



**Multi-Family Comprehensive Energy
Efficiency Program (MCEEP)
PY6 Evaluation Report**

Final

**Energy Efficiency/Demand Response Plan:
Plan Year 6
(6/1/2013-5/31/2014)**

**Presented to
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Executive Summary

This report presents a summary of the findings and results from Navigant Consulting, Inc.'s (Navigant's) impact evaluation for electric program year six (EPY6) and gas program year three (GPY3)¹ of the Commonwealth Edison Company (ComEd) Multi-Family Comprehensive Energy Efficiency Program (MCEEP). In March 2013, the program started planning a new design and delivery strategy to target whole-building savings, which resulted in the program now being referred to as MCEEP. The EPY6/GPY3 program year is the first full year for joint MCEEP program delivery with Nicor Gas Company and with Peoples Gas and North Shore Gas. The program achieves electric energy and demand savings for ComEd customers and natural gas energy savings for customers of Nicor Gas Company, Peoples Gas, and North Shore Gas. This evaluation report includes total ComEd electric impacts from all of the jointly implemented programs.

During EPY6/GPY3, MCEEP continued to implement its direct install components (including compact fluorescent lamps [CFLs], programmable thermostats, hot water pipe wrap insulation, and water efficiency measures in residential dwelling units and common areas). Concurrently, MCEEP developed marketing and outreach materials to commercial contractors and multi-family decision-makers about program measures designed to achieve energy savings in whole buildings and grounds. These measures include upgrades or improvements to central plant and heating, ventilating, and air-conditioning (HVAC) systems and controls, interior and exterior lighting systems, and building shell improvements. Some MCEEP measures were previously offered through different programs, such as the Business Standard program and the Business Custom program. The MCEEP was delivered through three channels in EPY6/GPY3: direct install, trade ally participant installation (TAPI), and through prescriptive incentives. The TAPI and incentive categories comprised the comprehensive component of the MCEEP design in EPY6/GPY3, in addition to the direct install measures offered in the previous program years. Franklin Energy Services, LLC (Franklin Energy) was the primary implementation contractor for the program.

E.1 Program Savings

The MCEEP realized verified net energy savings of 39,490 megawatt-hours (MWh), verified net demand reduction of 27.45 megawatts (MW) and verified net peak demand reduction of 5.29MW. Table E-1 summarizes the breakdown of electricity savings from the ComEd EPY6 MCEEP by tenant space and common area installations.

¹ EPY6/GPY3 began June 1, 2013, and ended May 31, 2014.

Table E-1. EPY6 Total Program Electric Savings by Installation Area

Savings Category	Energy Savings (MWh)	Demand Reduction (MW)	Peak Demand Reduction (MW)
Residential (Tenant Space)			
Ex Ante Gross Savings	14,405	23.50	1.45
Verified Gross Savings	14,405	23.50	1.45
Verified Net Savings	13,875	22.36	1.40
Business (Common Areas)			
Ex Ante Gross Savings	24,880	6.24	4.76
Verified Gross Savings	31,345	6.24	4.76
Verified Net Savings	25,615	5.09	3.89
EPY6 Program Total			
Ex Ante Gross Savings	39,285	29.74	6.21
Verified Gross Savings	45,750	29.74	6.21
Verified Net Savings	39,490	27.45	5.29

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

Table E-3 summarizes the breakdown of the electricity savings from the ComEd and Peoples Gas (PGL) and North Shore Gas (NSG) joint program, and from the ComEd and Nicor Gas joint program. The ComEd/PGL/NSG joint program realized net energy savings of 21,823 MWh, net demand reduction of 11.05 MW and net peak demand reduction of 3.19 MW. The ComEd/Nicor Gas joint program realized net energy savings of 17,667 MWh, net demand reduction of 16.40 MW and net peak demand reduction of 2.10 MW.

Table E-2. EPY6 Total Program Electric Savings by Utility

Utility Savings	Energy Savings (MWh)	Demand Reduction (MW)	Peak Demand Reduction (MW)
Savings from ComEd/PGL/NSG			
Ex Ante Gross Savings	21,743	12.20	3.85
Verified Gross Savings	25,988	12.20	3.85
Verified Net Savings	21,823	11.05	3.19
Savings from ComEd/Nicor Gas			
Ex Ante Gross Savings	17,542	17.53	2.36
Verified Gross Savings	19,762	17.53	2.36
Verified Net Savings	17,667	16.40	2.10
ComEd EPY6 Program Total			
Ex Ante Gross Savings	39,285	29.73	6.21
Verified Gross Savings	45,750	29.73	6.21
Verified Net Savings	39,490	27.45	5.29

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

The following tables summarize the breakdown of the electricity savings from the Energy Efficiency Portfolio Standard (EEPS) and Illinois Power Agency (IPA) subcategories of the ComEd EPY6 MCEEP. As shown in Table E-3, the EEPS category realized verified net energy savings of 20,469 MWh, verified net demand reduction of 23.64 MW and verified net peak demand reduction of 2.39 MW.

Table E-3. EPY6 Total Program EEPS Electric Savings

Savings Category †	Energy Savings (MWh)	Demand Reduction (MW)	Peak Demand Reduction (MW)
Residential (Tenant Space)			
Ex Ante Gross Savings	14,405	23.50	1.45
Verified Gross Savings	14,405	23.50	1.45
Verified Net Savings	13,874	22.36	1.40
Business (Common Areas)			
Ex Ante Gross Savings	6,061	1.47	1.14
Verified Gross Savings	7,569	1.47	1.14
Verified Net Savings	6,595	1.28	0.99
EEPS Program Total			
Ex Ante Gross Savings	20,466	24.97	2.59
Verified Gross Savings	21,974	24.97	2.59
Verified Net Savings	20,469	23.64	2.39

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

As shown in Table E-4, the IPA category realized verified net energy savings of 19,021 MWh, verified net demand reduction of 3.81 MW and verified net peak demand reduction of 2.90 MW. Navigant counted all direct install savings and large common area measures/projects as EEPS savings based on discussion with ComEd.² The IPA program savings included only common area measures.

² From Navigant’s correspondence with ComEd Program Manager on October 6, 2014, ComEd allocated 18,827 gross MWh to IPA based on the IPA budget, with the rest going to EEPS. Navigant identified verified gross savings of 18,819 MWh for IPA (based on findings from the tracking data, 8 MWh less than the ComEd allocation). EEPS verified gross savings was 20,469 MWh, 348 MWh less than ComEd’s 20,817 gross MWh.

Table E-4. EPY6 Total Program IPA Electric Savings

Savings Category	Energy Savings (MWh)	Demand Reduction (MW)	Peak Demand Reduction (MW)
Business (Common Areas)			
Ex Ante Gross Savings	18,819	4.77	3.62
Verified Gross Savings	23,776	4.77	3.62
Verified Net Savings	19,021	3.81	2.90

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

E.2 Program Savings by Channel and Measure Type

Table E-5 summarizes EPY6/GPY3 MCEEP savings by program channel and measure category. In EPY6/GPY3, the MCEEP achieved verified net energy savings of 39,490 MWh, verified net demand reduction of 27.45 MW, and verified net peak demand reduction of 5.29 MW. The MCEEP achieved verified net savings of 13,550 MWh from direct install lighting measures, verified net savings of 1,981 MWh from hot water measures, verified net savings of 22,674 MWh from common area comprehensive measures, and verified net savings of 1,285 MWh from programmable/reprogrammed thermostats. Additional impact details by measure, including total demand reduction by measure, are included in Section 3 and Section 4 of the report.

