

Market Monitor Report

MC Webinar

March 20, 2017

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Monitoring Analytics

Total price per MWh by category: 2015 and 2016

Category	2015		2015 Percent of		2016		2016 Percent of		Percent Change Totals
	2015	\$/MWh	Total	2016	\$/MWh	Total	Total		
Load Weighted Energy		\$36.16	63.6%		\$29.23	58.5%		(19.2%)	
Capacity		\$11.12	19.6%		\$10.96	21.9%		(1.5%)	
Transmission Service Charges		\$7.09	12.5%		\$7.81	15.6%		10.1%	
Transmission Enhancement Cost Recovery		\$0.51	0.9%		\$0.52	1.0%		2.1%	
PJM Administrative Fees		\$0.44	0.8%		\$0.45	0.9%		2.5%	
Reactive		\$0.37	0.7%		\$0.39	0.8%		4.9%	
Energy Uplift (Operating Reserves)		\$0.38	0.7%		\$0.17	0.3%		(54.8%)	
Regulation		\$0.23	0.4%		\$0.11	0.2%		(53.2%)	
Transmission Owner (Schedule 1A)		\$0.09	0.2%		\$0.09	0.2%		3.8%	
Black Start		\$0.08	0.1%		\$0.08	0.2%		8.8%	
Day Ahead Scheduling Reserve (DASR)		\$0.10	0.2%		\$0.07	0.1%		(24.4%)	
Synchronized Reserves		\$0.11	0.2%		\$0.05	0.1%		(53.5%)	
NERC/RFC		\$0.03	0.1%		\$0.03	0.1%		3.0%	
Load Response		\$0.02	0.0%		\$0.01	0.0%		(38.9%)	
Non-Synchronized Reserves		\$0.02	0.0%		\$0.01	0.0%		(48.3%)	
RTO Startup and Expansion		\$0.01	0.0%		\$0.00	0.0%		(43.4%)	
Transmission Facility Charges		\$0.00	0.0%		\$0.00	0.0%		(59.2%)	
Capacity (FRR)		\$0.13	0.2%		\$0.00	0.0%		(100.0%)	
Emergency Load Response		\$0.00	0.0%		\$0.00	0.0%		(100.0%)	
Emergency Energy		\$0.00	0.0%		\$0.00	0.0%		0.0%	
Total Price		\$56.88	100.0%		\$49.99	100.0%		(12.1%)	

