Energy Efficiency in U.S. Capacity Markets

A Synapse Mini-Paper

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AUTHORS

Pat Knight
Doug Hurley
Spencer Fields

Synapse
Energy Economics, Inc.

485 Massachusetts Avenue, Suite 2
Cambridge, Massachusetts 02139

617.661.3248 | www.synapse-energy.com

1. INTRODUCTION

The objective of a capacity market is to purchase sufficient capacity for reliable system operation during some future year.[1] In the New England ISO, the capacity market is called the Forward Capacity Market (FCM). In PJM, the capacity market is known as the Reliability Pricing Model (RPM).[2] Since the FCM began operation in 2010, non-traditional energy resources have participated in the market, including Energy Efficiency (EE) and Distributed Generation (DG). In contrast, while the RPM has been in operation since 2007, EE resources have only been able to participate in the market beginning with the 2012 delivery year. Allowing EE resources in capacity markets has the benefit of increased revenues to EE administrators, allowing for increased revenues for EE programs or decreased rates for ratepayers. This document examines the annual growth trends of these demand resources in both the FCM and the RPM. Over the period 2010 to 2017, while the FCM has cleared between 20% and 26% as much total capacity as the RPM, EE has comprised a much higher percentage in the FCM vs. the RPM (6% vs. 1% in the most recent auction). Both RTOs have seen similar annual increases in the amount of EE in their respective capacity markets, at around 16% and 19% in ISO-NE and PJM, respectively.

2. ENERGY EFFICIENCY AND DISTRIBUTED GENERATION IN NEW ENGLAND'S FCM

Over the first eight Forward Capacity Auctions, the total capacity cleared in the Forward Capacity Market (FCM), the Capacity Supply Obligation (CSO), has fluctuated between nearly 34,000 MW and 37,500 MW. As shown in Table 1, the total CSO attributable to EE and DG has tripled during this time period, from 2% of the total CSO in FCA-1 to over 6% of the total CSO in FCA-8.

Table 1. EE & DG CSO and total CSO, FCA-1 through FCA-8

	FCA 1	FCA 2	FCA 3	FCA 4	FCA 5	FCA 6	FCA 7	FCA 8
Total EE & DG	701.0	983.1	1,061.6	1,294.6	1,485.7	1,770.2	1,751.6	2,059.4
	2.06%	*2.64%*	*2.87%*	*3.45%*	*4.02%*	*4.88%*	*4.84%*	*6.11%*
Total CSO	34,077	37,283	36,996	37,501	36,918	36,309	36,220	33,702

[1] For FCA-1, the auction was conducted 28 months prior to the start of the commitment period. With each subsequent auction, the lag between auction and commitment period has increased. Starting with FCA-7, the auction will take place 40 months before the commitment period, at which point the shifting will cease.

[2] The RPM replaced an earlier capacity market, called the "Capacity Credit Market", which began operation in 1999.

Figure 1 demonstrates the split between the CSO attributable to energy efficiency and distributed generation. The amount of EE that clears in the FCM increases steadily each year, while the amount of DG is less predictable.

Figure 1. Capacity cleared by type, energy efficiency vs. distributed generation, MW