Table E-5. EPY6/GPY3 MCEEP Results by Channel and Measure

Program Channel	Net Energy Savings (MWh)	Net Demand Reduction (MW)	Net Peak Demand Reduction (MW)
Lighting (Direct Install)			
Ex Ante Gross Savings	13,085	12.84	1.59
Verified Gross Realization Rate**	106%	100%	100%
Verified Gross Savings	13,827	12.84	1.59
NTGR*	0.98	0.98	0.98
Verified Net Savings	13,550	12.58	1.56
Hot Water Measures (Direct Install)			
Ex Ante Gross Savings	2,153	11.23	0.29
Verified Gross Realization Rate**	100%	100%	100%
Verified Gross Savings	2,153	11.23	0.29
NTGR*	0.92	0.92	0.92
Verified Net Savings	1,981	10.33	0.26
Thermostats (Direct Install)			
Ex Ante Gross Savings	1,427	0.00	0.00
Verified Gross Realization Rate**	100%	0.00	0.00
Verified Gross Savings	1,427	0.00	0.00
NTGR**	0.90	0.90	0.90
Verified Net Savings	1,285	0.00	0.00
Common Areas (Comprehensive)			
Ex Ante Gross Savings	22,620	5.67	4.33
Verified Gross Realization Rate**	125%	100%	100%
Verified Gross Savings	28,343	5.67	4.33
NTGR*	0.80	0.80	0.80
Verified Net Savings	22,674	4.54	3.47
Program Total			
Ex Ante Gross Savings	39,285	29.74	6.21
Verified Gross Realization Rate**	116%	100%	100%
Verified Gross Savings	45,750	29.74	6.21
Verified Net Savings	39,490	27.45	5.29

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)*A deemed value from the IL SAG consensus process

"ComEd PY5-PY6 Proposal Comparisons with SAG.xls,

" Available on the IL SAG website here: <http://ilsag.info/net-to-gross-framework.html>**Based on evaluation research findings

E.3 Impact Estimate Parameters for Future Use

In the course of Navigant’s EPY6/GPY3 research, the evaluation team investigated parameters used in impact calculations, including those in the Illinois Statewide Technical Reference Manual for Energy Efficiency Version 2.0 (Illinois TRM v2.0). Some of those parameters are eligible for deeming values for future program years or for inclusion in future versions of the Illinois TRM. Table E-6 shows the evaluation team’s parameters recommended for future use. Additional TRM recommendations are provided in the Appendix.

Table E-6. Impact Estimate Parameters for Future Use

Parameter	Value	Data Source
Programmable Thermostats NTGR – ComEd	0.90	Research Findings Sources: 2010 Gas Efficiency Annual Report by the Massachusetts Joint Utility and Efficiency Vermont Year 2010 Savings Claim

Source: Evaluation research

E.4 Program Volumetric Detail

As shown in Table E-7, the MCEEP in EPY6/GPY3 implemented 42,876 projects and 391,884 measures. Overall, lighting measures contributed close to 94 percent of the MCEEP measure mix/quantity and 83 percent of the projects in EPY6/GPY3. Non-lighting measures (including hot water efficiency, HVAC and other/custom measures) contributed 6 percent of the measure mix and 17 percent of the projects³ in EPY6/GPY3. Figure E-1 disaggregates the program volumetric findings into the program delivery channels and compares residential in-unit measures with common area measures, installation from joint utilities, and also compares EEPS and IPA programs participation.

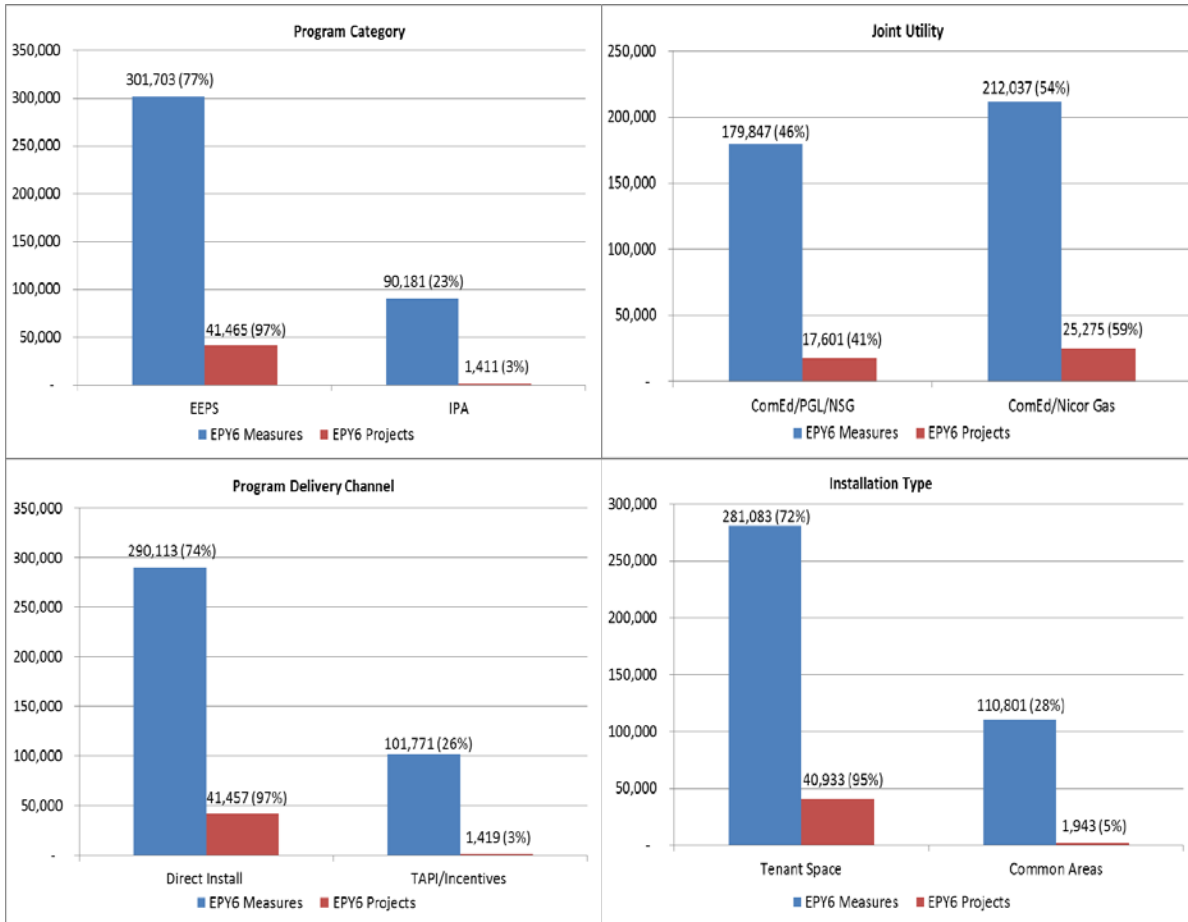
Table E-7. EPY6/GPY3 Volumetric Findings Detail by Program Delivery Channel

	Direct Install	TAPI	Incentive	Total
Total Participants (Projects)	41,457	1,299	120	42,876
Total Program Measures	290,113	86,061	15,710	391,884
Average Program Measures/Project	7	66	131	9

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

³ Some projects installed both lighting and non-lighting measures. If a project has more lighting savings, it is categorized as lighting project, and vice versa.

Figure E-1. ComEd EPY6/GPY3 Differences in MCEEP Participation



Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

E.5 Results Summary

Table E-8 summarizes the key metrics from EPY6/GPY3.

