

2016 Year in Review

PJM Annual Meeting
May 16, 2017

Joseph Bowring

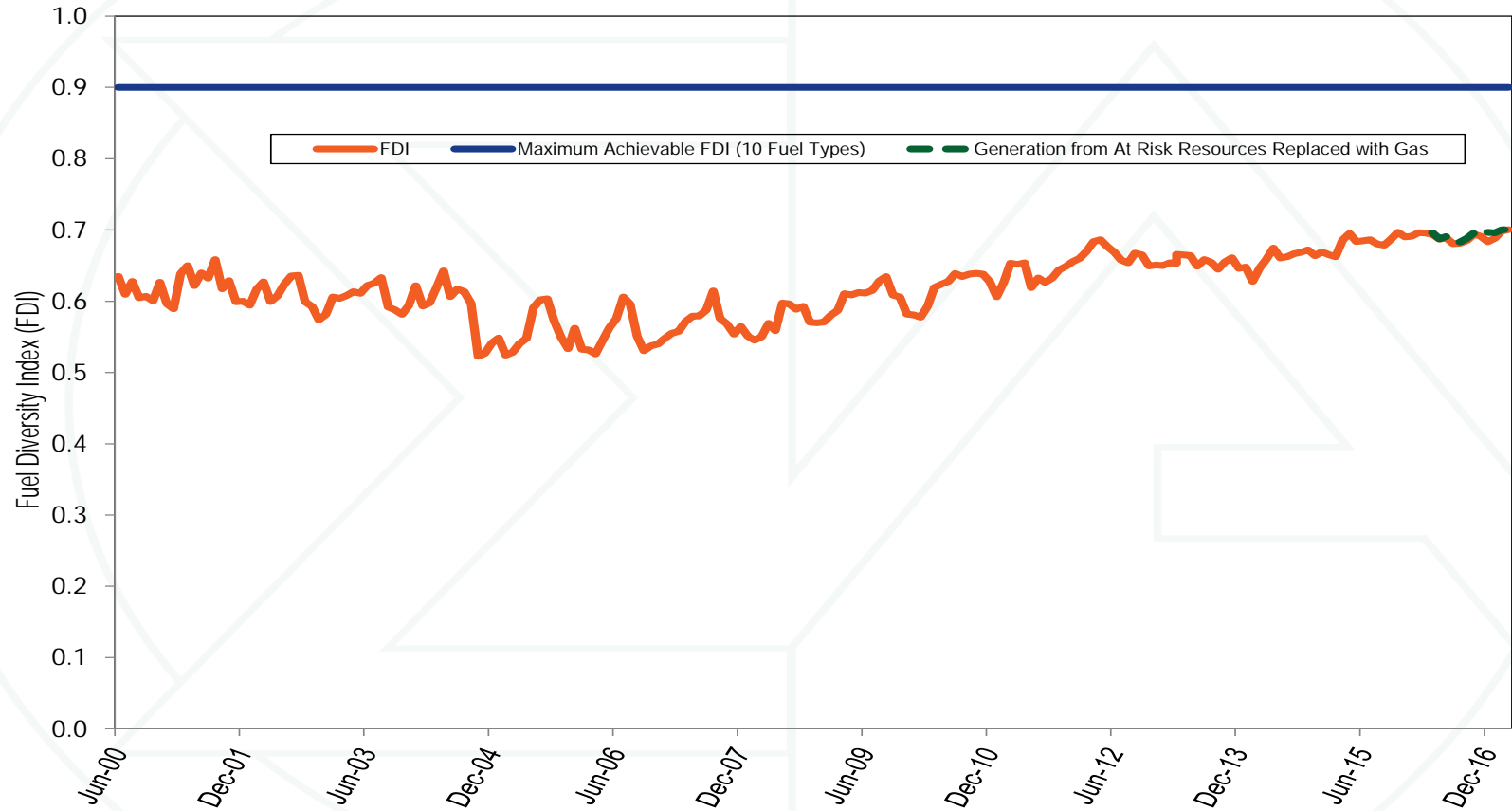


Monitoring Analytics

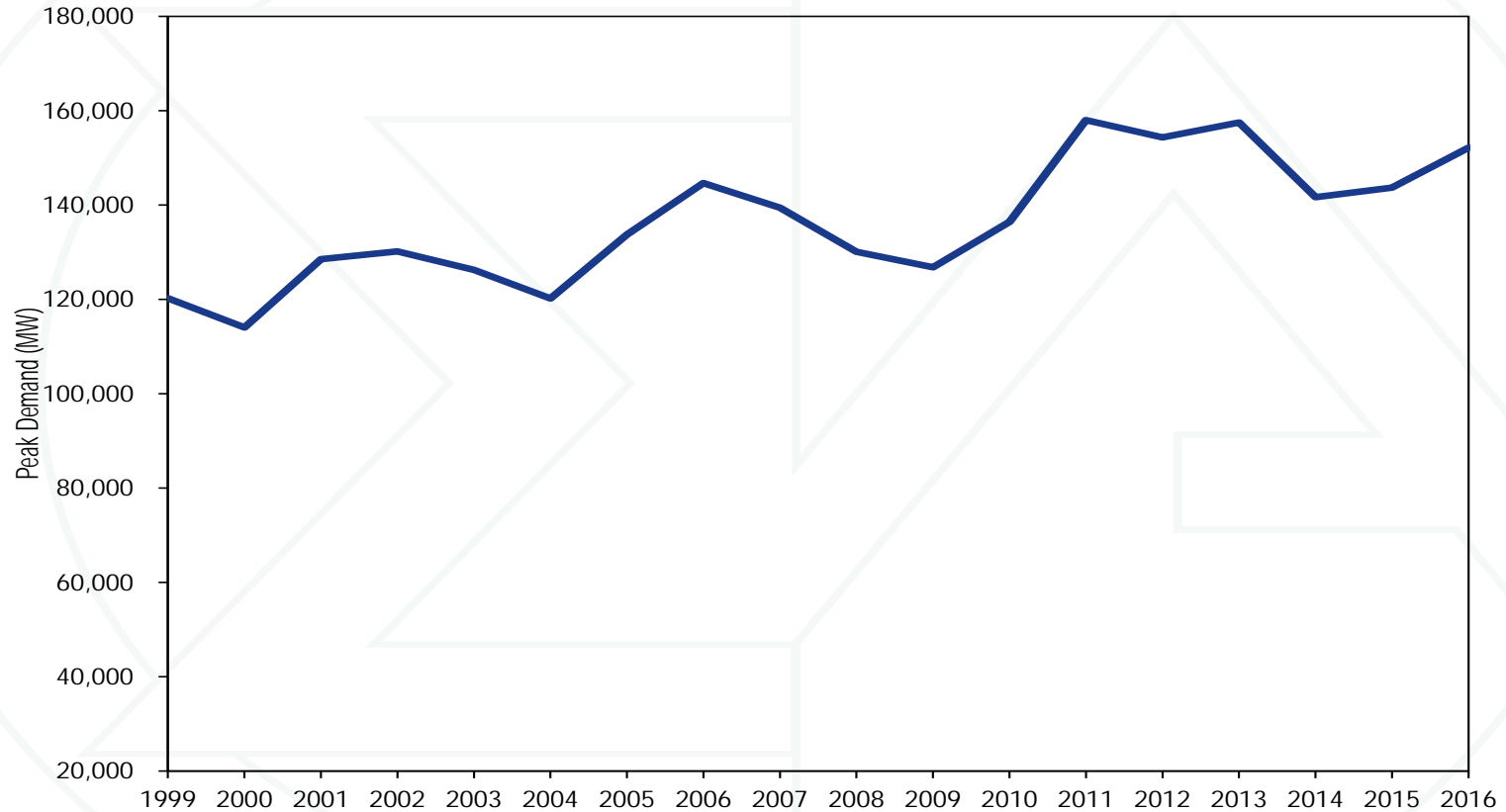