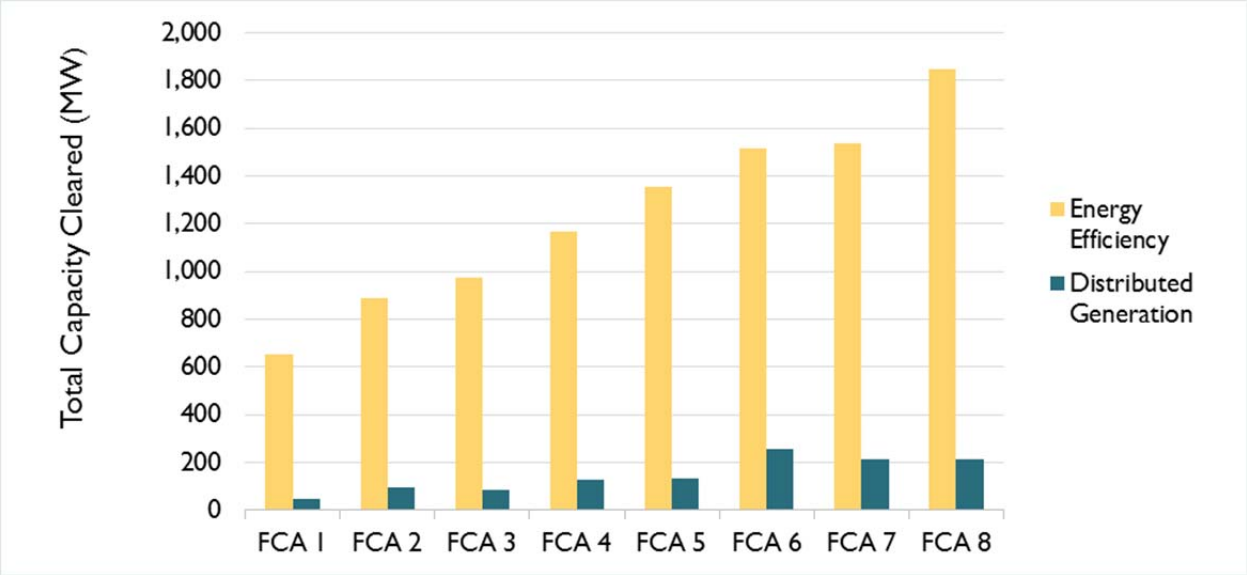
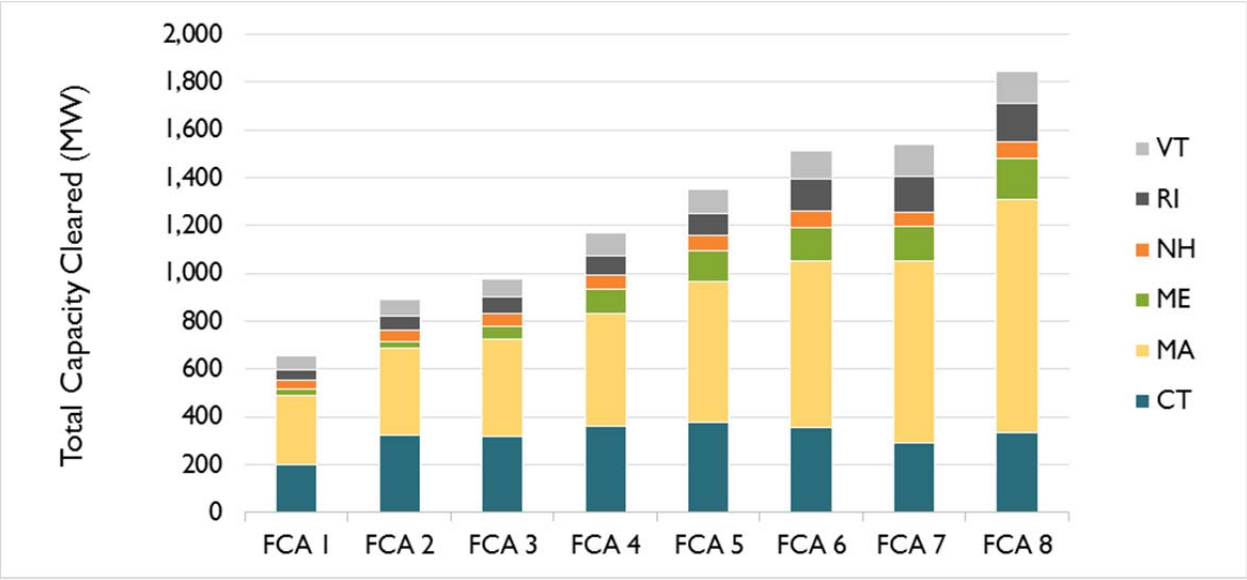


Figure 2 and Figure 3 provide the breakdown of the EE CSO by state and by participant type, respectively.

Figure 2. Capacity cleared by state, energy efficiency, MW



Of all the states in New England, Massachusetts is the largest contributor of EE to the FCM, with over 53% of the EE CSO in FCA-8. Maine has seen the largest increase in EE cleared capacity from FCA-1 to FCA-8 at 549%.