Table E-8. EPY6/GPY3 Results Summary

	Units	EPY6/GPY3
Net Savings	MWh	39,490
Net Demand Reduction	MW	27.45
Net Peak Demand Reduction	MW	5.29
Gross Savings	MWh	45,750
Gross Demand Reduction	MW	29.74
Gross Peak Demand Reduction	MW	6.21
Program Realization Rate	%	116%
Program NTGR (lighting direct install)*	#	0.98
Program NTGR (hot water measures)*	#	0.92
Program NTGR (common area measures)*	#	0.80
Program NTGR (thermostats)**	#	0.90

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

*A deemed value from the IL SAG consensus process "ComEd PY5-PY6 Proposal Comparisons with SAG.xls," available on the IL SAG website: <http://ilsag.info/net-to-gross-framework.html>

**Based on evaluation research findings

E.6 Key Findings and Recommendations

Overall, the EPY6/GPY3 MCEEP program continues to be effective in the multi-family market sector. The program achieved verified net savings 39,490 MWh which is approximately 121 percent of the planned target of 32,617 MWh.⁴ The addition of TAPI and Incentive common area program components contributed to the program's increased savings over previous years.

» Verified Gross Impacts and Realization Rate

- **Finding 1.** The EPY6/GPY3 MCEEP achieved 45,750 MWh verified gross savings verified gross demand reduction of 29.73 MW and verified gross peak demand reduction of 6.21 MW with an overall verified gross realization rate of 116 percent for electricity savings. The program is accurately tracking gross savings for most measures with updates recommended for common area lighting and chillers.
- **Recommendation 1.** Based on the Illinois TRM v2.0, the multi-family common area savings input should apply a waste heat factor of 1.34 for cooling energy savings,

⁴ ComEd PY6 Goals.xlsx (planned target for EEPs program was 15,000 MWh, and for IPA programs was 17,617 MWh).

compared to 1.04 used in the ex ante savings calculation. The adjustment increased the program's realized savings.

» **Peak Demand Reduction**

- **Finding 2.** The MCEEP data extract did not track demand savings, although the tracking system has an input field for demand that could be used. Navigant observed the implementation contractor's measure default savings spreadsheet calculated the EPY6/GPY3 measure demand savings.
- **Recommendation 2.** ComEd or the implementation contractor should transfer demand savings estimates in the measure default savings spreadsheet to the tracking system to update demand savings input data. The program should estimate demand savings for all custom type measures, where applicable.

» **Verified Net Impacts & NTGR**

- **Finding 3.** Navigant used deemed net-to-gross ratio (NTGR) estimates from the Illinois Stakeholder Advisory Group (IL SAG) consensus process to calculate net verified savings for EEPS measures.⁵ NTGR estimates were 0.98 for direct install lighting measures and 0.92 for direct install hot water efficiency measures. The planning NTGR value of 0.80 was used for common area measures (categorized by Navigant to include comprehensive lighting measures, HVAC systems, and custom type measures). For programmable thermostats savings, Navigant referenced NTGR values for comparable programs in the Northeast.⁶ ⁷ PY6 IPA measures were not covered by the SAG NTG consensus decision. The evaluation team determined that NTGR estimates for PY6 EEPS measures were appropriate to use for comparable PY6 IPA measures.
- **Finding 4.** Overall, the program achieved verified net savings of 39,490 MWh, verified net demand reduction of 27.45 megawatts (MW) and verified net peak demand reduction of 5.29 M.Th. EEPS category realized verified net energy savings of 20,469 MWh, verified net demand reduction of 23.64 MW and verified net peak demand reduction of 2.39 MW. The IPA category realized verified net energy savings of 19,021 MWh, verified net demand reduction of 3.81 MW and verified net peak demand reduction of 2.90 MW. The ComEd/PGL/NSG joint program realized net energy savings of 21,823 MWh, net demand reduction of 11.05 MW and net peak demand reduction of 3.19 MW. The ComEd/Nicor Gas joint program realized net energy savings of 17,667 MWh, net demand reduction of 16.40 MW and net peak demand reduction of 2.10 MW.

» **Program Volumetric Findings**

- **Finding 5.** The MCEEP in EPY6/GPY3 implemented 42,876 projects and 391,884 measures. In addition to direct install CFLs (269,456 units) and hot water measures (11,541

⁵ "ComEd PY5-PY6 Proposal Comparisons with SAG.xls," available on the IL SAG website: <http://ilsag.info/net-to-gross-framework.html>

⁶ "2010 Gas Energy Efficiency Annual Report," Boston Gas Company, Colonial Gas Company, and Essex Gas Company, each doing business as National Grid, August 2011, page 67.

⁷ "Year 2010 Savings Claim," Efficiency Vermont, April 1, 2011, page 162.

units), the EPY6/GPY3 program included new measures such as DHW pipe insulations (3,859 linear feet) and programmable/reprogrammed thermostats (9,116 units) which together represented 4 percent of the direct install measure mix. The comprehensive program component had 101,771 lighting and HVAC measures which represented 26 percent of the overall program measures. Multi-family measures installed in common areas represented 28 of the program measures and 5 percent of the total projects. Additional measure breakdown are shown in Figure E-1 above and in Section 3.

1 Introduction

1.1 Program Description

This report presents a summary of the findings and results from Navigant Consulting, Inc.'s (Navigant's) impact evaluation for electric program year six (EPY6) and gas program year three (GPY3)¹ of the Commonwealth Edison Company (ComEd) Multi-Family Comprehensive Energy Efficiency Program (MCEEP). In March 2013, the program started planning a new design and delivery strategy to target whole-building savings, which resulted in the program now being referred to as MCEEP. The EPY6/GPY3 program year is the first full year for joint MCEEP program delivery with Nicor Gas Company and with Peoples Gas and North Shore Gas. The MCEEP achieves electric energy and demand savings for ComEd customers and natural gas energy savings for customers of Nicor Gas Company, Peoples Gas, and North Shore Gas. This evaluation report includes total ComEd electric impacts from all of the jointly implemented programs.

During EPY6/GPY3, MCEEP continued to implement its direct install components (including compact fluorescent lamps [CFLs], programmable thermostats, hot water pipe wrap insulation, and water efficiency measures in residential dwelling units and common areas). Concurrently, MCEEP developed marketing and outreach materials to commercial contractors and multi-family decision-makers about program measures designed to achieve energy savings in whole buildings and grounds. These measures include upgrades or improvements to central plant and heating, ventilating, and air-conditioning (HVAC) systems and controls, interior and exterior lighting systems, and building shell improvements. Some MCEEP measures were previously offered through different programs, such as the Business Standard program and the Business Custom program. The MCEEP was delivered through three channels in EPY6/GPY3: direct install, trade ally participant installation (TAPI), and through prescriptive incentives. The TAPI and incentive categories comprised the comprehensive component of the MCEEP design in EPY6/GPY3, in addition to the direct install measures offered in the previous program years.

Franklin Energy Services, LLC (Franklin Energy) was the primary implementation contractor for the EPY6/GPY3 program year for all four utilities. However, implementation transition activities to CLEAResult began in March 2014 in preparation for EPY7/GPY4.

1.2 Evaluation Objectives

In EPY6/GPY3, Navigant's evaluation objectives were limited to (1) verifying program tracking system data, (2) verifying gross savings impacts based on the Illinois Statewide Technical Reference Manual for Energy Efficiency Version 2.0 (Illinois TRM v2.0),⁸ and (3) quantifying net savings impacts using net-to-gross ratio (NTGR) values from previous evaluation research for the MCEEP. For EPY6/GPY3, the evaluation team identified the key researchable questions listed in the following sections.