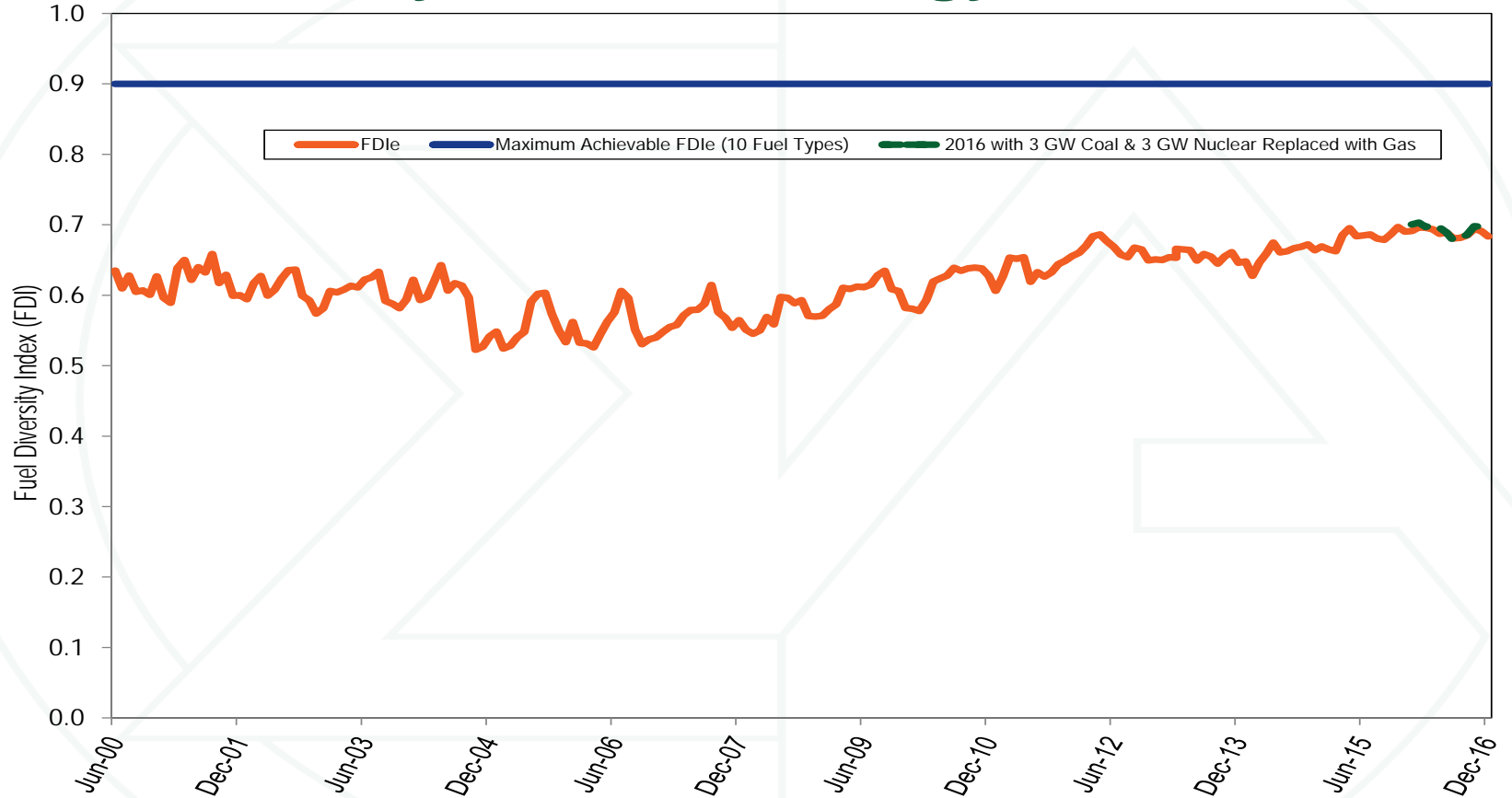
PJM load: 1998 through 2016

	PJM Real-Time Demand (MWh)				Year-to-Year Change			
	Load		Load Plus Exports		Load		Load Plus Exports	
	Load	Standard Deviation	Demand	Standard Deviation	Load	Standard Deviation	Demand	Standard Deviation
1998	28,578	5,511	28,578	5,511	NA	NA	NA	NA
1999	29,641	5,955	29,641	5,955	3.7%	8.1%	3.7%	8.1%
2000	30,113	5,529	31,341	5,728	1.6%	(7.2%)	5.7%	(3.8%)
2001	30,297	5,873	32,165	5,564	0.6%	6.2%	2.6%	(2.9%)
2002	35,776	7,976	37,676	8,145	18.1%	35.8%	17.1%	46.4%
2003	37,395	6,834	39,380	6,716	4.5%	(14.3%)	4.5%	(17.5%)
2004	49,963	13,004	54,953	14,947	33.6%	90.3%	39.5%	122.6%
2005	78,150	16,296	85,301	16,546	56.4%	25.3%	55.2%	10.7%
2006	79,471	14,534	85,696	15,133	1.7%	(10.8%)	0.5%	(8.5%)
2007	81,681	14,618	87,897	15,199	2.8%	0.6%	2.6%	0.4%
2008	79,515	13,758	86,306	14,322	(2.7%)	(5.9%)	(1.8%)	(5.8%)
2009	76,034	13,260	81,227	13,792	(4.4%)	(3.6%)	(5.9%)	(3.7%)
2010	79,611	15,504	85,518	15,904	4.7%	16.9%	5.3%	15.3%
2011	82,541	16,156	88,466	16,313	3.7%	4.2%	3.4%	2.6%
2012	87,011	16,212	92,135	16,052	5.4%	0.3%	4.1%	(1.6%)
2013	88,332	15,489	92,879	15,418	1.5%	(4.5%)	0.8%	(3.9%)
2014	89,099	15,763	94,471	15,677	0.9%	1.8%	1.7%	1.7%
2015	88,594	16,663	92,665	16,784	(0.6%)	5.7%	(1.9%)	7.1%
2016	88,601	17,229	93,551	17,498	0.0%	3.4%	1.0%	4.3%

PJM generation by fuel source

	2015		2016		Change in Output
	GWh	Percent	GWh	Percent	
Coal	284,757.4	36.2%	275,281.7	33.9%	(3.3%)
Bituminous	257,700.0	32.8%	241,050.2	29.7%	(6.5%)
Sub Bituminous	22,528.7	2.9%	28,949.7	3.6%	28.5%
Other Coal	4,528.6	0.6%	5,281.7	0.7%	16.6%
Nuclear	279,106.5	35.5%	279,546.4	34.4%	0.2%
Gas	183,650.7	23.3%	217,214.5	26.7%	18.3%
Natural Gas	180,948.7	23.0%	215,022.4	26.5%	18.8%
Landfill Gas	2,275.8	0.3%	2,176.2	0.3%	(4.4%)
Other Gas	426.3	0.1%	15.9	0.0%	(96.3%)
Hydroelectric	13,067.2	1.7%	13,686.8	1.7%	4.7%
Pumped Storage	4,660.2	0.6%	4,840.2	0.6%	3.9%
Run of River	6,736.3	0.9%	7,332.8	0.9%	8.9%
Other Hydro	1,670.8	0.2%	1,513.8	0.2%	(9.4%)
Wind	16,609.7	2.1%	17,716.0	2.2%	6.7%
Waste	4,365.1	0.6%	4,139.8	0.5%	(5.2%)
Solid Waste	4,175.4	0.5%	4,139.8	0.5%	(0.9%)
Miscellaneous	189.7	0.0%	0.0	0.0%	(100.0%)
Oil	3,276.2	0.4%	2,163.6	0.3%	(34.0%)
Heavy Oil	622.9	0.1%	270.6	0.0%	(56.6%)
Light Oil	1,122.0	0.1%	341.1	0.0%	(69.6%)
Diesel	163.8	0.0%	59.4	0.0%	(63.7%)
Gasoline	0.0	0.0%	0.0	0.0%	NA
Kerosene	413.0	0.1%	74.8	0.0%	(81.9%)
Jet Oil	0.0	0.0%	0.0	0.0%	NA
Other Oil	954.5	0.1%	1,417.7	0.2%	48.5%
Solar, Net Energy Metering	548.4	0.1%	1,019.4	0.1%	85.9%
Energy Storage	7.6	0.0%	15.7	0.0%	106.7%
Battery	7.6	0.0%	15.7	0.0%	106.7%
Compressed Air	0.0	0.0%	0.0	0.0%	NA
Biofuel	1,309.6	0.2%	1,760.3	0.2%	34.4%
Geothermal	0.0	0.0%	0.0	0.0%	NA
Other Fuel Type	0.0	0.0%	0.0	0.0%	NA
Total	786,698.5	100.0%	812,544.1	100.0%	3.3%