Figure 3. Capacity cleared by participant type, energy efficiency, MW

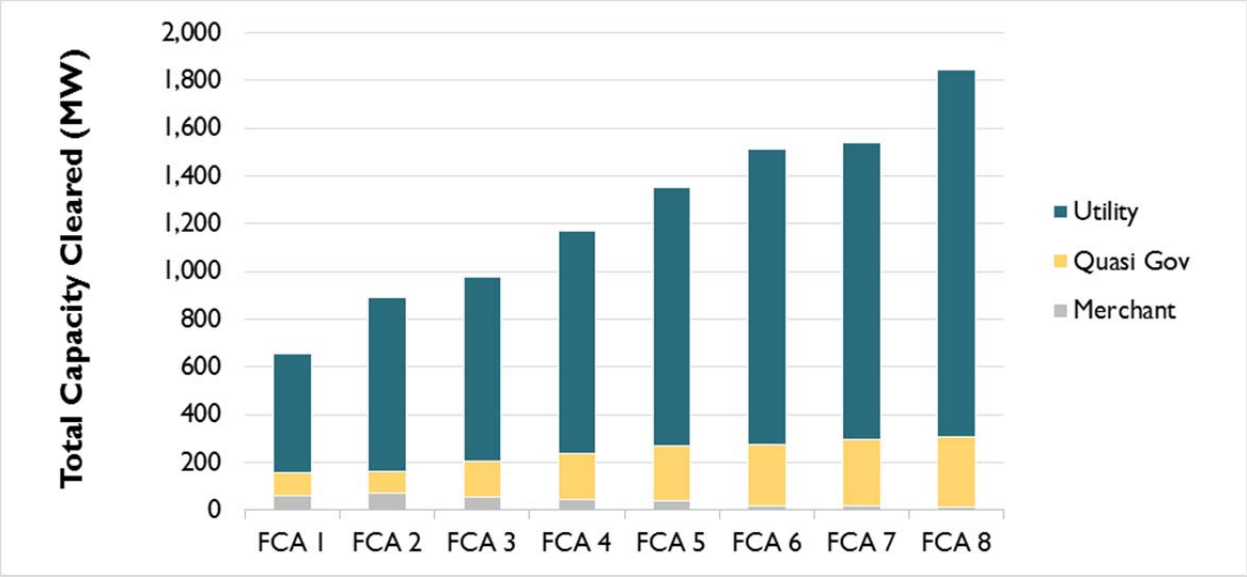


Table 2 describes the annual change in EE CSO from FCA-1 to FCA-8. Utilities have made up the majority of the EE CSO each FCA. During FCA-8, utilities comprised 83% of the EE CSO, followed by Quasi-Government organizations at 16%. Merchants made up the remainder, with a CSO that has been steadily decreasing since FCA-1. On average, the total EE CSO has been increasing by 16% per year, or 170 MW of additional EE each year, on average.

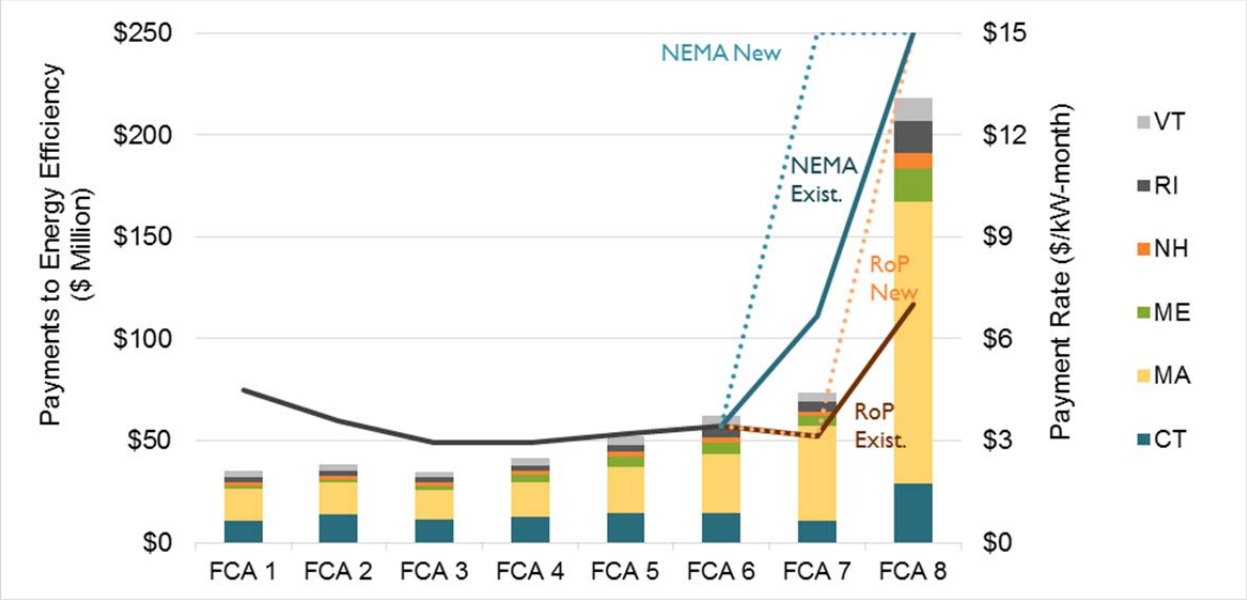
Table 2. Annual change in cleared capacity, energy efficiency