⁸ IL TRM available at <http://www.ilsag.info/technical-reference-manual.html>
(Illinois_Statewide_TRM_Effective_060113_Version_2.0_060713_Clean.pdf)

1.2.1 Impact Questions

1. What is the program's verified net and gross savings?
2. Are Illinois TRM v2.0 algorithms and measure savings applied correctly and accurately reflected in the program(s) tracking system(s)?
3. What are the energy savings associated with program measures not found in the Illinois TRM v2.0, such as custom measures implemented through MCEEP, as applicable?

1.2.2 Process Questions

Navigant conducted process research for this impact evaluation through interviews with program managers to understand the program's performance and changes in EPY6/GPY3.

2 Evaluation Approach

The evaluation team reviewed the program tracking data and performed gross and net impact calculations to inform verified energy and demand savings for EPY6/GPY3. For the direct install portion of the program evaluation, Navigant evaluated the gross savings by (1) reviewing the tracking system, (2) comparing the use of measure algorithms in the tracking database to their use in the Illinois TRM v2.0 to ensure that they are appropriately applied, and (3) cross-checking totals. The direct install measures in EPY6/GPY3 included new measures, such as domestic hot water pipe insulation (counted among the hot water measures), and programmable/reprogrammed thermostats from electric heat or gas heat fan savings.

CI Custom (comprehensive) measures included incentive projects with custom-type savings calculations. These projects comprised lighting measures, wall and attic insulations, HVAC chillers and controls/motors, toilet exhaust variable frequency drives (VFD), among others. Additional evaluation approaches for gross and net impacts are described below.

2.1 Overview of Data Collection Activities

The core data collection activities included review of the program’s tracking data and verification of direct install and common area measures savings against the Illinois TRM v2.0 or against engineering research for the custom measures. Table 2-1 shows the full set of data collection activities and Table 2-2 provides additional data resources.

Table 2-1. Primary Data Collection Activities

Method	Subject	Quantity Goal	Quantity Achieved	Dates	Comments
Review program tracking data	Program Tracking Database(s)	All	All	June-August 2014	Source of information for verified gross analysis
Review measures in IL TRM	Illinois Statewide Technical Reference Manual for Energy Efficiency Version 2.0	selected	selected	June-September 2014	Source of information for verified gross analysis
Interviews with program staff	Program Managers/Implementer Staff	3	3	March-April 2014	Includes interviews with staff from ComEd, Nicor Gas, and Franklin Energy

Source: Navigant

Table 2-2. Additional Resources

Reference Source	Author	Application	Gross Impact	Process
ComEd_021914 Illinois Electric Master Measure Database.xlsx	ComEd	Measure lookup and unit savings review	X	
ComEd PY6 Measure Work papers 5-29-13.docx	ComEd	Measures not found in Illinois TRM v2.0	X	
2010 Gas Efficiency Annual Report by the Massachusetts Joint Utility	Massachusetts Energy Efficiency Advisory Council	Thermostat NTGR Research	X	

Source: Navigant

2.2 Verified Savings Parameters

2.2.1 Verified Gross Program Savings Analysis Approach

Navigant estimated verified per unit savings for each program measure using impact algorithm sources found in the Illinois TRM v2.0⁹ for deemed measures, and evaluation research for non-deemed measures. The tracking data for the MCEEP EPY6/GPY3 evaluation came from ComEd’s Frontier tracking system, uploaded on the ComEd SharePoint site for evaluators, and extracted by Navigant on August 27, 2014. Navigant reviewed the MCEEP tracking system and procedures to verify that the program accurately reported measure counts. In addition, Navigant sourced ComEd’s MCEEP default measure lookup savings spreadsheet with the supporting ComEd work papers¹⁰ to verify input assumptions for other deemed or non-deemed measures. The spreadsheet enabled the evaluation team to verify the tracking inputs against the Illinois TRM v2.0. Navigant verified that the majority of the EPY6/GPY3 program savings were derived based on deemed values and algorithms from the Illinois TRM v2.0. For common area measures found in the Illinois TRM v2.0, Navigant verified that the program used correct measure values using a similar evaluation method as a Business Standard project evaluation. For measures not found in the Illinois TRM v2.0, Navigant reviewed project files using a similar method as a Business Custom project evaluation, as applicable. Verified per unit savings reflect evaluation adjustments to per unit savings values based on Navigant measure review. The verified gross savings are the product of verified per unit savings and verified measure quantities.

2.2.2 Verified Net Program Savings Analysis Approach

Navigant used deemed net-to-gross ratio (NTGR) estimates from the Illinois Stakeholder Advisory Group (IL SAG) consensus process to calculate net verified savings for EEPS measures.¹¹ NTGR estimates were 0.98 for direct install lighting measures and 0.92 for direct install hot water efficiency measures. The planning NTGR value of 0.80 was used for common area measures (categorized by Navigant to include comprehensive lighting measures, HVAC systems, and custom type measures). For programmable

⁹ (Illinois_Statewide_TRM_Effective_060113_Version_2.0_060713_Clean.pdf)

¹⁰ ComEd PY6 Measure Workpapers 5-29-13.docx

¹¹ IL SAG consensus process “ComEd PY5-PY6 Proposal Comparisons with SAG.xls,” available on the IL SAG website: <http://ilsag.info/net-to-gross-framework.html>

thermostats savings, Navigant referenced NTGR values for comparable programs in the Northeast.^{12 13} PY6 IPA measures were not covered by the SAG NTG consensus decision. The evaluation determined that NTGR estimates for PY6 EEPS measures were appropriate to use for comparable PY6 IPA measures.

Table 2-3 presents the key parameters and the references used in the verified gross and net savings calculations (energy and coincident peak demand).

Table 2-3. Verified Savings Parameter Data Sources

Verified Gross and Net Input Parameter	Value	Data Source	Deemed [†] or Evaluated
NTGR – Direct Install CFLs and LED Lighting*	0.98	IL SAG Spreadsheet [‡]	Deemed
NTGR – Hot Water Measures**	0.92	IL SAG Spreadsheet [‡]	Deemed
NTGR – Common Areas Measures***	0.80	IL SAG Spreadsheet [‡]	Deemed
NTGR – Thermostats [†]	0.90	Research (Massachusetts Joint Utility)	Evaluated
Gross Realization Rate	116%	Program Tracking Data Review	Evaluated
All lighting measures delta watts	Vary	Illinois TRM v2.0 (Sections 4.5 for CA & Section 5.5 for DI)	Deemed
Direct Install CFL & LED In-Service Rate	0.969	Illinois TRM v2.0, Section 5.5.1	Deemed
Comprehensive/Prescriptive Lighting Measures In-Service Rate	1.00	Illinois TRM v2.0, Section 4.5.1	Deemed
Showerhead In-Service Rate	0.93	Illinois TRM v2.0, Section 5.4.5	Deemed
Faucet Aerators In-Service Rate	0.95	Illinois TRM v2.0, Section 5.4.4	Deemed
HVAC/VSD Measure Inputs	Vary	ComEd Work paper, Illinois TRM v2.0, Sections 4.4.6, 4.4.11, 4.4.17, and 5.3.11	Evaluated/Deemed
Pipe Insulation Inputs	Vary	Illinois TRM v2.0, Sections 4.4.14 Verified heat loss from 3E Plus	Evaluated/Deemed
Custom Measures	Vary	Navigant Research, ComEd Work Paper	Evaluated

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

* Includes direct install in-unit and common area CFLs and in-unit LED lamps

** Includes direct install bathroom/kitchen aerators, showerheads, DHW pipe insulations, and vending misers

*** Includes comprehensive/prescriptive lighting measures, HVACs and custom type measures

[†] Includes direct install programmable and reprogrammed thermostats (include thermostats with gas heat fan savings).