PJM generation by fuel source

	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%

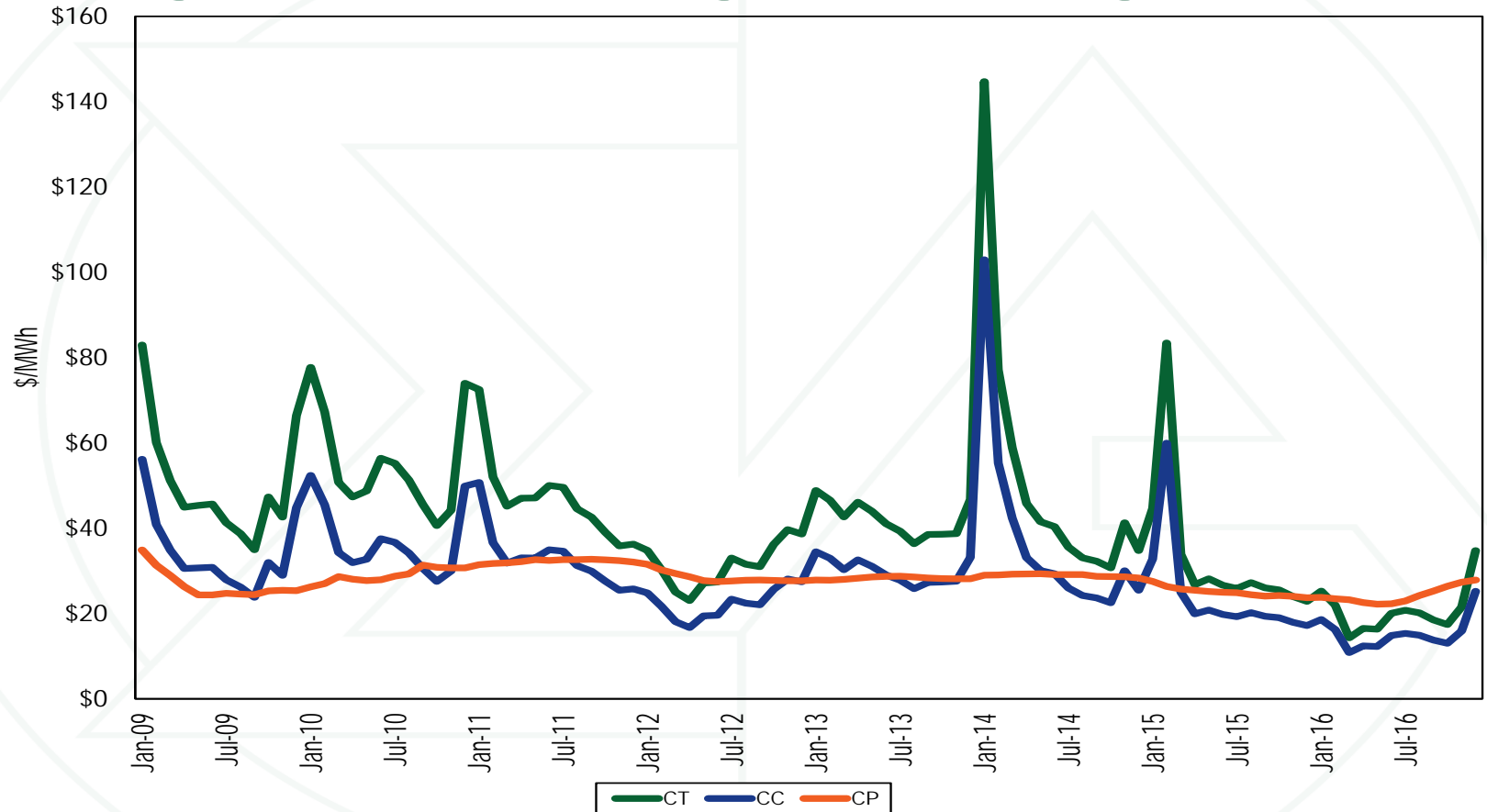
Generation fuel diversity index