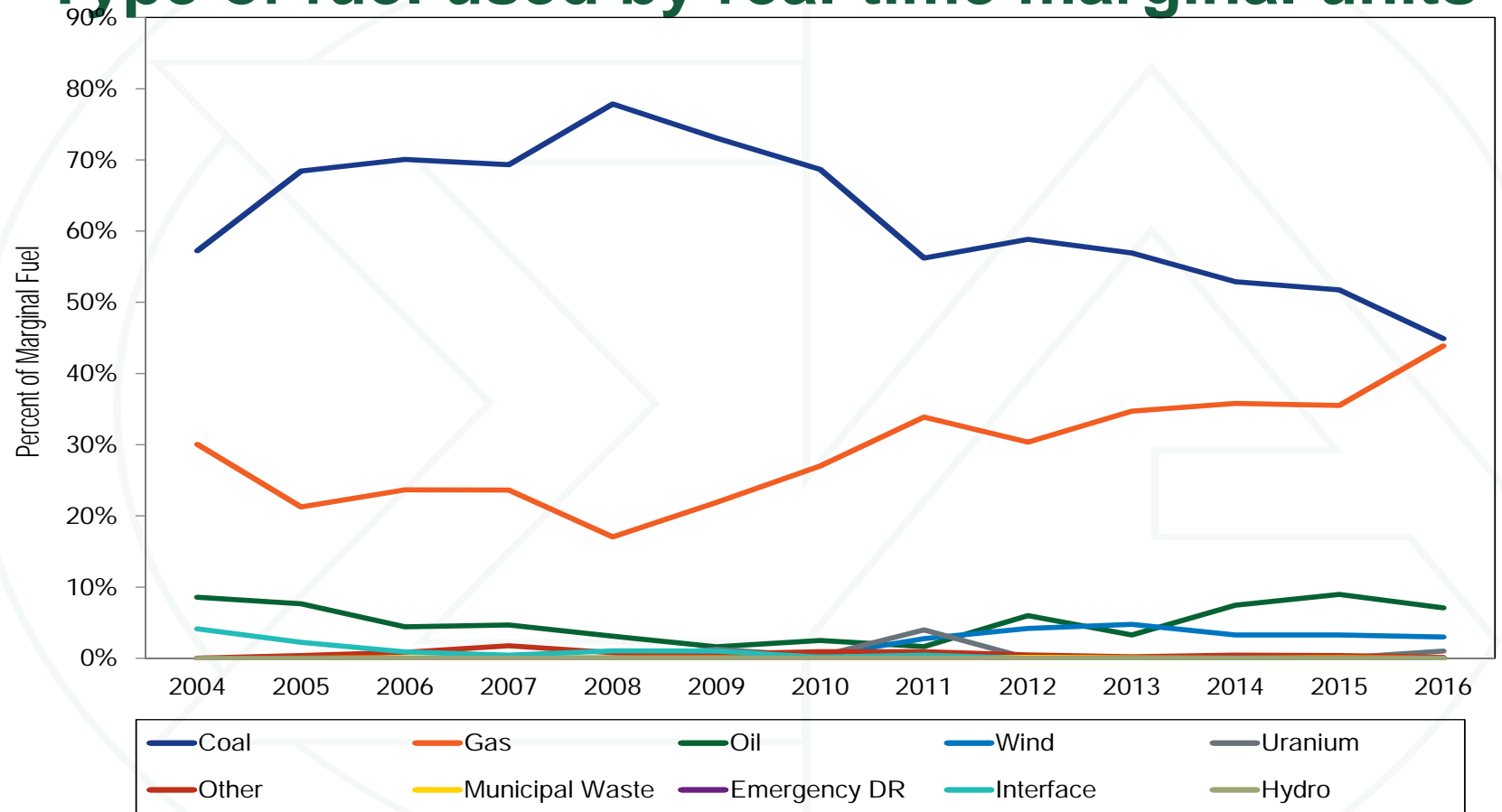
Fuel diversity index for energy



PJM real-time, load-weighted, average LMP

	Real-Time, Load-Weighted, Average LMP			Year-to-Year Change		
	Average	Median	Standard Deviation	Average	Median	Standard Deviation
1998	\$24.16	\$17.60	\$39.29	NA	NA	NA
1999	\$34.07	\$19.02	\$91.49	41.0%	8.1%	132.8%
2000	\$30.72	\$20.51	\$28.38	(9.8%)	7.9%	(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%)	(0.7%)
2007	\$61.66	\$54.66	\$36.94	15.6%	23.1%	(2.3%)
2008	\$71.13	\$59.54	\$40.97	15.4%	8.9%	10.9%
2009	\$39.05	\$34.23	\$18.21	(45.1%)	(42.5%)	(55.6%)
2010	\$48.35	\$39.13	\$28.90	23.8%	14.3%	58.7%
2011	\$45.94	\$36.54	\$33.47	(5.0%)	(6.6%)	15.8%
2012	\$35.23	\$30.43	\$23.66	(23.3%)	(16.7%)	(29.3%)
2013	\$38.66	\$33.25	\$23.78	9.7%	9.3%	0.5%
2014	\$53.14	\$36.20	\$76.20	37.4%	8.9%	220.4%
2015	\$36.16	\$27.66	\$31.06	(31.9%)	(23.6%)	(59.2%)
2016	\$29.23	\$25.01	\$16.12	(19.2%)	(9.6%)	(48.1%)

Type of fuel used by real-time marginal units



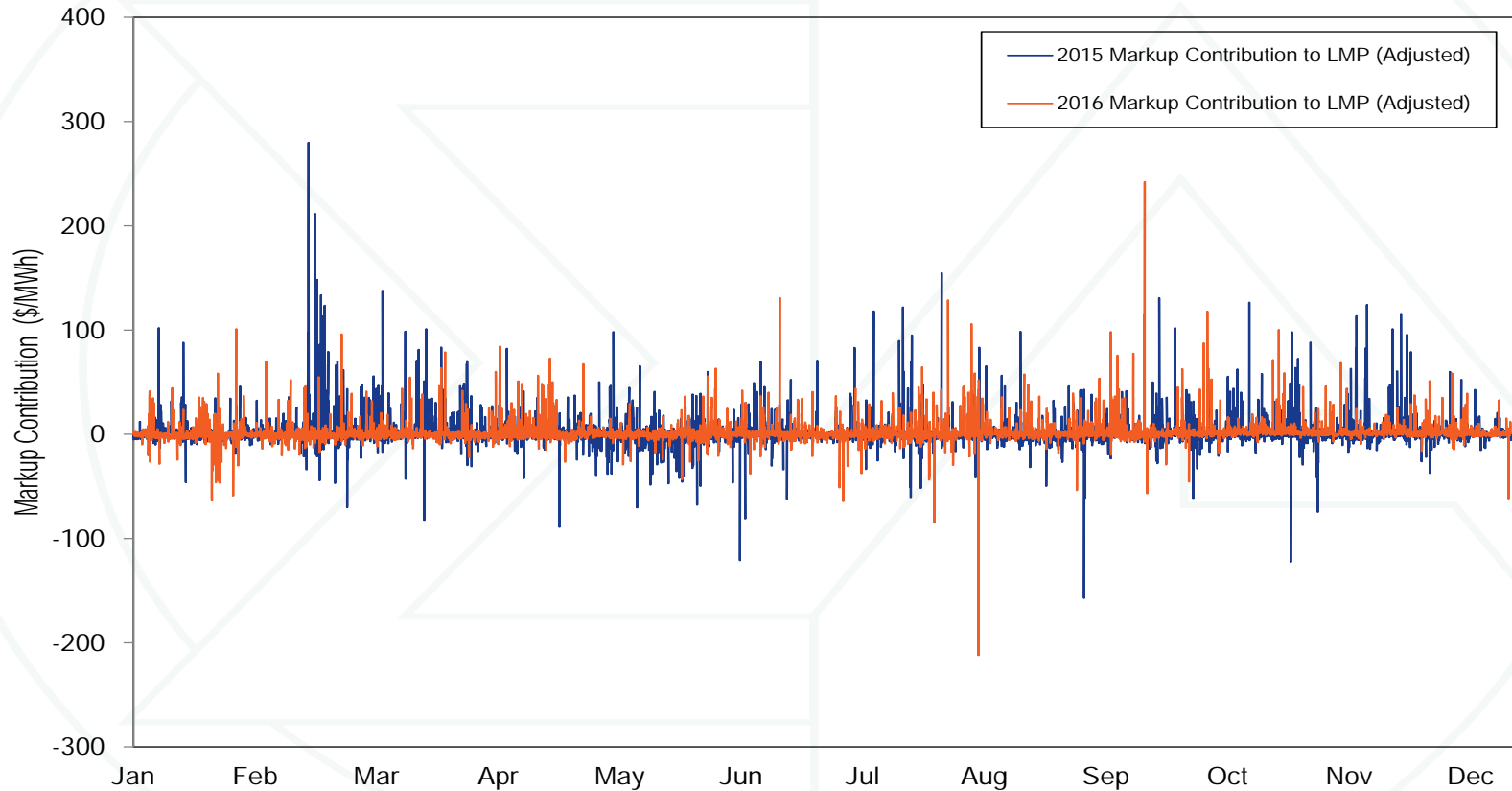
PJM real-time annual, fuel-cost adjusted, load-weighted average LMP