	FCA 1 - FCA 2	FCA 2 - FCA 3	FCA 3 - FCA 4	FCA 4 - FCA 5	FCA 5 - FCA 6	FCA 6 - FCA 7	FCA 7 - FCA 8	Average
State								
CT	62%	-2%	13%	5%	-6%	-18%	16%	10%
MA	26%	12%	16%	25%	18%	9%	28%	19%
ME	2%	105%	92%	22%	7%	8%	15%	36%
NH	38%	8%	7%	10%	10%	-12%	13%	11%
RI	30%	15%	19%	12%	50%	8%	12%	21%
VT	18%	10%	26%	14%	13%	12%	-2%	13%
Participant Type								
Merchant	20%	-22%	-27%	-7%	-50%	-19%	-10%	-17%
Quasi Gov	-5%	66%	30%	18%	11%	10%	6%	19%
Utility	46%	6%	21%	17%	14%	0%	23%	18%
Total								
Total %	36%	9%	20%	16%	12%	2%	20%	16%
Total MW	236	84	192	187	160	24	307	170

Figure 4 aggregates the estimated annual payments to energy efficiency by the FCM for new and existing resources.[3] The calculation of payments to energy efficiency has several distinct components as a result of divergent payment rates for capacity in different zones and resource types during FCA 7 and FCA 8. Through FCA 6, all resources – new and existing from each load zone – received the same capacity payment rate. Thus, to calculate the total payments to EE from those auctions, we multiply the total EE CSO by the capacity clearing price. These results, which are aggregated by state, are presented as the columns in Figure 4, below. In FCA 7, new and existing resources from the NEMA load zone receive payments at different, higher rates than the rest of ISO-NE, which again received the auction floor price. In FCA 8, however, new and existing resources from NEMA receive the same payments, while payments for new and existing resources in the rest of pool diverge. These fluctuations in payment rates for resources are displayed as the lines in Figure 4, with the payment rates for NEMA and the Rest of Pool (RoP) diverging after FCA 6.

[3] Note that this chart assumes that (a) all PAs have taken the 1-year price every year (as opposed to multi-year pricing), (b) no incentive payments are taken, (c) there is perfect performance during each delivery year, and (d) no trading occurs during reconfiguration auctions.

Figure 4. Estimated payments to energy efficiency, $ Million



Note: The payment rate for all states is the auction floor price for FCA 1 through FCA 6. In FCA 7, new and existing resources from the NEMA region received different capacity payments as a result of local load constraints. Given the preliminary results from FCA 8, new and existing resources from the Rest of Pool (RoP) are slated to receive different capacity payments.