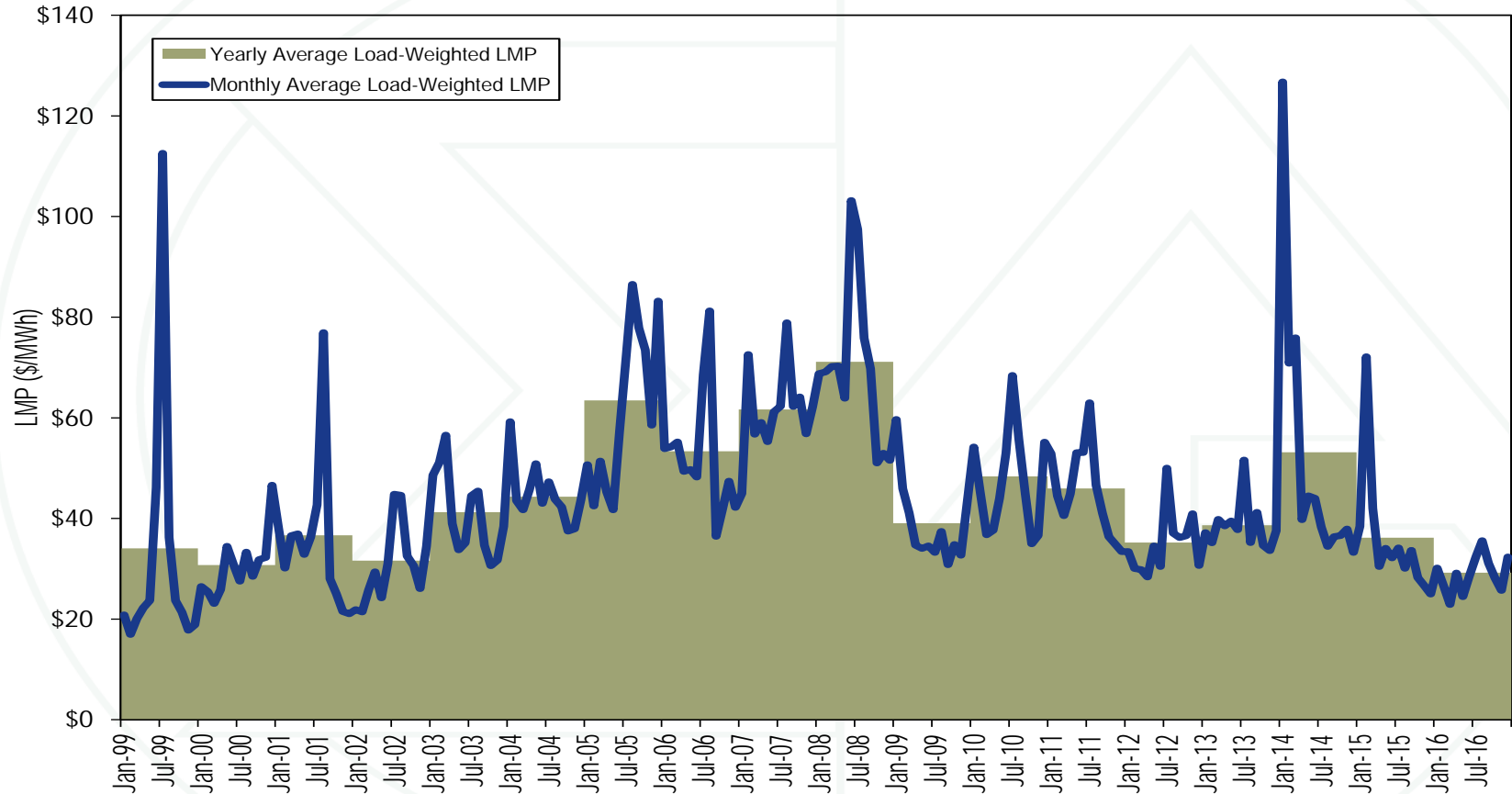
Peak loads: 1999 to 2016



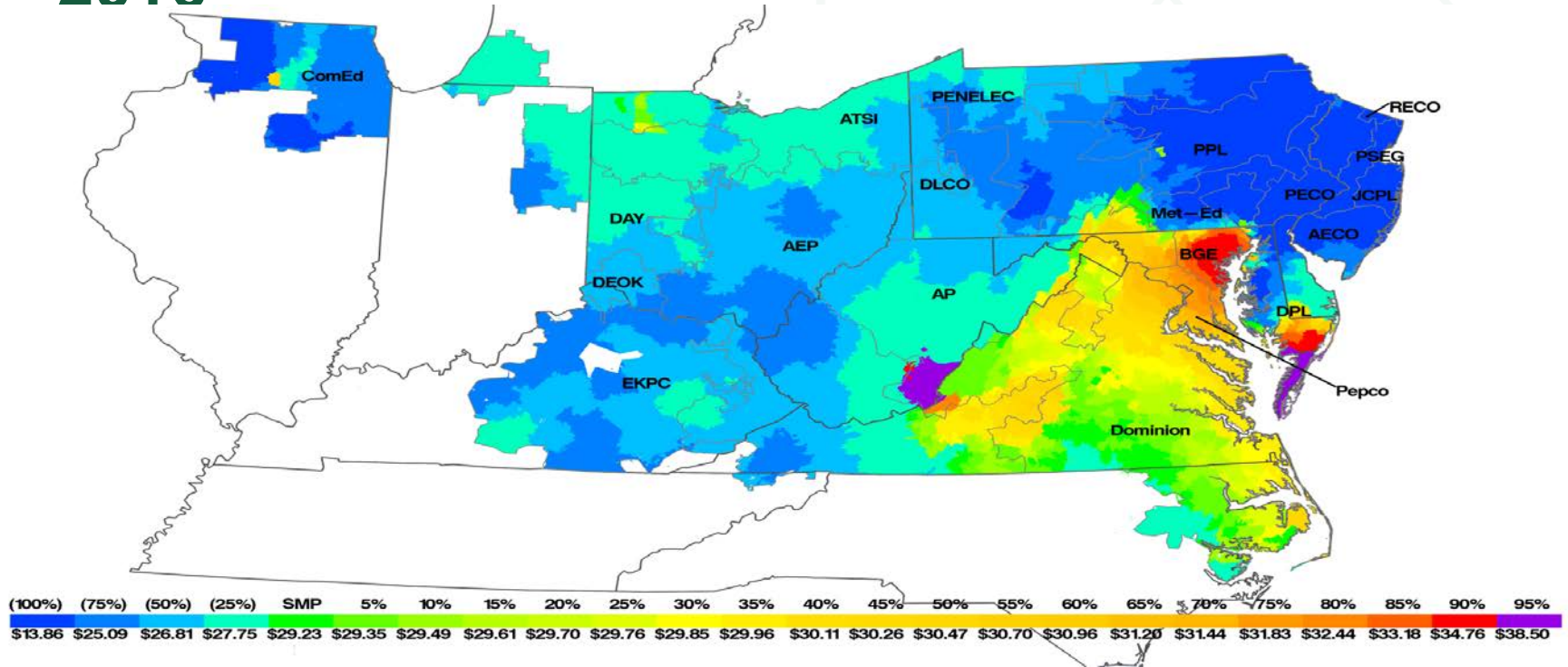
Average short run marginal costs: gas and coal