	2016 Load-Weighted LMP	2016 Fuel-Cost Adjusted, Load-Weighted LMP	Change
Average	\$29.23	\$29.72	1.7%
	2015 Load-Weighted LMP	2016 Fuel-Cost Adjusted, Load-Weighted LMP	Change
Average	\$36.16	\$29.72	(17.8%)
	2015 Load-Weighted LMP	2016 Load-Weighted LMP	Change
Average	\$36.16	\$29.23	(19.2%)

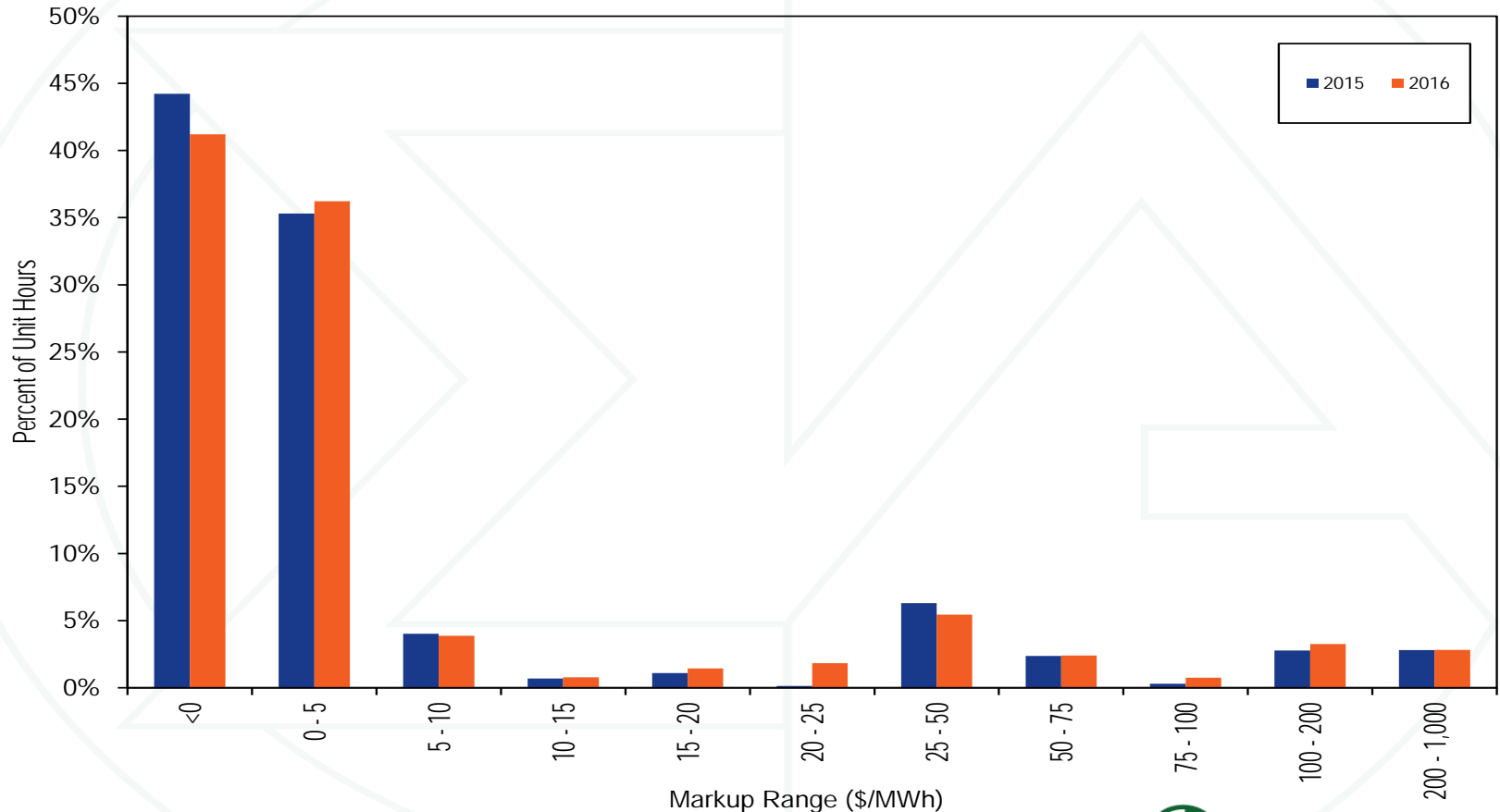
Components of RT LMP

Element	2015		2016		Change Percent
	Contribution to LMP	Percent	Contribution to LMP	Percent	
Coal	\$15.62	43.2%	\$13.28	45.4%	2.2%
Gas	\$9.85	27.2%	\$7.96	27.2%	(0.0%)
VOM	\$2.38	6.6%	\$2.04	7.0%	0.4%
Markup	\$1.75	4.8%	\$1.77	6.1%	1.2%
NA	\$0.89	2.4%	\$1.23	4.2%	1.8%
Ten Percent Adder	\$1.40	3.9%	\$1.06	3.6%	(0.2%)
NO _x Cost	\$0.29	0.8%	\$0.42	1.4%	0.6%
Increase Generation Adder	\$0.24	0.7%	\$0.35	1.2%	0.5%
Ancillary Service Redispatch Cost	\$1.06	2.9%	\$0.33	1.1%	(1.8%)
LPA Rounding Difference	\$0.94	2.6%	\$0.29	1.0%	(1.6%)
Oil	\$1.25	3.5%	\$0.29	1.0%	(2.5%)
Other	\$0.15	0.4%	\$0.14	0.5%	0.1%
SO ₂ Cost	\$0.35	1.0%	\$0.07	0.3%	(0.7%)
CO ₂ Cost	\$0.21	0.6%	\$0.06	0.2%	(0.4%)
Market-to-Market Adder	\$0.01	0.0%	\$0.01	0.0%	(0.0%)
Uranium	(\$0.00)	(0.0%)	\$0.00	0.0%	0.0%
FMU Adder	\$0.00	0.0%	\$0.00	0.0%	(0.0%)
Municipal Waste	\$0.01	0.0%	\$0.00	0.0%	(0.0%)
Constraint Violation Adder	(\$0.00)	(0.0%)	\$0.00	0.0%	0.0%
LPA-SCED Differential	(\$0.11)	(0.3%)	(\$0.01)	(0.0%)	0.3%
Decrease Generation Adder	(\$0.06)	(0.2%)	(\$0.03)	(0.1%)	0.1%
Wind	(\$0.07)	(0.2%)	(\$0.05)	(0.2%)	0.0%
Total	\$36.16	100.0%	\$29.23	100.0%	0.0%