[‡] From IL SAG consensus process "ComEd PY5-PY6 Proposal Comparisons with SAG.xls," available on the IL SAG website: <http://ilsag.info/net-to-gross-framework.html>

¹² "2010 Gas Energy Efficiency Annual Report," Boston Gas Company, Colonial Gas Company, and Essex Gas Company, each doing business as National Grid, August 2011, page 67.

¹³ "Year 2010 Savings Claim," Efficiency Vermont, April 1, 2011, page 162.

2.3 Process Evaluation

Process research related to the EPY6/GPY3 evaluation was through interviews with program staff and the implementation contractor staff to verify information about program performance, measures and tracking system.

3 Gross Impact Evaluation

Navigant reports verified gross savings of 45,750 MWh, verified demand reduction of 29.74 MW, and verified peak demand reduction of 6.21 MW. The program’s verified gross realization rate was 116 percent. The high realization rate was due mainly to evaluation adjustment to the input assumption used to calculate common area lighting measure savings. Based on the Illinois TRM v2.0, the multi-family common area savings input should apply 1.34 waste heat factor for cooling energy savings, compared to 1.04 used in the ex ante savings calculation. The adjustment increased the program’s realized savings.

3.1 Tracking System Review

For the EPY6/GPY3 evaluation, ComEd provided a platform for the evaluation team to automatically and regularly download the MCEEP and other programs’ tracking data from the Frontier tracking system¹⁴ after ComEd had uploaded the data on the ComEd evaluation SharePoint site. Navigant downloaded the final data for the MCEEP impact evaluation on August 27, 2014. Navigant reviewed the tracking data to verify the completeness and accuracy of the tracking system data and to identify any issues that would affect the impact evaluation of the MCEEP. Navigant verified that the program tracking system was accurately recording measure counts, aside from the suggested updates listed below.

Key findings from the tracking system review include the following:

1. The evaluation team reviewed the tracking data and applied adjustments to default unit savings for the majority of the common area comprehensive lighting measures. Upon further information received from ComEd (measure default savings spreadsheet), we adjusted the common area lighting savings assumption in the algorithm by changing the waste heat interaction factor from 1.04 to 1.34. These changes were consistent with the Illinois TRM v2.0 commercial savings algorithm and assumptions for multi-family common areas. The adjustments increased the tracking ex ante savings by an additional 16 percent.
2. The evaluation team applied minor adjustments to default unit savings for centrifugal chillers from 79.20 kWh to 79.23 kWh. For chillers with 0.01 KW/ton Integrated Part Load Value (IPLV) efficiency improvements, we adjusted the incremental energy savings per ton from 14.40 kWh to 14.43 kWh. These changes were consistent with estimates verified from ComEd work papers.
3. The evaluation team identified 14 custom (comprehensive) projects (including #384879-chillers, #536030-lighting, and #559299-lighting) with non-deemed claimed savings. We performed engineering file reviews on a sample of five custom projects to verify the savings assumptions. We found that the energy savings input and calculations are reasonable; however, demand savings were not estimated or tracked for any of the custom projects. We could not establish the location or the condition of the space where these projects were installed. Even so, after reviewing the noted HVAC chiller and lighting projects, it appears these projects could realize demand savings.

¹⁴ Email correspondence with ComEd Program Manager (on May 5, 2014).

4. The evaluation team found 11,872 LED lamps in the tracking database installed in tenant spaces (in-units). ComEd indicated that in-unit LEDs were not a measure within the program and the 11,872 LEDs were completed by a trade ally without approval. Navigant did not include the measure and associated savings (355 MWh) in the savings verification.

3.2 Program Volumetric Findings

Table 3-1 disaggregates the program volumetric findings into the program delivery channels. The MCEEP in EPY6/GPY3 implemented 42,876 projects and 391,884 measures. Navigant counted all direct install projects and large common area measures and projects as EEPS savings based on discussion with ComEd.¹⁵ The IPA program savings included only common area measures.

Table 3-1. EPY6/GPY3 Volumetric Findings Detail by Program Delivery

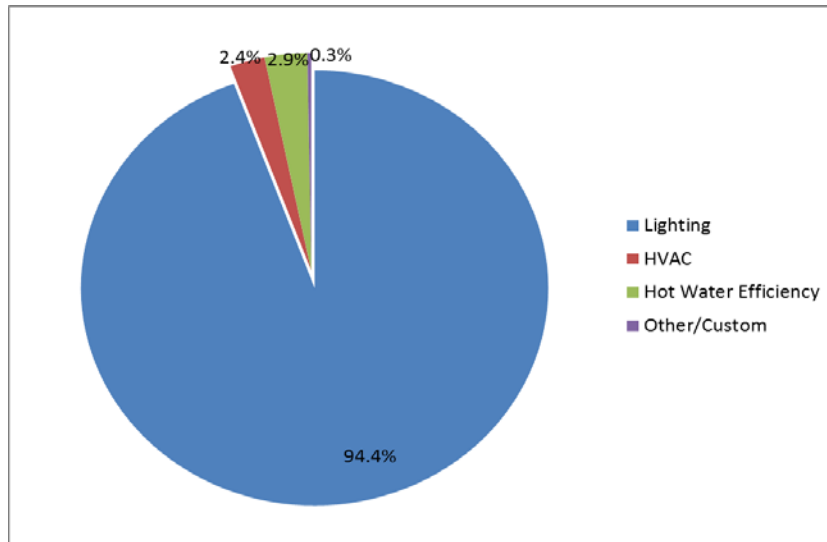
Participation	EPY6 Measures	Measure %	EPY6 Projects	Projects %
Program Category				
EEPS	301,703	77%	41,465	97%
IPA	90,181	23%	1,411	3%
Joint Utility				
ComEd/PGL/NSG	179,847	46%	17,601	41%
ComEd/Nicor Gas	212,037	54%	25,275	59%
Program Channel				
Direct Install	290,113	74%	41,457	97%
TAPI/Incentives	101,771	26%	1,419	3%
Installation Type				
Tenant Space (in-unit)	281,083	72%	40,933	95%
Common Areas	110,801	28%	1,943	5%
End-use Type				
Lighting	369,863	94%	35,624	83%
Non-Lighting	22,021	6%	7,252	17%

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

¹⁵ From Navigant’s correspondence with ComEd Program Manager (on October 6, 2014), ComEd allocated 18,827 gross MWh to IPA based on the IPA budget, with the rest going to EEPS. Navigant identified verified gross savings of 18,819 MWh for IPA (based on findings from the tracking data, 8 MWh less than the ComEd allocation). EEPS had verified gross savings of 20,469MWh in the tracking data, 348 MWh less than ComEd’s 20,817 gross MWh.

Figure 3-1 provides the measure mix by end-use type. Overall, lighting measures contributed 94 percent of the MCEEP measure mix/quantity in EPY6/GPY3, and non-lighting measures (including hot water efficiency, HVAC and other/custom measures) contributed the remaining 6 percent.

Figure 3-1. Number of Measures Installed by End-use Type



Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

Table 3-2 and Table 3-3 below provide additional measure details for the direct install measures and comprehensive (TAPI and incentive) measures. As indicated, ex ante and verified measure counts were the same. The MCEEP in EPY6/GPY3 had 41,457 direct install projects and distributed 290,113 measures, including 269,456 CFLs and 11,541 hot water measures. Direct install measures in EPY6/GPY3 included new measures, such as domestic hot water (DHW) pipe insulations (3,859 linear feet), and programmable/reprogrammed thermostats (9,116). Direct install measures accounted for 74 percent of the EPY6/GPY3 measure mix.