Real-time load-weighted, average LMP



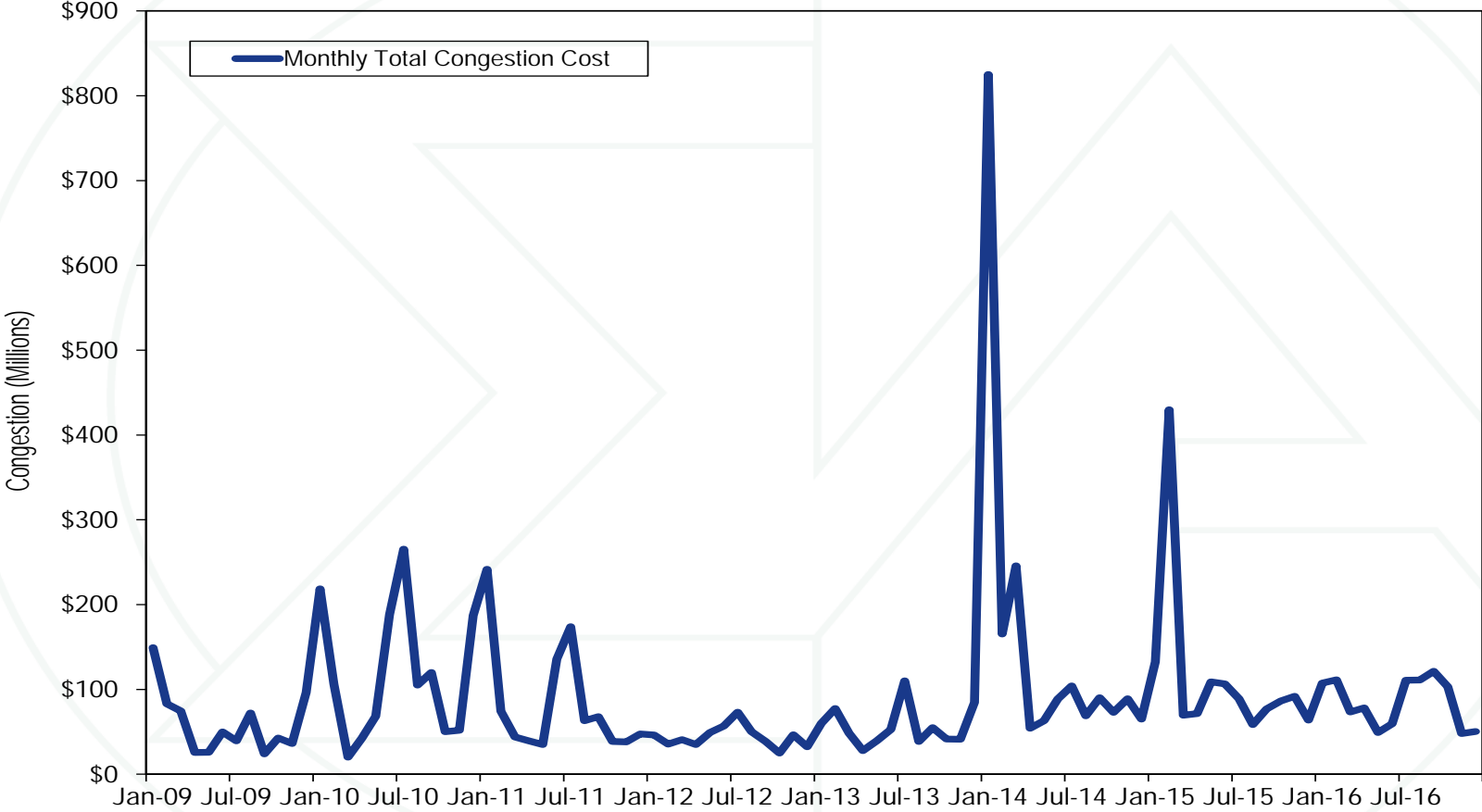
PJM real-time, load-weighted, average LMP: 2016