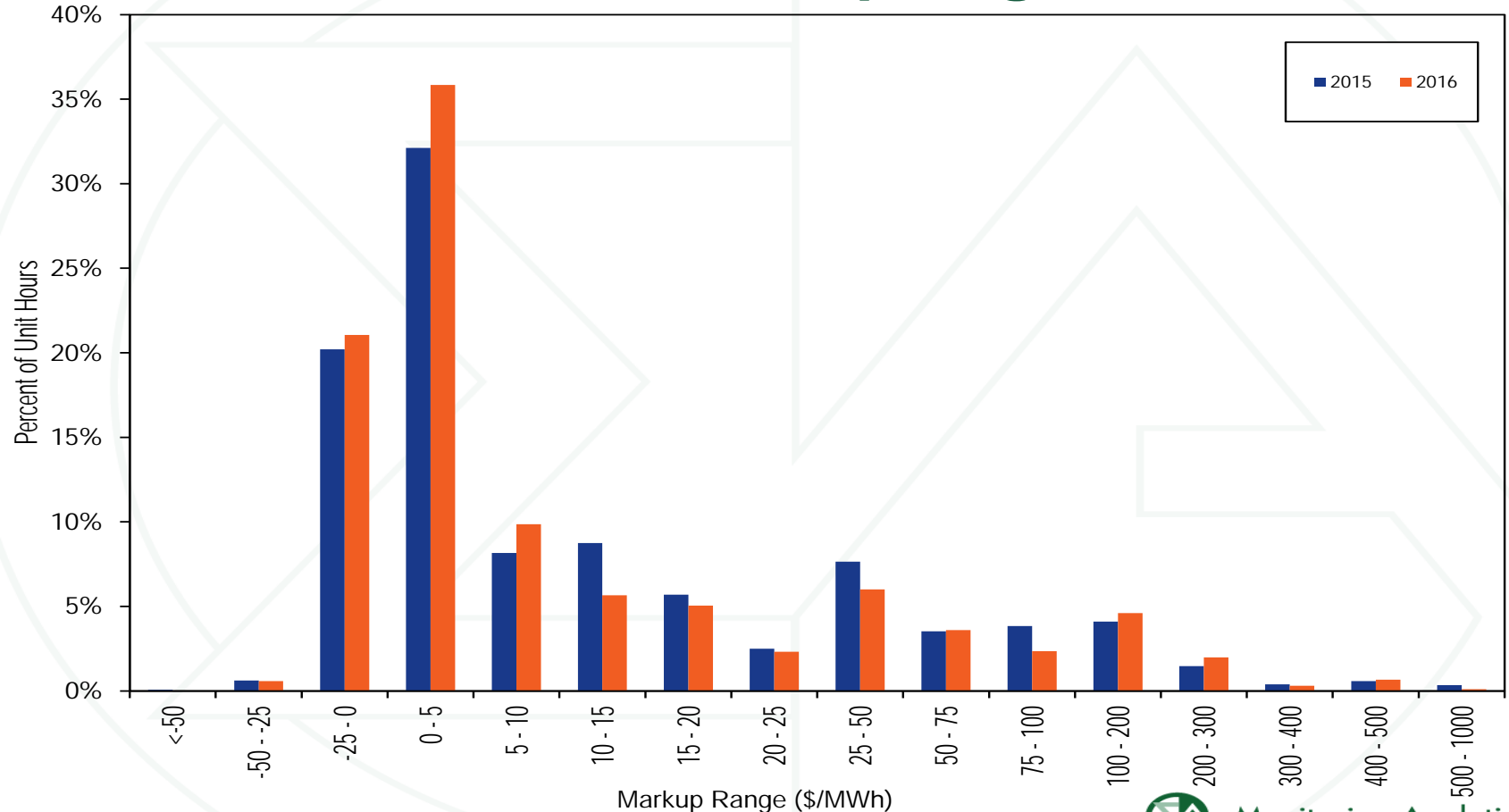
Markup contribution to RT hourly LMP



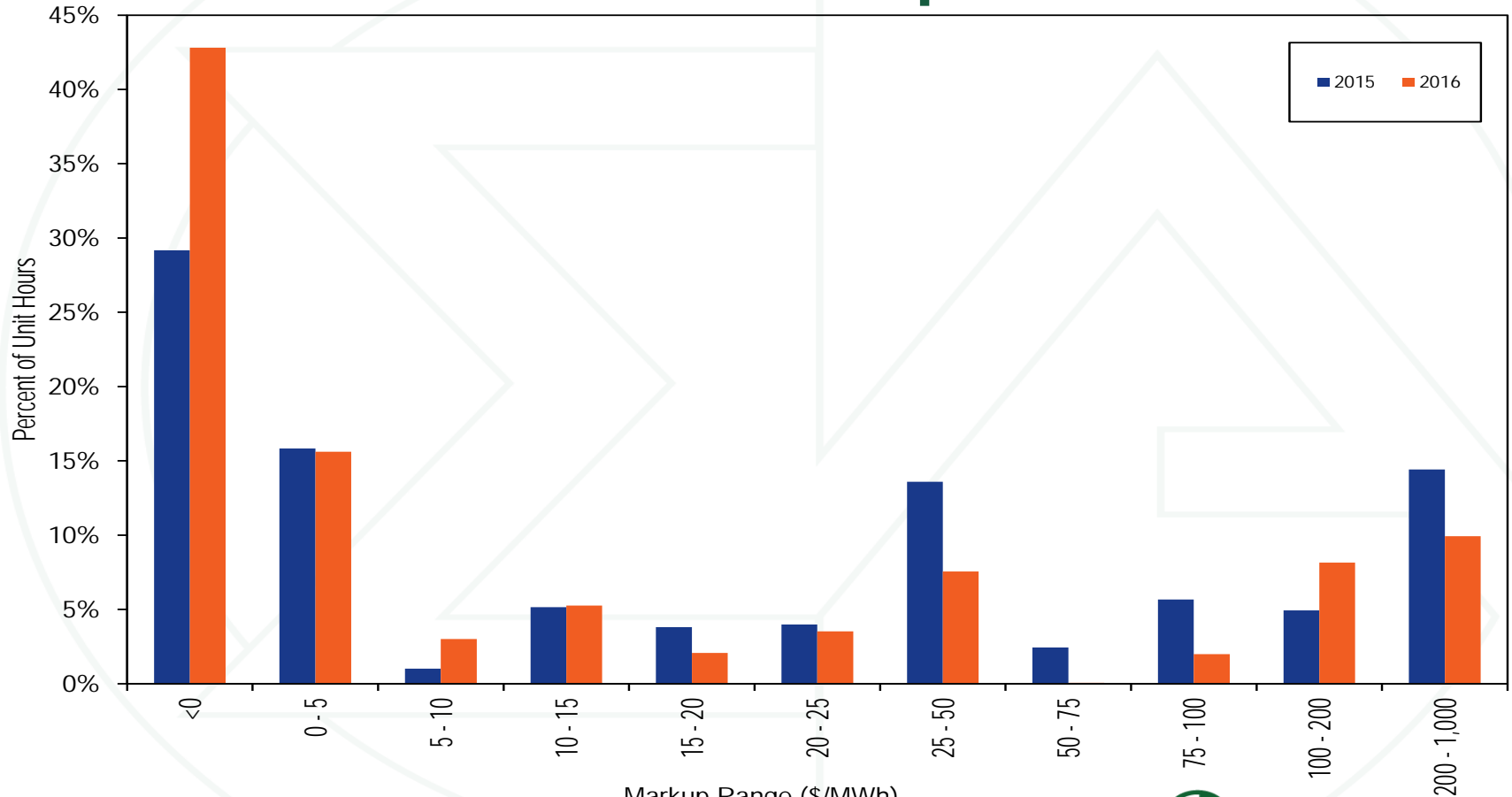
Distribution of markup of coal units