The comprehensive program component had 1,419 projects (1,299 TAPI and 120 incentive projects) and 101,771 lighting and HVAC measures (including 86,061 TAPI measures and 15,710 incentive measures). The comprehensive measures accounted for 26 percent of the EPY6/GPY3 measure mix. Overall program measures installed in multi-family common areas accounted for 28 percent and projects accounted for 5 percent, compare to tenant in-unit measures 72 percent and 95 percent projects respectively.

Table 3-2. EPY6/GPY3 MCEEP Ex Ante and Verified Direct Install Measure Count

Measure	Unit	Install Type	Ex Ante Measure Count	Verified Measure Count
9W CFL (incl. Globe CFL)	Each	In-unit	91,144	91,144
14W CFL	Each	In-unit	164,358	164,358
19W CFL	Each	In-unit	3,640	3,640
23W CFL	Each	In-unit	1,297	1,297
9W CFL (incl. Globe CFL)	Each	Common area	2,145	2,145
14W CFL (incl. Flood CFL)	Each	Common area	5,492	5,492
19W CFL	Each	Common area	779	779
23W CFL	Each	Common area	601	601
Vending Miser	Each	In-unit	13	13
Programmable/Reprogrammed T-Stat - Gas Heat Fan Savings	Each	In-unit	7,938	7,938
Programmable/Reprogrammed Thermostat	Each	In-unit	1,174	1,174
Programmable/Reprogrammed T-Stat - Gas Heat Fan Savings	Each	Common area	4	4
Showerheads	Each	In-unit	3,311	3,311
Bathroom Aerator	Each	In-unit	4,000	4,000
Kitchen Aerator	Each	In-unit	3,129	3,129
DHW Pipe Insulation*	Each	In-unit	1,079	1,079
DHW Pipe Insulation*	Each	Common area	9	9
Total			290,113	290,113

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

* The program installed 3,859 linear feet of pipe installation, but for evaluation reporting purpose, Navigant treated each row entry of pipe insulation in the tracking data as one measure, making a total of 1,088 measures.

Table 3-3. EPY6/GPY3 MCEEP Ex Ante and Verified Comprehensive Measure Count

Measure	Unit	Install Type	Ex Ante Measure Count	Verified Measure Count
Chiller 0.01 kW/ton*	Each	Common area	7	7
Centrifugal Chiller*	Each	Common area	5	5
Air Cooled Chiller*	Each	Common area	2	2
VSD for HVAC	Each	Common area	277	277
CAC /w Furnace Replacement	Each	Common area	25	25
Energy Star CFL Fixture	Each	Common area	626	626
Exterior LED	Each	Common area	550	550
LED Exit Sign	Each	Common area	2,184	2,184
Delamping T12 to HPT8/RWT8	Each	Common area	2,567	2,567
Parking Garage >=150W	Each	Common area	19	19
Occupancy Sensor	Each	Common area	427	427
HPT8/LW Retrofit	Each	Common area	6,062	6,062
LED Lamp & Fixture	Each	Common area	76,659	76,659
Cold Cathode	Each	Common area	15	15
Photocell w/Time Clock	Each	Common area	5,712	5,712
Time Clock	Each	Common area	5,338	5,338
Photocell	Each	Common area	103	103
Metal Halides	Each	Common area	145	145
Custom Measures**	Each	Common area	1,048	1,048
Total			101,771	101,771

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

* The program installed HVAC air and centrifuge chillers with a total capacity of 34,488 tons. For evaluation reporting purposes, Navigant treated each row entry of chiller installation in the tracking data as one measure, making a total of 14 measures.

** The custom measures comprised lighting measures, wall and attic insulations, HVAC chillers and controls/motors, toilet exhaust VFDs, among others, making a total of 1,048 measures.

3.3 Gross Program Impact Parameter Estimates

As described in Section 2, Navigant estimated verified per unit savings for each program measure using impact algorithm sources found in the Illinois TRM v2.0 for deemed measures¹⁶, and using evaluation research for non-deemed measures. Navigant used ComEd’s MCEEP default measure lookup savings spreadsheet¹⁷ with the supporting ComEd work papers¹⁸ to verify input assumptions for other deemed or

¹⁶ Source: Illinois Statewide Technical Reference Manual for Energy Efficiency Version 2.0, available at: <http://www.ilsag.info/technical-reference-manual.html>

¹⁷ ComEd_021914 Illinois Electric Master Measure Database.xlsx

¹⁸ ComEd PY6 Measure Workpapers 5-29-13.docx

non-deemed measures. Table 3-4 presents the key parameters and the references used in the verified gross and net savings calculations (energy and coincident peak demand) for the direct install measures.

Table 3-4. EPY6/GPY3 MCEEP Direct Install Measures Ex Ante and Verified Gross Savings Parameters

Measure	Ex Ante Gross Savings (kWh/unit)	Verified Gross Savings (kWh/unit)	Verified Gross Savings (kW/unit)	Method*	Source (Illinois TRM v2.0)
14W CFL	43.48	43.48	0.005	Deemed	
14W CFL (incl. Flood CFL CA)	275.82	366.75	0.052	Deemed	
19W CFL (IU)	32.14	32.14	0.003	Deemed	
19W CFL (CA)	203.87	271.08	0.039	Deemed	
23W CFL (IU)	46.32	46.32	0.005	Deemed	Sections 5.5.1 & 5.5.2
23W CFL (CA)	293.81	390.67	0.056	Deemed	
9W CFL (Globe IU)	38.74	38.74	0.004	Deemed	
9W CFL (IU)	29.3	29.3	0.003	Deemed	
9W CFL (incl. Globe CA)	185.88	247.16	0.035	Deemed	
Bathroom Aerator	29.98	29.98	0.021	Deemed	Sections 5.4.4
Kitchen Aerator	83.96	83.96	0.020	Deemed	
Showerheads	501.43	501.43	0.039	Deemed	Sections 5.4.5
DHW Pipe Insulation (IU)	21.22	21.22	0.002	Deemed	Sections 5.4.1
DHW Pipe Insulation =<1" (CA)	65.99	65.99	0.008	Deemed	
DHW Pipe Insulation >2" (CA)	148.25	148.25	0.017	Deemed	Sections 5.4.14
DHW Pipe Insulation 1.25-2" (CA)	38.38	38.38	0.004	Deemed	
Programmable/Reprogrammed Thermostat (IU)	1002.46	1002.46	0.000	Deemed	
Reprogrammed Thermostat - Gas Heat Fan Savings (IU)	31.48	31.48	0.000	Deemed	Sections 5.3.11
Reprogrammed Thermostat - Gas Heat Fan Savings (CA)	163.76	163.76	0.000	Deemed	
Vending Miser	1612.94	1612.94	0.000	Deemed	Sections 4.6.5

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

* Deemed values are from Illinois TRM v2.0, available at <http://www.ilsag.info/technical-reference-manual.html>.

Table 3-5 presents the key parameters and the references used in the verified gross and net savings calculations (energy and coincident peak demand) for the comprehensive common area measures.