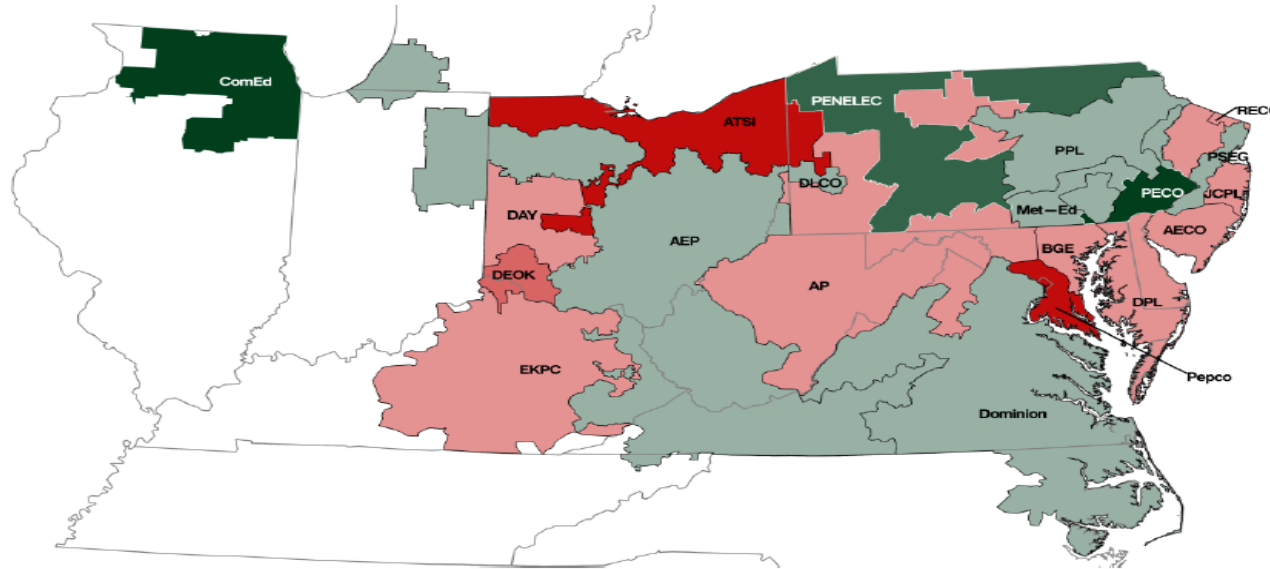
Components of PJM real-time LMP

Element	2015		2016		Change
	Contribution to LMP	Percent	Contribution to LMP	Percent	Percent
Coal	\$15.62	43.2%	\$13.28	45.4%	2.2%
Gas	\$9.85	27.2%	\$7.96	27.2%	(0.0%)
Ten Percent Adder	\$3.02	8.4%	\$2.43	8.3%	(0.0%)
VOM	\$2.38	6.6%	\$2.04	7.0%	0.4%
NA	\$0.89	2.4%	\$1.23	4.2%	1.8%
NO _x Cost	\$0.29	0.8%	\$0.42	1.4%	0.6%
Markup	\$0.12	0.3%	\$0.40	1.4%	1.0%
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%