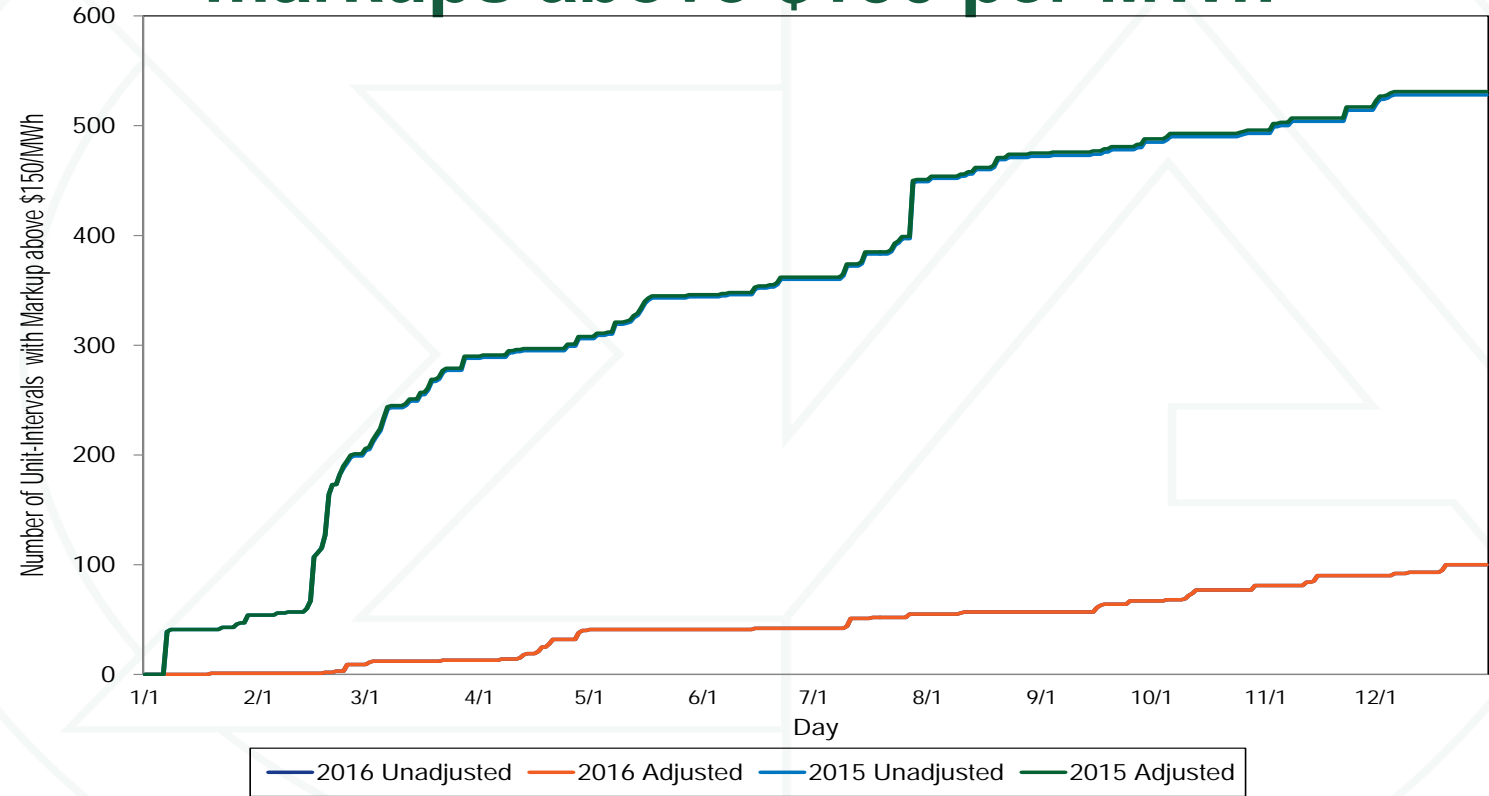
Distribution of markup of gas units



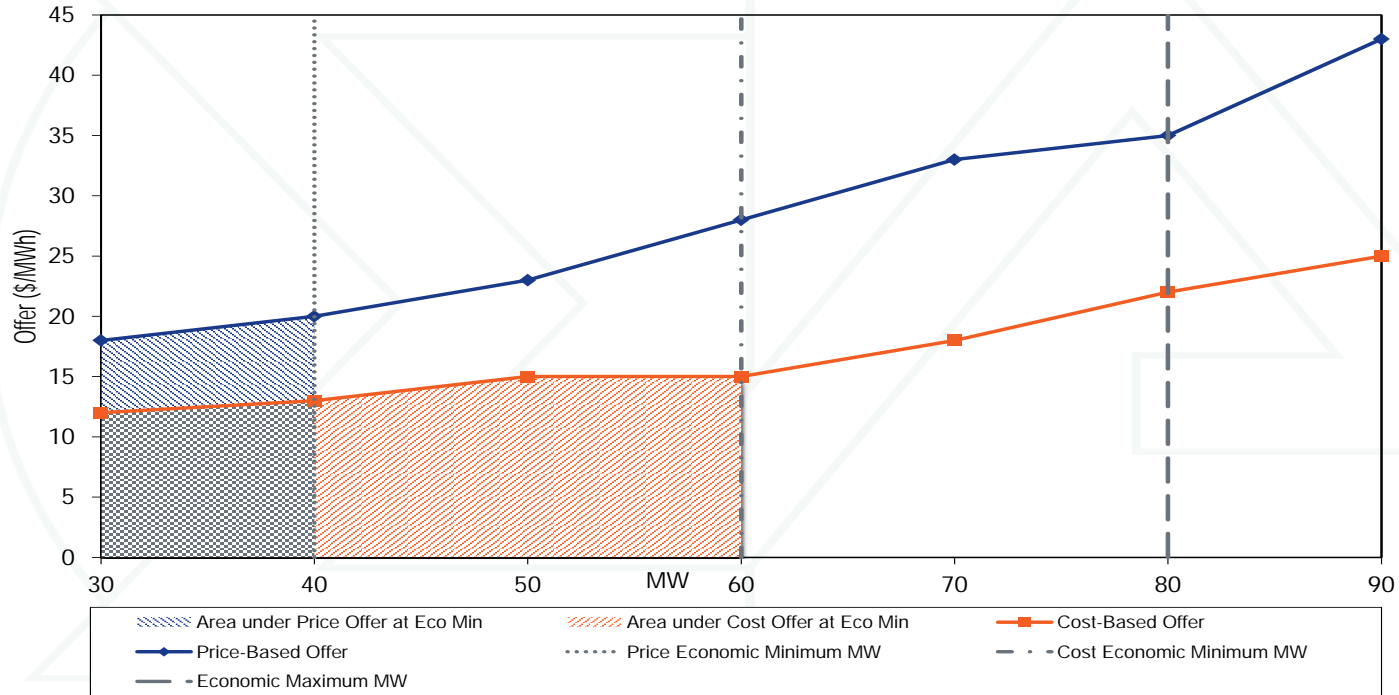
Distribution of markup of oil units



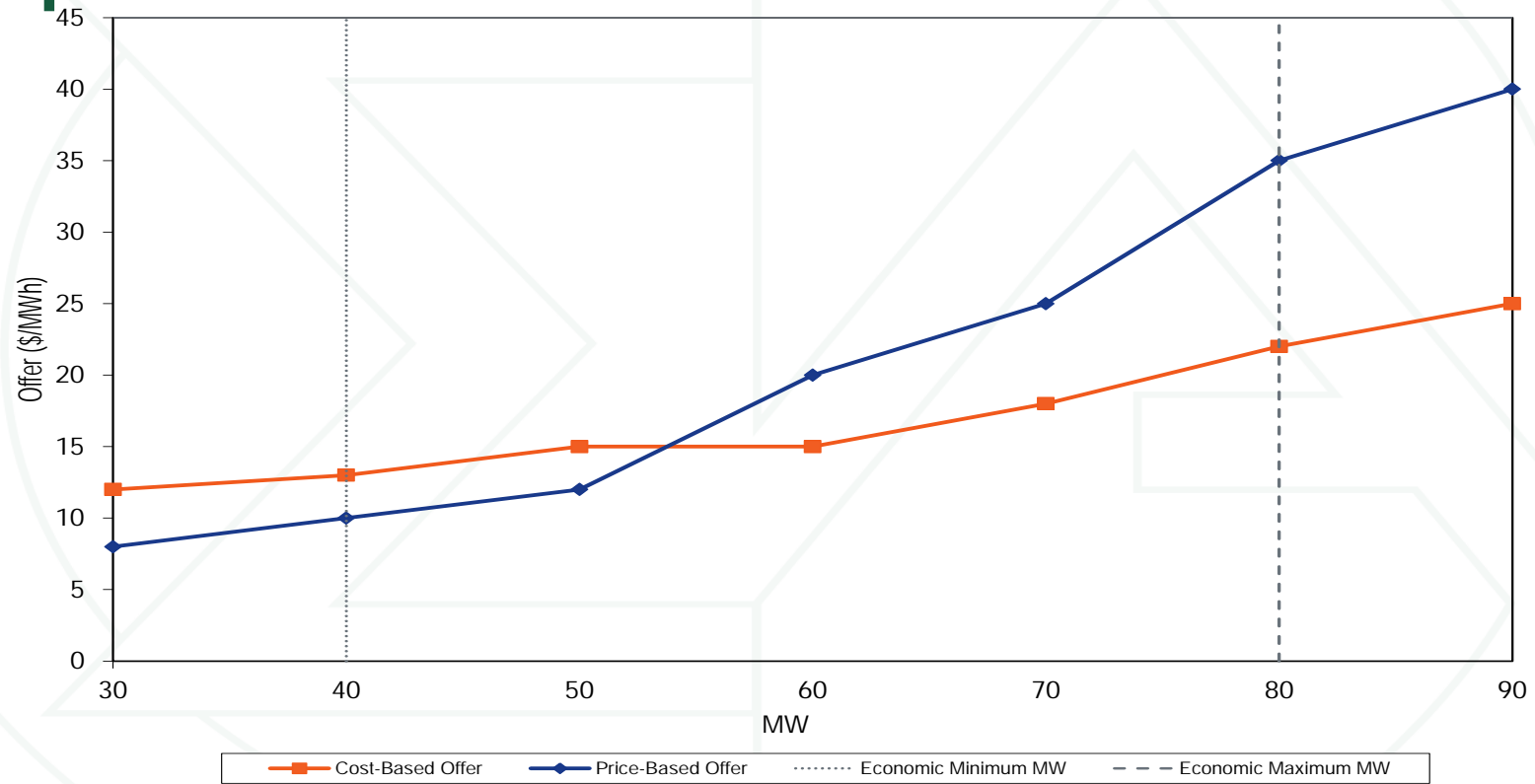