3. ENERGY EFFICIENCY IN PJM'S RPM

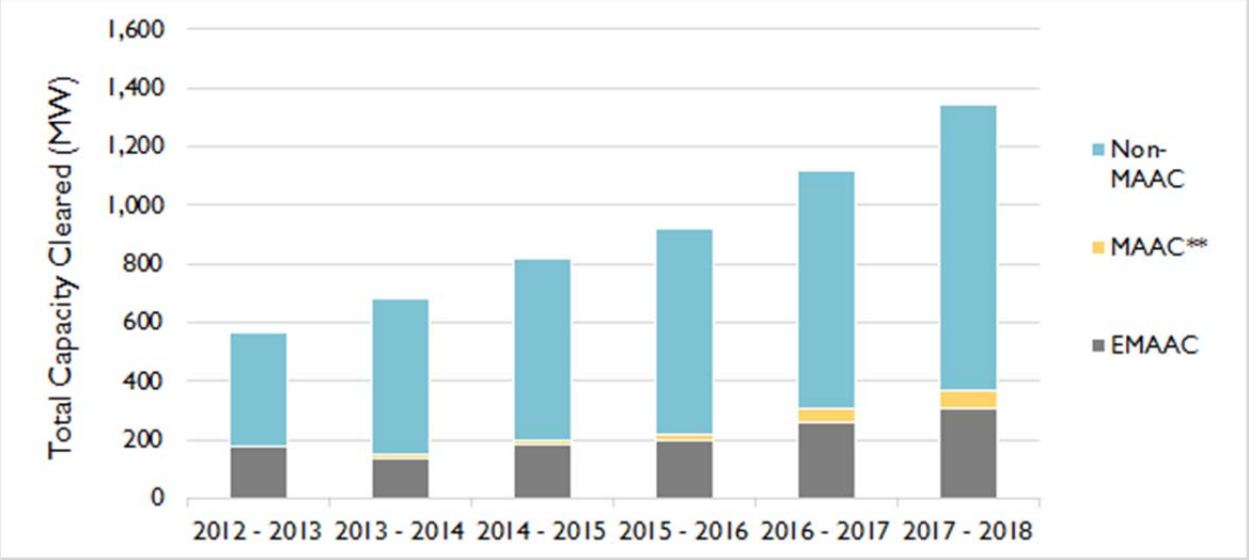
The total capacity bid into the RPM has grown by nearly 23% in the five auctions since 2012-2013, the first auction in which EE was able to bid. Table 3 indicates that during this time, EE has represented a small, though growing, percent of the total Unforced Capacity Obligations (UCAP Obligations).

Table 3. EE UCAP obligation and total UCAP obligation, RPM delivery years 2012-2013 through 2017-2018, MW

	2012 - 2013	2013 - 2014	2014 - 2015	2015 - 2016	2016 - 2017	2017 - 2018
EE UCAP Obligation	568.9	679.4	822.1	922.5	1,117.3	1,340.0
	0.41%	*0.43%*	*0.53%*	*0.55%*	*0.64%*	*0.78%*
Total UCAP Obligation	139,487	156,493	153,683	168,631	173,313	171,129

Figure 5 demonstrates the total EE cleared for each of the delivery years in which EE has been able to participate in the RPM. The sum of all EE cleared in the MAAC LDAs represented about a third of the total EE cleared in the initial auction. This percent has been decreasing each year, with the most recent auction having non-MAAC LDAs represent over 72% of the cleared EE capacity.

Figure 5. Capacity cleared by LDA, energy efficiency, MW



*** Note that the "MAAC" capacity depicted above includes only the EE which cleared in non-EMAAC zones. This allocation is based on the split used in for the 2015-2016 auction; zones have been allocated to other LDAs differently in other auctions.*

Table 4 shows the growth in cleared EE capacity by LDA. The greatest increase has been in non-MAAC zones, with gains of about 20% each year. On average PJM is seeing annual increases of about 19% across all zones.

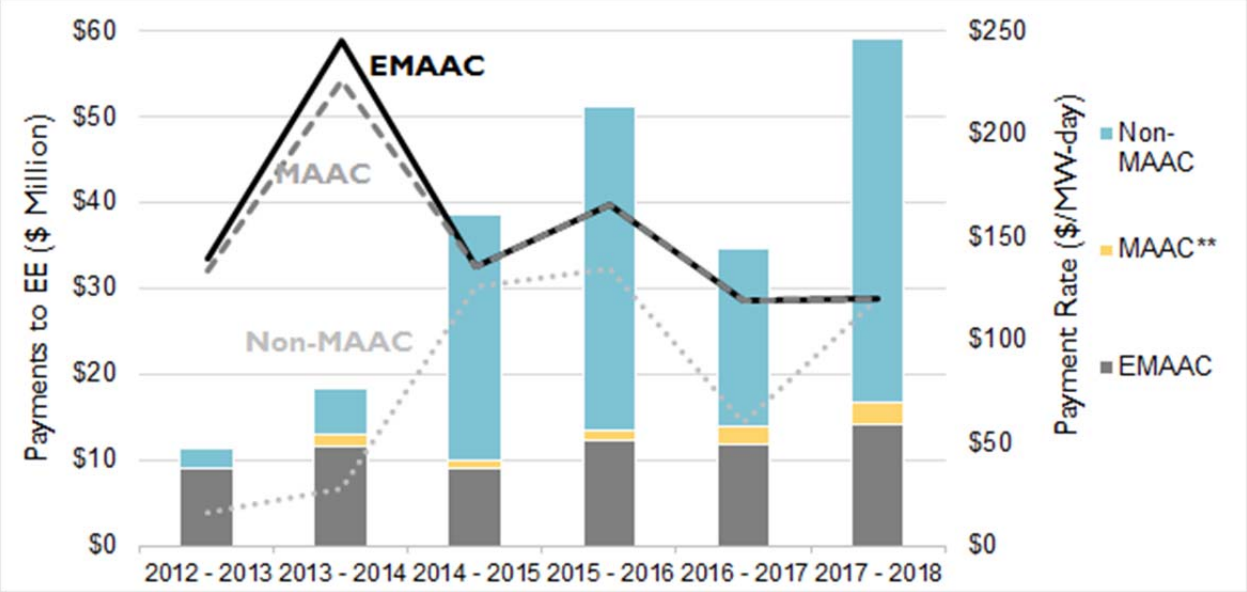
Table 4. Annual change in cleared capacity, energy efficiency