Monthly total congestion costs



Real-time generation less real-time load by zone: 2016

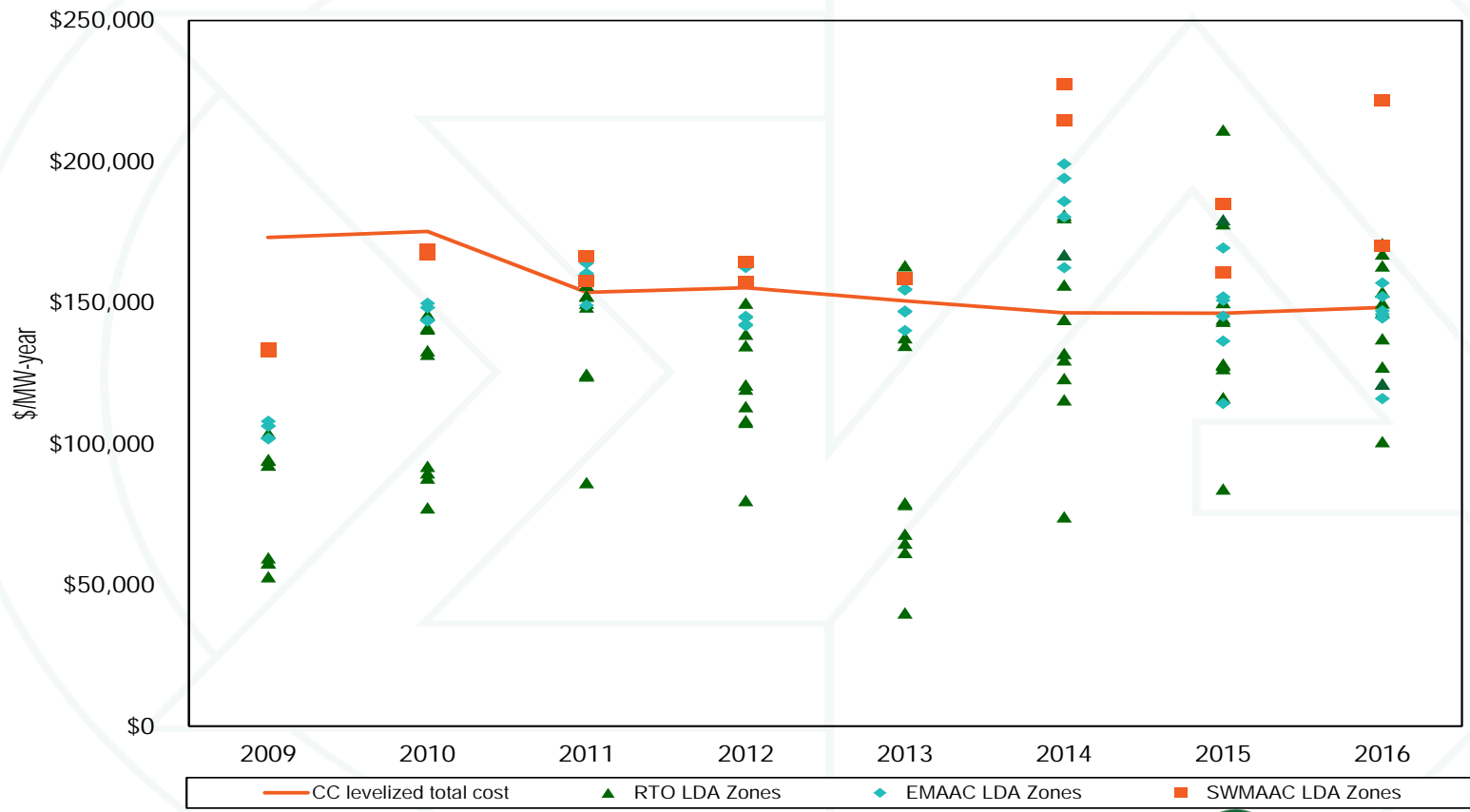


Zone	Net Gen Minus Load (GWh)	Zone	Net Gen Minus Load (GWh)	Zone	Net Gen Minus Load (GWh)	Zone	Net Gen Minus Load (GWh)
AECO	(3,427)	ComEd	31,369	DPL	(9,806)	PENELEC	20,307
AEP	14,986	DAY	(1,908)	EKPC	(2,765)	Pepco	(20,204)
AP	(574)	DEOK	(10,616)	JCIPL	(4,712)	PPL	9,668
ATSI	(24,444)	DLCO	3,361	Met-Ed	6,937	PSEG	1,800
BGE	(9,363)	Dominion	264	PECO	24,506	RECO	(1,481)

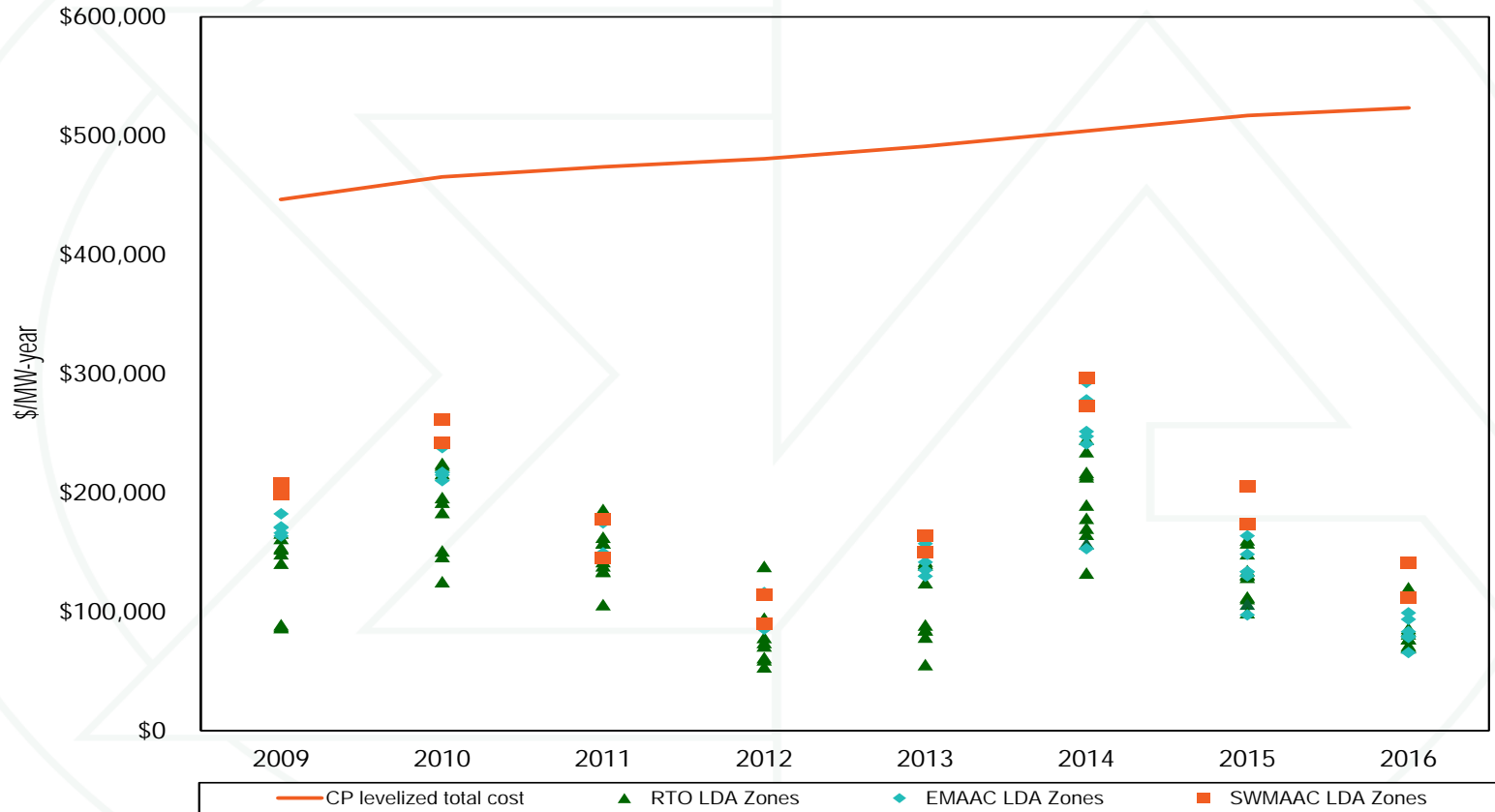
New entrant CT net revenue and total cost