Cumulative number of unit intervals with markups above \$150 per MWh



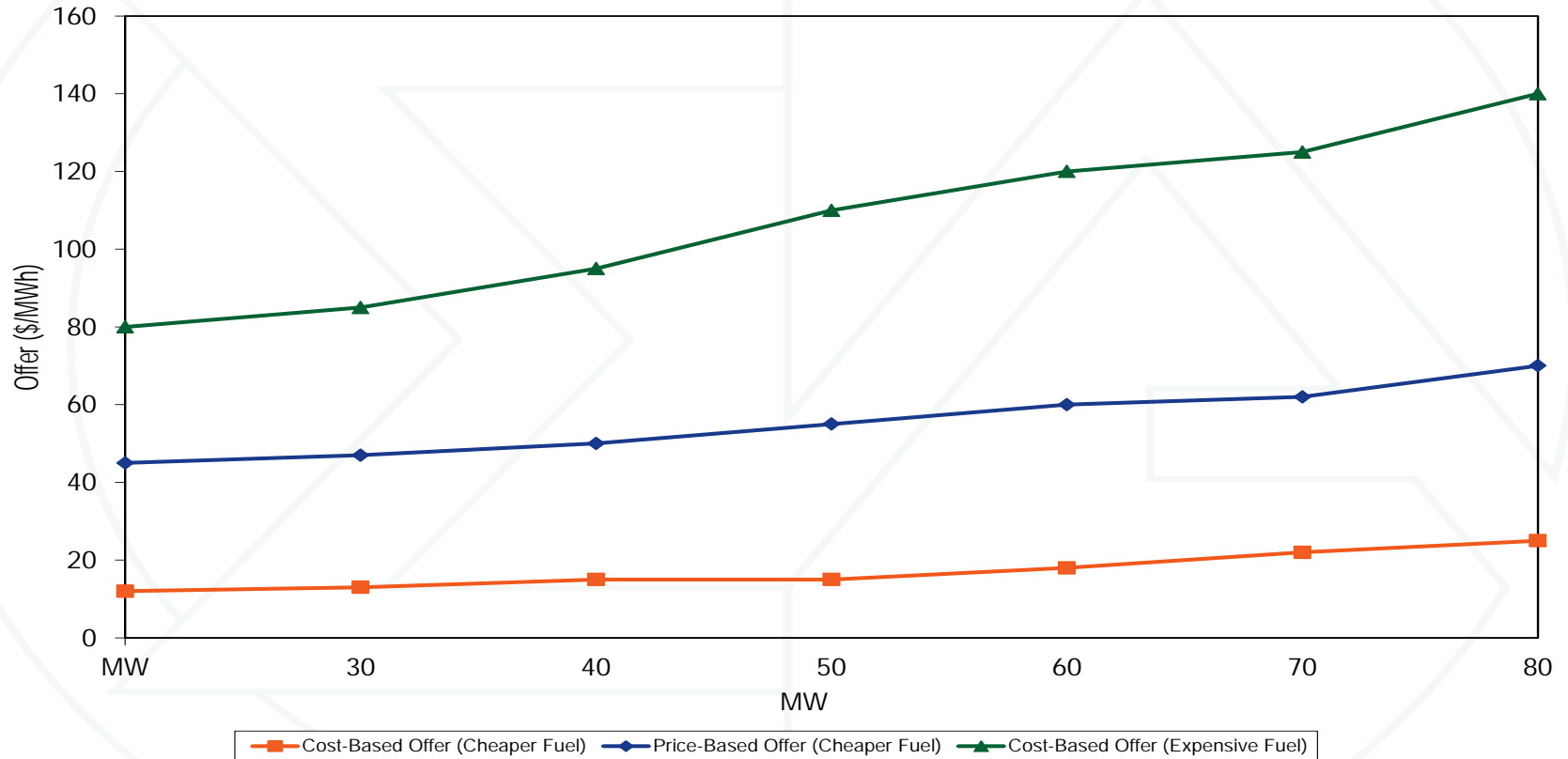
Offers with a positive markup but different economic minimum MW