LDA	12 - '13 - '13 - '14	13 - '14 - '14 - '15	14 - '15 - '15 - '16	15 - '16 - '16 - '17	16 - '17 - '17 - '18	Average
EMAAC Sub Total	-25%	35%	11%	29%	19%	14%
MAAC Sub Total*	-16%	31%	12%	39%	19%	17%
Non-MAAC Total	36%	18%	12%	15%	20%	20%
Total	19%	21%	12%	21%	20%	19%

*** Note that "MAAC" includes all MAAC zones, including EMAAC zones.*

Figure 6 shows the estimated annual payments to energy efficiency in the RPM. Note that in this figure, the payment rate is calculated by zone, and then summed by LDA. Payment rate lines indicate the average payment rate for each of the LDAs.

Figure 6. Estimated payments to energy efficiency, $ Million



*** Note that the "MAAC" capacity depicted above includes only the EE which cleared in non-EMAAC zones. This allocation is based on the split used in for the 2015-2016 auction; zones have been allocated to other LDAs differently in other auctions.*

4. COMPARISON

Although ISO-NE is a much smaller region and clears significantly less capacity in each auction than PJM, EE capacity clearing in ISO-NE has exceeded the same resources in PJM on a MW level during every auction year. As such, and as seen in Table 5, ISO-NE boasts a much higher percentage of EE capacity as a portion of overall cleared capacity in each auction.

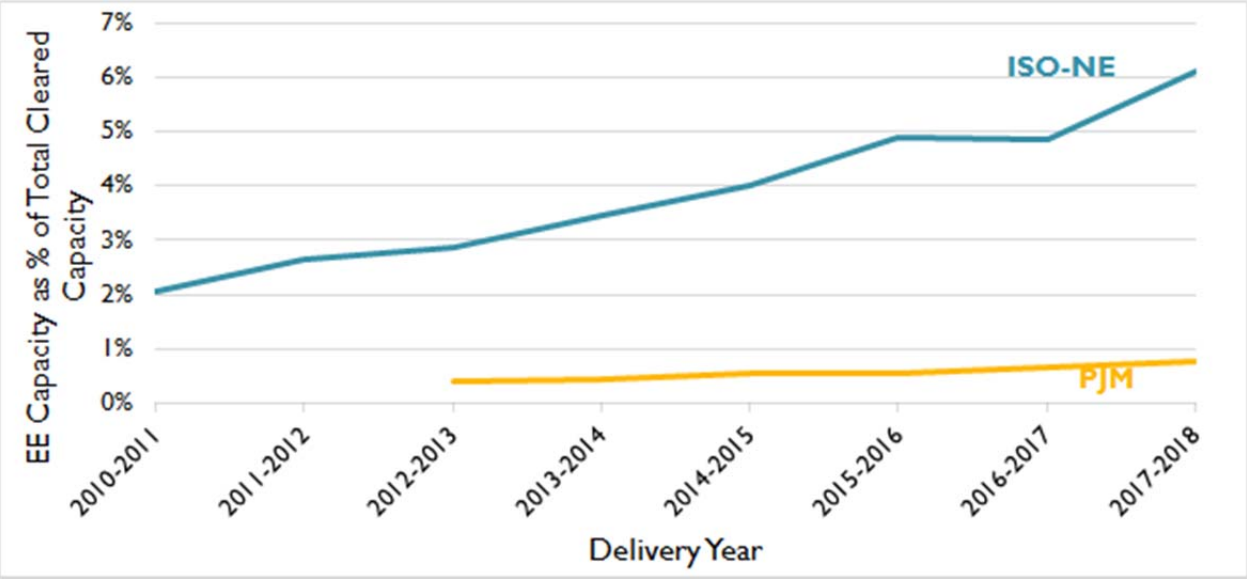
Table 5: Comparison of EE Capacity and Overall Cleared Capacity, PJM vs. ISO-NE