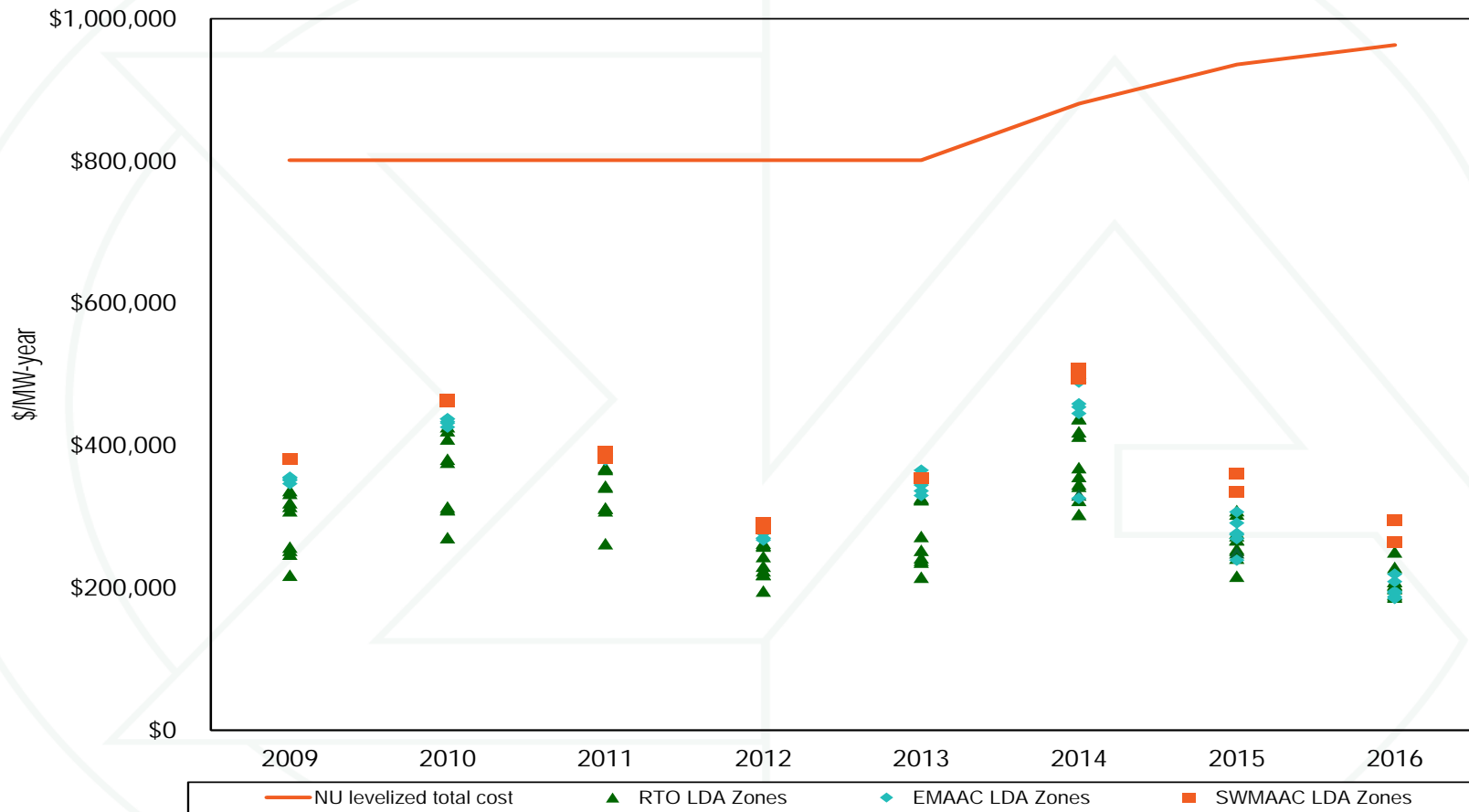
New entrant CC net revenue and total cost



New entrant CP net revenue and total cost



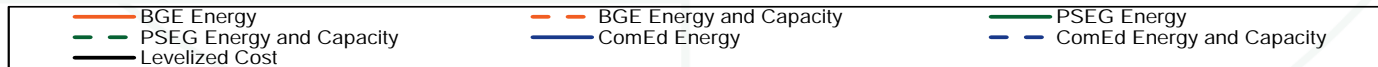
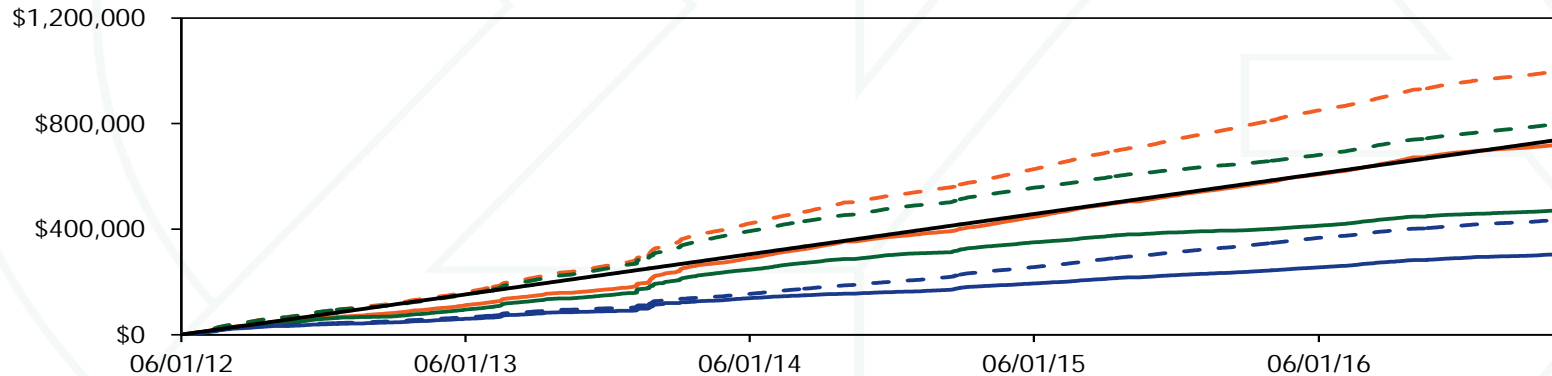
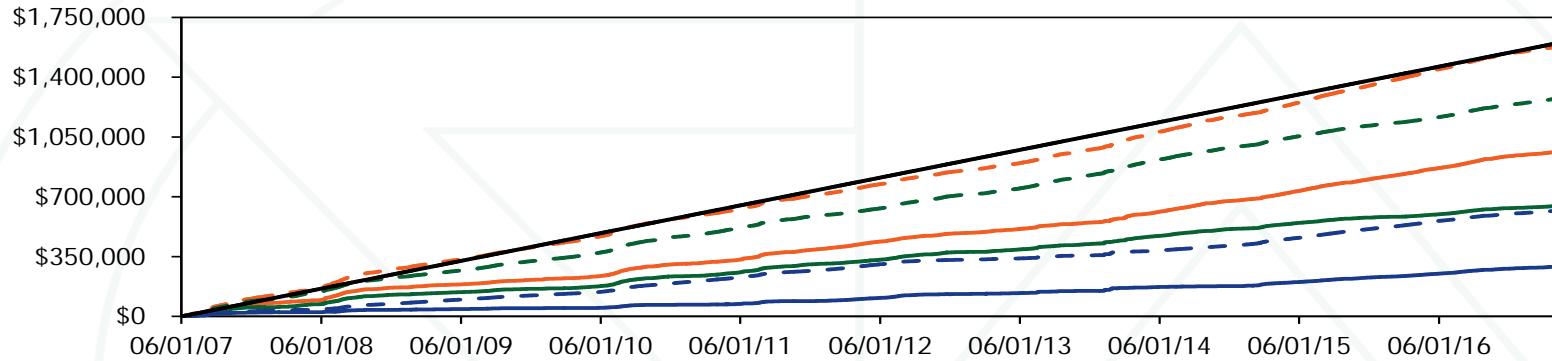
New entrant nuclear net revenue and total cost