Table 3-5. EPY6/GPY3 MCEEP Comprehensive Measures Ex Ante and Verified Gross Savings Parameters

Measure	Ex Ante Gross Savings (kWh/unit)	Verified Gross Savings (kWh/unit)	Verified Gross Savings (kW/unit)	Method*	Source
Cold Cathode	278.46	358.79	0.053	Deemed	IL TRM v2.0, Section 4.5.8
Energy Star CFL Fixture	239.79	318.84	0.046	Deemed	IL TRM v2.0, Section 4.5.1
Delamping T12 to HPT8/RWT8	Vary	Vary. Adjusted	Vary	Deemed	IL TRM v2.0, Section 4.5.2
Exterior LED	Vary	Vary. Adjusted	Vary	Deemed	IL TRM v2.0, Section 4.5.4
HPT8/LW Retrofit	Vary	Vary. Adjusted	Vary	Deemed	IL TRM v2.0, Section 4.5.3
LED Exit Sign	Vary	Vary. Adjusted	Vary	Deemed	IL TRM v2.0, Section 4.5.5
LED Lamp & Fixture	Vary	Vary. Adjusted	Vary	Deemed	IL TRM v2.0, Section 4.5.4
Occupancy Sensor	Vary	Vary. Adjusted	Vary	Deemed	IL TRM v2.0, Section 4.5.10
Photocell	0.28	0.28	0.000	Evaluated	ComEd work papers
Photocell w/Time Clock	1.74	1.74	0.000	Evaluated	ComEd work papers
Time Clock	0.62	0.62	0.000	Evaluated	ComEd work papers
Parking Garage >=150W	31.48	31.48	0.000	Deemed	IL TRM v2.0, Section 4.5.8
VSD for HVAC Pump Motor	2015.33	2015.33	0.000	Deemed	IL TRM v2.0, Section 4.4.17
VSD on HVAC Fan or Pump	860.09	860.09	0.046	Deemed	IL TRM v2.0, Section 4.4.17
CAC w/Furnace Replacement ER 14.5 SEER	671.1	671.1	0.083	Deemed	IL TRM v2.0, Section 4.4.13
CAC w/Furnace Replacement ROB 14.5 SEER	189.3	189.3	0.046	Deemed	
Air Cooled Chiller =>150 tons	135.83	135.83	0.115	Evaluated	
Air Cooled Chiller <150 tons	138.54	138.54	0.115	Evaluated	
Centrifugal Chiller <=300 tons	86.01	86.01	0.058	Evaluated	ComEd work papers
Centrifugal Chiller 300-599 tons	79.2	79.23	0.053	Evaluated	
Chiller 0.01 kW/ton	14.4	14.43	0.009	Evaluated	
Custom Measures	Vary	File review	NA	Evaluated	Engineering research

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

* Deemed values are from Illinois TRM v2.0, available at <http://www.ilsag.info/technical-reference-manual.html>.

Table 3-6 presents the verified gross savings parameters and the verified realization rates on the ex ante gross savings for lighting and non-lighting measures, by program delivery. Verified gross realization rate is the ratio of verified gross savings to ex ante gross savings from the program tracking system. Navigant applied verified measure quantities found in the program tracking system and presented in Table 3-2 and

Table 3-3 to verified unit measure savings values as displayed in Table 3-4 and Table 3-5 to calculate verified gross savings.

Table 3-6. Verified Gross Savings Parameters

Gross Savings Input Parameters	Value	Deemed* or Evaluated?
Measure Type and Eligibility	Vary. All verified as acceptable	Evaluated
Gross Savings per Unit, Sampled Deemed Measures	Vary. See Table 3-4. Some adjustments applied	Deemed
Gross Savings per Unit, Sampled Non-Deemed Measures	Vary. See Table 3-5. Most found as acceptable	Evaluated
Verified Realization Rate on Ex Ante Gross Savings (Overall EPY6/GPY3 Program)	116%	Evaluated
Verified Realization Rate on Ex Ante Gross Savings (Lighting)	119%	Evaluated
Verified Realization Rate on Ex Ante Gross Savings (Non-Lighting)	100%	Evaluated
Verified Realization Rate on Ex Ante Gross Savings (All Direct Install Measures)	104%	Evaluated
Verified Realization Rate on Ex Ante Gross Savings (TAPI)	129%	Evaluated
Verified Realization Rate on Ex Ante Gross Savings (Incentive)	104%	Evaluated
Verified Realization Rate on Ex Ante Gross Savings (Direct Install Lighting), <i>applied to calculate Net Savings</i>	106%	Evaluated
Verified Realization Rate on Ex Ante Gross Savings (Hot Water Measures), <i>applied to calculate Net Savings</i>	100%	Evaluated
Verified Realization Rate on Ex Ante Gross Savings (Common Area—incl. lighting, HVAC, custom), <i>applied to calculate Net Savings</i>	125%	Evaluated
Verified Realization Rate on Ex Ante Gross Savings (Thermostat), <i>applied to calculate Net Savings</i>	100%	Evaluated

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

* Deemed values are from Illinois TRM v2.0, available at <http://www.ilsag.info/technical-reference-manual.html>.

3.4 Verified Gross Program Impact Results

The ComEd EPY6/GPY3 MCEEP reported ex ante gross energy savings of 39,285 MWh. Evaluation adjustments described in the previous sections resulted in evaluation verified gross energy savings of 45,750 MWh, verified gross demand reduction of 29.74 MW, and verified gross peak demand reduction of 6.21 MW. The program achieved 116 percent overall gross realization rate on electricity savings. Table 3-7 presents the details of the verified savings, including the verified gross savings based on the program or measure category defining the deemed NTGR applied to calculate program net savings.

Table 3-7. EPY6/GPY3 Verified Gross Impact Savings Estimates by Measure Category

Program Channel	Gross Energy Savings (MWh)	Gross Demand Reduction (MW)	Gross Coincident Peak Demand Reduction (MW)	Sample (90/10 Significance?)*
Lighting (Direct Install)				
Ex Ante Gross Savings	13,085	12.84	1.59	
Verified Gross Realization Rate**	106%	100%	100%	NA
Verified Gross Savings	13,827	12.84	1.59	
Hot Water Measures (Direct Install)				
Ex Ante Gross Savings	2,153	11.23	0.29	
Verified Gross Realization Rate**	100%	100%	100%	NA
Verified Gross Savings	2,153	11.23	0.29	
Thermostats (Direct Install)				
Ex Ante Gross Savings	1,427	0.00	0.00	
Verified Gross Realization Rate**	100%	0.00	0.00	NA
Verified Gross Savings	1,427	0.00	0.00	
Common Areas (Comprehensive)				
Ex Ante Gross Savings	22,620	5.67	4.33	
Verified Gross Realization Rate**	125%	100%	100%	NA
Verified Gross Savings	28,343	5.67	4.33	
Program Total Savings				
Ex Ante Gross Savings	39,285	29.74	6.21	
Verified Gross Realization Rate**	116%	100%	100%	NA
Verified Gross Savings	45,750	29.74	6.21	

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

* NA indicates that the Illinois TRM v2.0 determines the gross savings.

** Based on evaluation research findings

Table 3-8 and Table 3-9 provide breakdown by measure of the verified gross savings from the joint gas utilities. Key findings from the verified gross program impact results are discussed following the tables.