	Market	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Total Capacity	ISO-NE	36,996	37,501	36,918	36,309	36,220	33,702
	PJM	139,487	156,493	153,683	168,631	173,313	171,129
EE Capacity	ISO-NE	1,062	1,295	1,486	1,770	1,752	2,059
	PJM	569	679	822	923	1,117	1,340
EE Capacity as a % of overall obligation	ISO-NE	2.9%	3.5%	4.0%	4.9%	4.8%	6.1%
	PJM	0.4%	0.4%	0.5%	0.5%	0.6%	0.8%
EE Payment Rate ($/kW-month)	ISO-NE	$2.951	$2.951	$3.209	$3.434	$3.150	$7.025
	PJM	$0.501	$0.843	$3.831	$4.095	$1.806	$3.644

Note: The payment prices used above are the "Rest-of-Pool" rate in ISO-NE, and the "RTO" rate in PJM, which has been converted from $/MW-day to $/kW-month for purposes of comparison.

Even as capacity prices have fluctuated in each region, and especially in PJM, there had been no clear single-year spikes in incremental capacity clearing until FCA 8 in ISO-NE. In fact, as seen in Figure 7, the growth from year to year has been largely consistent in both regions.

Figure 7: EE Capacity as a Percentage of Overall Cleared Capacity, PJM vs. ISO-NE



5. NEXT STEPS

The information presented above provides only the shell of a story. Absent from the numbers in the figures and tables is an exploration of why so little energy efficiency capacity is clearing in PJM base residual auctions, or how ISO-NE has encouraged continued growth of efficiency capacity across the forward capacity auctions. As such, there are a few possible research avenues that could augment the overall discussion of energy efficiency performance in capacity markets.

Why is so much more efficiency clearing in ISO-NE than in PJM? While it certainly cannot hurt that all but two of the states included in ISO-NE are ranked in the top ten of the 2013 State Energy Efficiency Scorecard produced by the American Council for an Energy Efficient Economy, PJM consists of several states in the top half of the rankings, so this statistic alone does not explain the substantial difference between quantities of efficiency cleared in each auction. By delving into state efficiency targets and the differences between the mechanisms in each market, we can provide a better narrative as to why so much more efficiency clears in ISO-NE than in PJM, while also proposing recommendations for how PJM can increase efficiency clearing in the markets.

Do capacity markets reflect actual energy efficiency capacity? During a 2012 case before the Ohio Public Utilities Commission, Chris Neme of Energy Futures Group submitted testimony

finding that FirstEnergy had significantly underbid energy efficiency capacity into the PJM BRA, failing to account for savings that in reality were on the order of 5 to 6 times higher than the capacity bid.[4] This finding did not occur in a vacuum: in a 2012 memorandum to the EPA, Synapse found that the amount of efficiency bid into capacity markets often does not align with the amount of efficiency that utilities actually achieve. In order to determine to what extent this is driving down energy efficiency participation in capacity markets in PJM and ISO-NE, Synapse proposes to examine annual reports and planning documents from utilities in addition to detailed capacity market results to compare planned efficiency with the amount bid in to capacity markets and, ultimately, with the amount of efficiency actually achieved.

What comes next for energy efficiency? In the aftermath of the recent overturning of FERC Order 745 by the DC Circuit Court of Appeals, the potential for demand side resources to continue to participate and be compensated in capacity markets is in flux. However, regardless of the final outcome of the legal process surrounding this order, energy efficiency should be incorporated into other aspects of forward planning. For instance, now that the contribution of energy efficiency resources has been well documented and verified, EE capacity should be included in transmission planning. While ISO-NE has already begun to do just that, there are other areas in which efficiency resources are undercounted or undervalued in planning in both PJM and ISO-NE.

[4] Direct Testimony of Chris Neme on Behalf of Sierra Club Before the Public Utilities Commission of Ohio. Case No. 12-1230-EL-SSO. May 21, 2012.