Offers with varying markups at different MW output levels



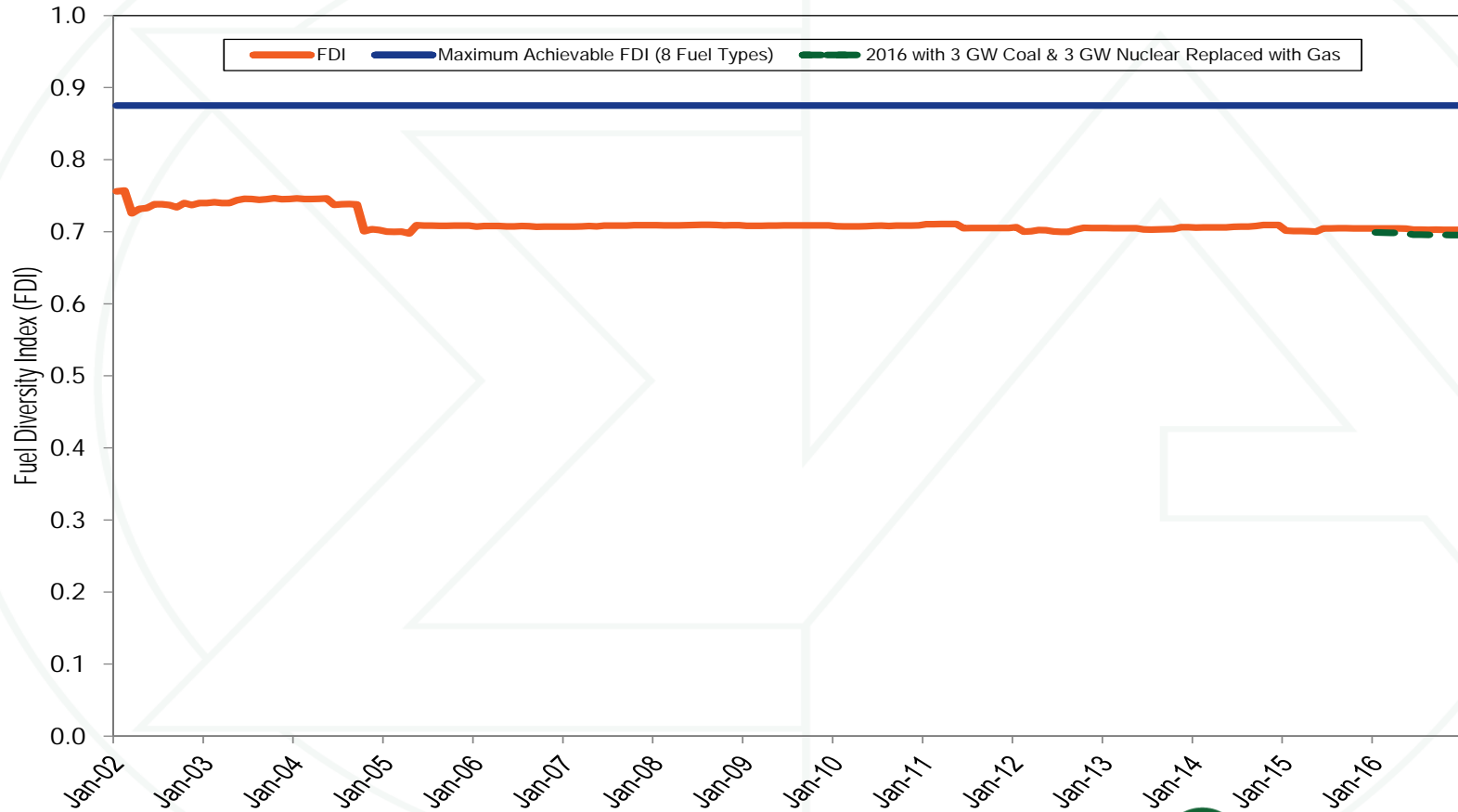
Dual fuel unit offers: cost and price



PJM installed capacity by fuel source

	1-Jan-16		31-May-16		1-Jun-16		31-Dec-16	
	MW	Percent	MW	Percent	MW	Percent	MW	Percent
Coal	66,674.8	37.5%	66,429.7	36.9%	66,619.9	36.6%	66,622.2	36.5%
Gas	60,487.4	34.0%	62,805.9	34.9%	64,721.7	35.5%	65,110.3	35.7%
Hydroelectric	8,787.5	4.9%	8,854.8	4.9%	8,850.4	4.9%	8,850.4	4.9%
Nuclear	33,071.5	18.6%	33,175.5	18.4%	33,050.6	18.2%	33,043.4	18.1%
Oil	6,851.8	3.9%	6,787.2	3.8%	6,779.8	3.7%	6,772.0	3.7%
Solar	128.0	0.1%	128.0	0.1%	252.4	0.1%	262.3	0.1%
Solid waste	769.4	0.4%	767.5	0.4%	767.5	0.4%	769.4	0.4%
Wind	912.4	0.5%	918.4	0.5%	1,019.1	0.6%	1,019.1	0.6%
Total	177,682.8	100.0%	179,867.0	100.0%	182,061.4	100.0%	182,449.1	100.0%

Fuel Diversity Index for capacity



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