Avoidable cost recovery by quartile: 2016

Technology	Total Installed Capacity (ICAP)	Recovery of avoidable costs from energy and ancillary net revenue			Recovery of avoidable costs from all markets		
		First quartile	Median	Third quartile	First quartile	Median	Third quartile
CC - Combined Cycle	55,596	12%	288%	535%	256%	487%	706%
CT - Aero Derivative	6,173	10%	27%	42%	243%	322%	434%
CT - Industrial Frame	21,081	0%	13%	38%	400%	472%	532%
Coal Fired	61,317	6%	21%	52%	61%	85%	131%
Diesel	439	0%	56%	329%	426%	490%	696%
Hydro	9,725	127%	164%	233%	179%	277%	354%
Nuclear	31,661	61%	87%	104%	90%	119%	134%
Oil or Gas Steam	8,199	0%	0%	16%	163%	183%	214%
Pumped Storage	31,013	214%	260%	681%	250%	561%	715%

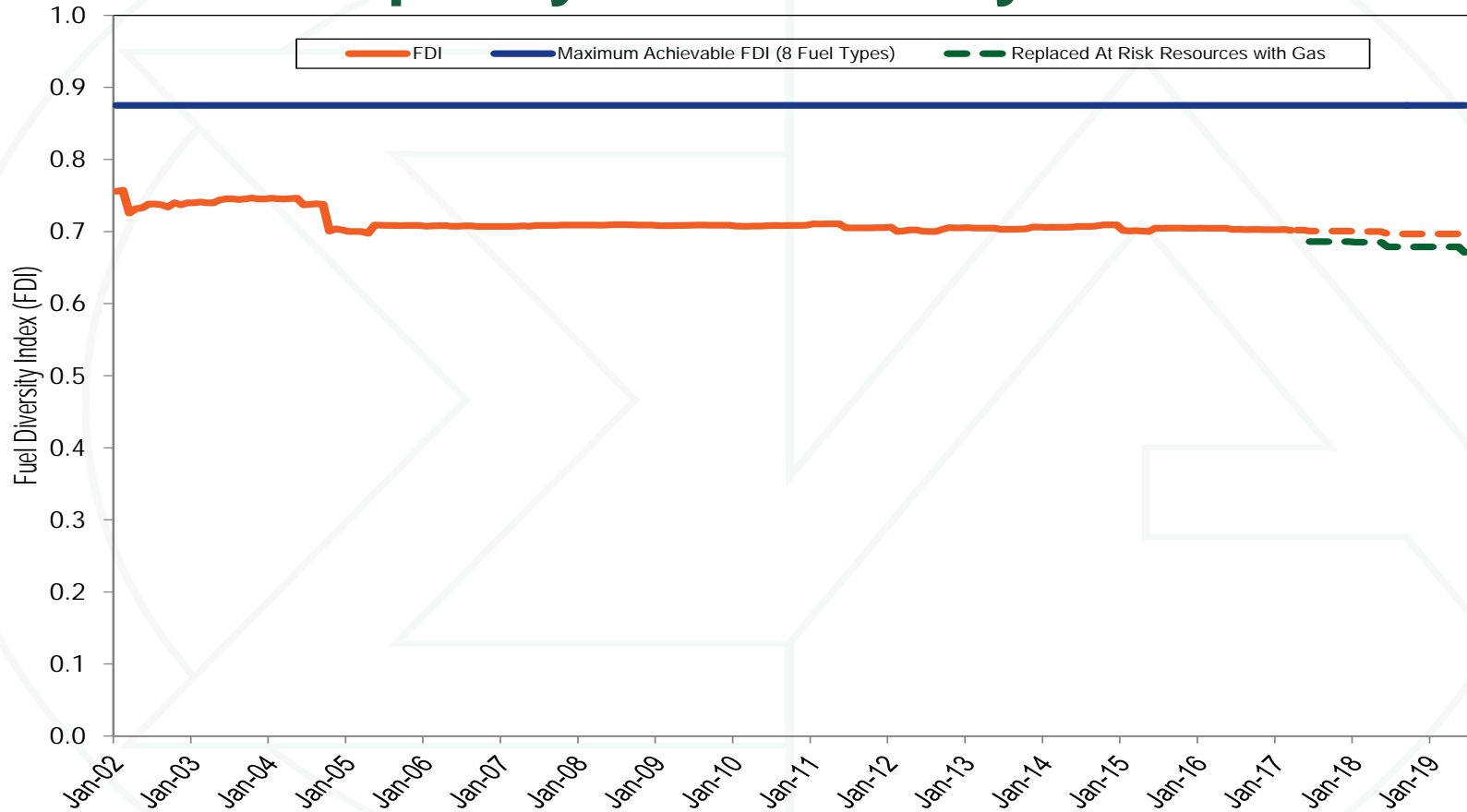
Historical new entrant CC revenue adequacy



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%

Installed capacity fuel diversity index



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