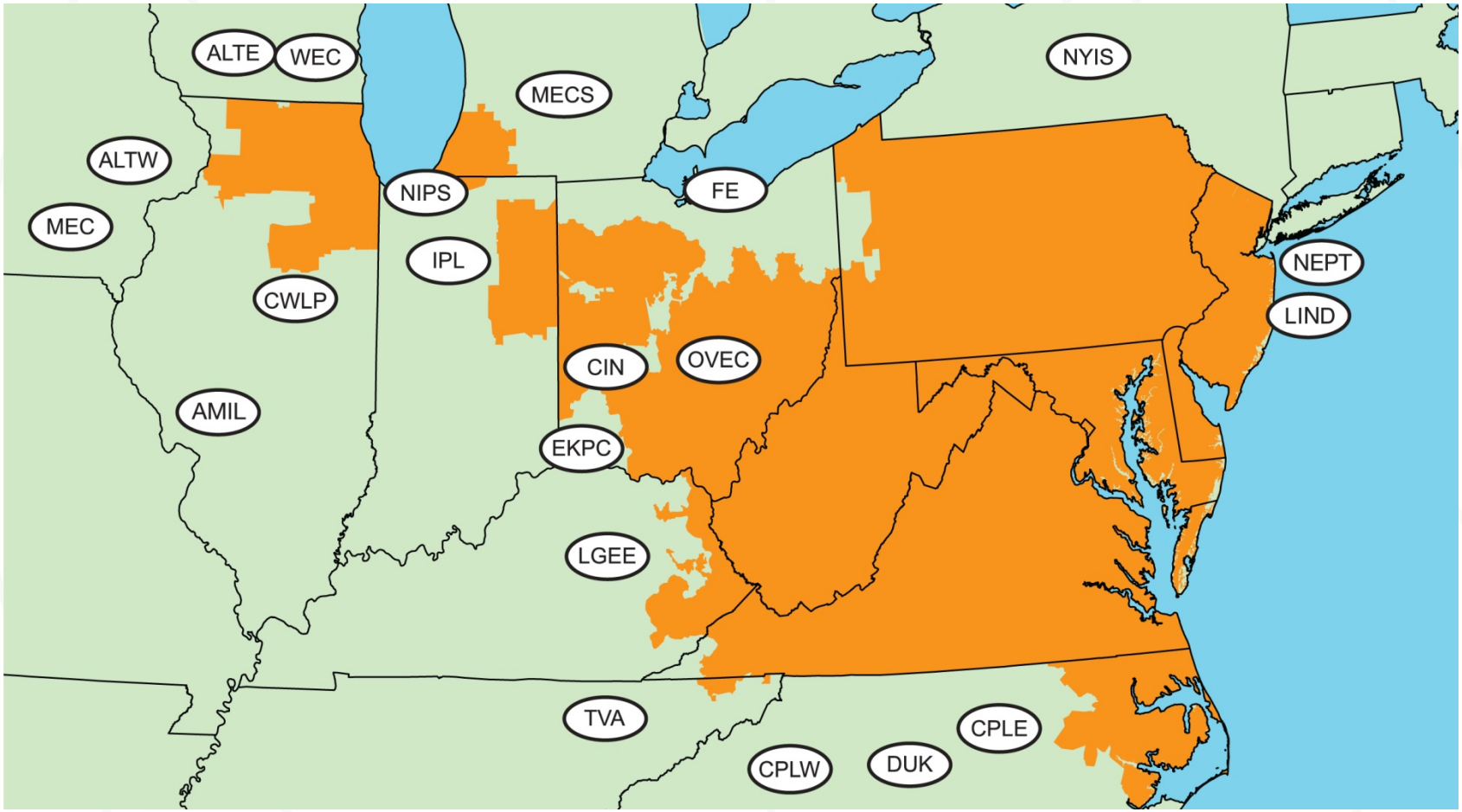

Figure 4-9 PJM, NYISO and Midwest ISO real-time border price averages: Calendar year 2010

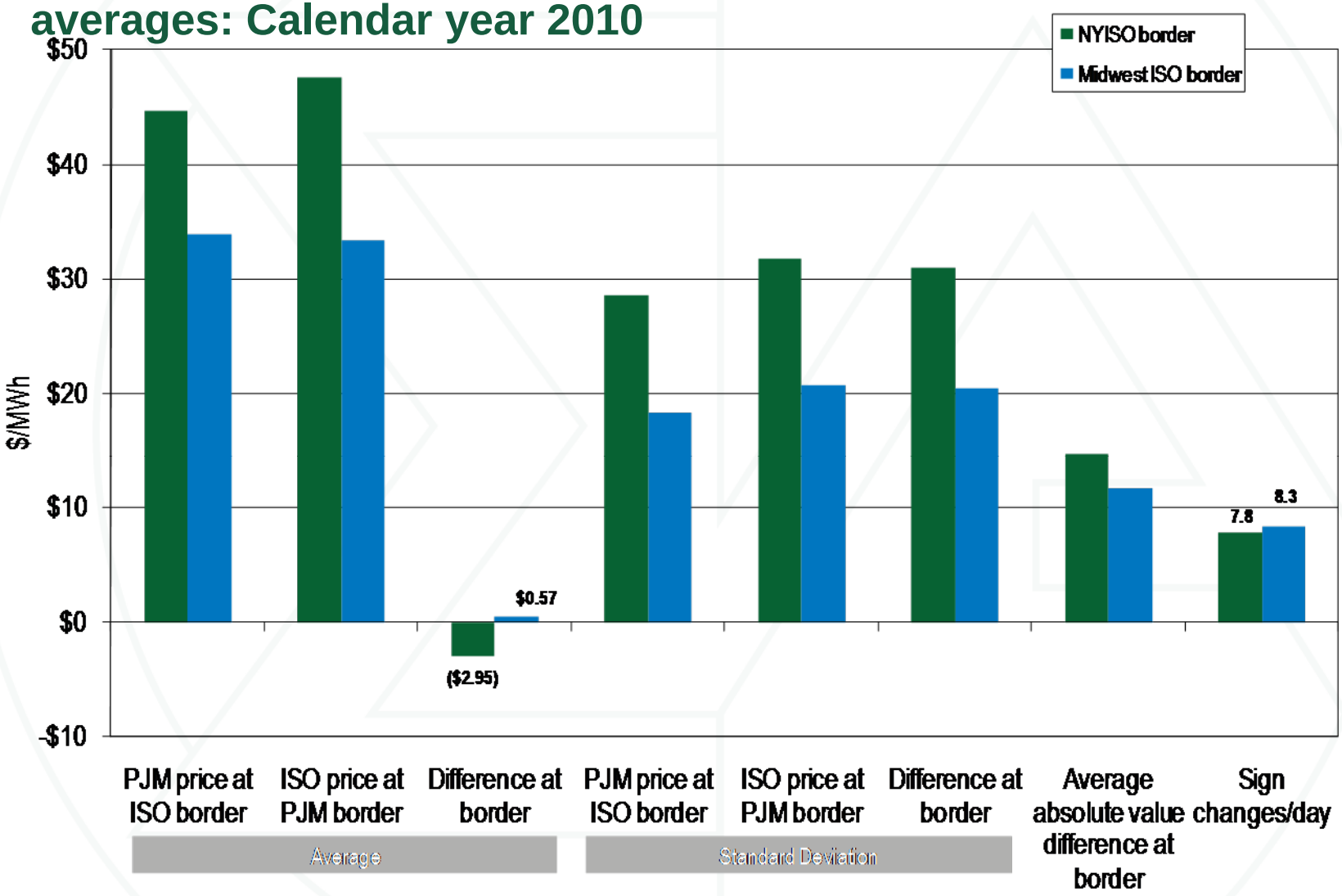

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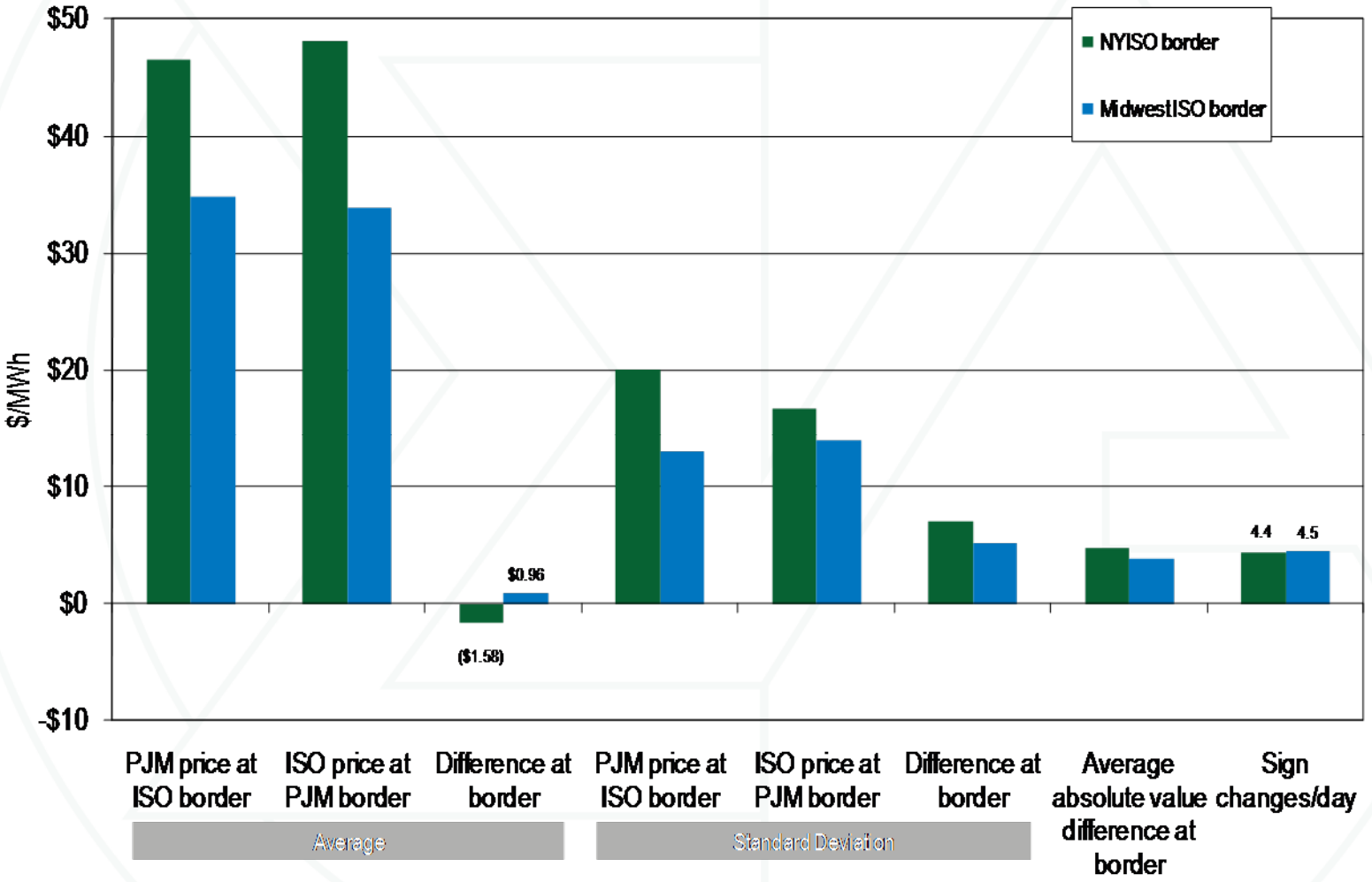
Figure 4-10 PJM, NYISO and Midwest ISO day-ahead border price averages: Calendar year 2010



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