Table 3-8. ComEd/PGL/NSG EPY6/GPY3 Verified Gross Impact Savings

Program Category	Measure Type	Ex Ante Gross Savings (MWh)	Verified Gross Demand Reduction (MW)	Verified Gross Peak Demand Reduction (MW)	Verified Gross MWh Realization Rate	Verified Gross Savings (MWh)
Direct Install Measures	CFLs (in-unit)	4,559	5.16	0.49	100%	4,559
	CFLs (common areas)	596	0.15	0.11	133%	794
	Showerheads	438	1.24	0.03	100%	438
	Faucet Aerators	92	1.52	0.03	100%	92
	Pipe Insulation	23	0.00	0.01	100%	23
	Programmable/Reprogrammed Thermostat (incl. Gas Heat Fan Savings)	33	0.00	0.00	100%	33
Direct Install Subtotal		5,741	8.07	0.67	103%	5,939
Comprehensive Measures	Delamping	630	0.16	0.12	129%	813
	HPT8/LW Retrofits	806	0.19	0.14	123%	995
	LED Exit Sign	380	0.06	0.04	115%	439
	LED Lamps and Fixtures	12,514	3.15	2.38	129%	16,116
	Exterior LED	206	0.03	0.00	100%	206
	Parking Garage >=150W	41	0.01	0.01	100%	41
	Occupancy Sensors	230	0.13	0.09	106%	243
	HVAC Chillers	593	0.41	0.38	100%	594
	HVAC Variable Speed Drives (VSDs)	360	0.01	0.01	100%	360
	CAC w/Furnace Replacement ER & ROB 14.5 SEER	15	<0.01	<0.01	100%	15
Custom Measures	227	NA	NA	100%	227	
Comprehensive Subtotal		16,002	4.13	3.18	125%	20,049
Program Total		21,743	12.20	3.85	120%	25,988

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

Table 3-9. ComEd/Nicor Gas EPY6/GPY3 Verified Gross Impact Savings

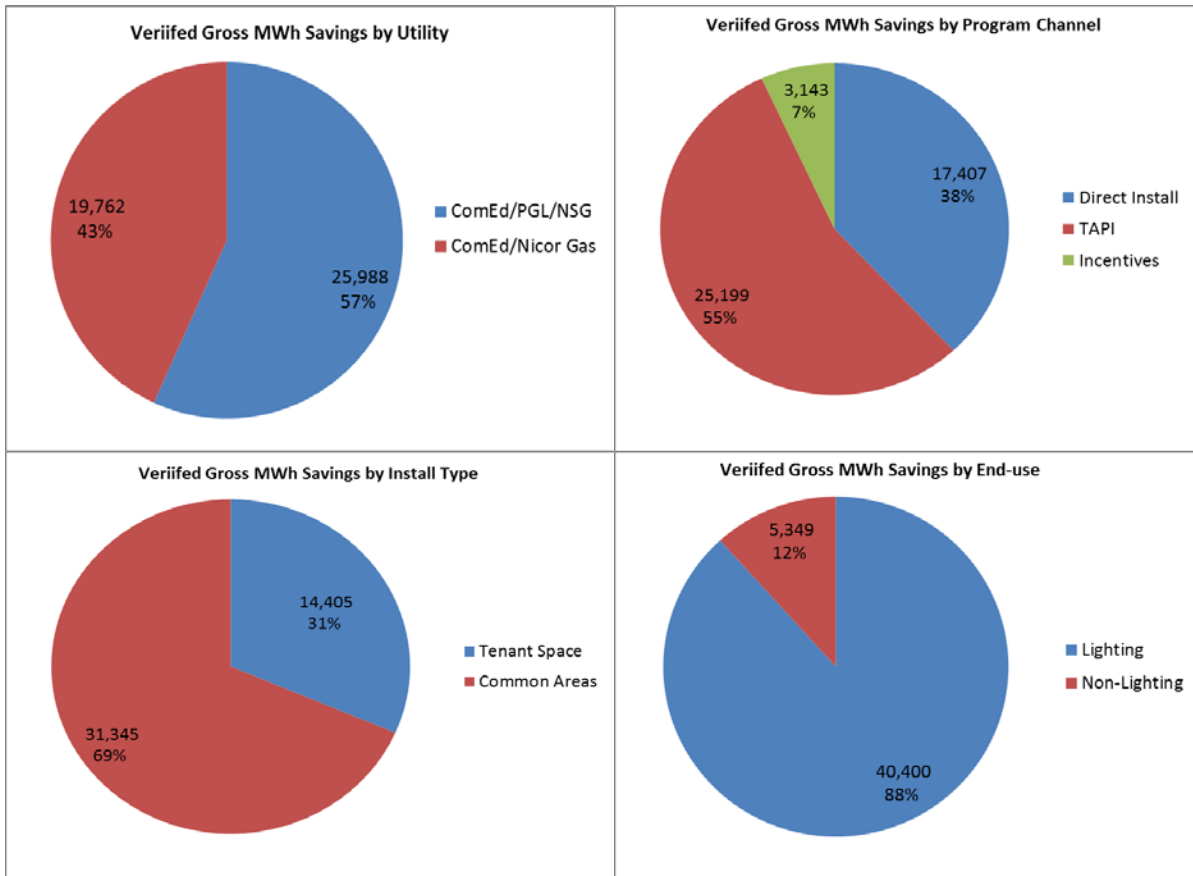
Program Category	Measure Type	Ex Ante Gross Savings (MWh)	Verified Gross Demand Reduction (MW)	Verified Gross Peak Demand Reduction (MW)	Verified Gross MWh Realization Rate	Verified Gross Savings (MWh)
Direct Install Measures	CFLs (in-unit)	6,278	7.10	0.68	100%	6,278
	CFLs (common areas)	1,651	0.42	0.31	133%	2,196
	Showerheads	1,222	3.44	0.10	100%	1,222
	Faucet Aerators	291	5.02	0.11	100%	291
	Pipe Insulation	66	0.01	<0.01	100%	66
	Programmable/Reprogrammed Thermostat (incl. Gas Heat Fan Savings)	1,395	0.00	0.00	100%	1,395
	Vending Misers	21	NA	0.00	100%	21
Direct Install Subtotal		10,924	15.98	1.20	105%	11,469
Comprehensive Measures	CFLs (common areas)	150	0.04	0.03	133%	200
	Cold Cathode	4	<0.01	<0.01	129%	5
	Delamping	626	0.15	0.12	130%	813
	HPT8/LW Retrofits	548	0.14	0.11	130%	713
	Exterior LED	286	0.05	0.00	100%	286
	LED Exit Sign	76	0.01	0.01	129%	97
	LED Lamps and Fixtures	4,243	1.07	0.81	129%	5,467
	Occupancy Sensors	99	0.03	0.02	127%	126
	Photocell	10	<0.01	0.00	100%	10
	Time Clock	3	<0.01	0.00	100%	3
	HVAC Chillers	87	0.07	0.07	100%	87
	HVAC Variable Speed Drives (VSDs)	38	<0.01	<0.01	100%	38
CAC w/Furnace Replacement ER & ROB 14.5 SEER	1	<0.01	<0.01	100%	1	
Custom Measures	447	NA	NA	100%	447	
Comprehensive Subtotal		6,618	1.56	1.16	125%	8,293
Program Total		17,542	17.54	2.36	113%	19,762

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

Figure 3-2 provides the disaggregation of the EPY6/GPY3 MCEEP verified gross savings by program component. Gross savings from the ComEd/PGL/NSG joint program were 57 percent of the EPY6/GPY3

program savings and the ComEd/Nicor Gas joint program realized 43 percent of the verified gross savings.

Figure 3-2. ComEd EPY6/GPY3 MCEEP Verified Gross Savings by Program Components



Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

The direct install measures contributed 17,407 MWh, which represented 38 percent of the overall EPY6/GPY3 verified gross savings (CFLs accounted for 78 percent, hot water measures accounted for 14 percent and programmable thermostats accounted for 8 percent of the direct install verified gross savings). The comprehensive TAPI projects accounted for 25,199 MWh (55 percent of program gross savings) and the Incentive projects accounted for 3,143 MWh (7 percent of program savings). Savings from LED retrofits accounted for the bulk 76 percent of the TAPI/Incentive delivery channel.

The comprehensive common area lighting and HVAC measures contributed 31,345 MWh of the verified gross savings, representing 69 percent of the program savings in EPY6/GPY3 compare to 31 percent from tenant space in-unit installations. The Savings from all lighting measures accounted for 40,400 MWh (88 percent) of the verified gross savings and the non-lighting measures accounted for 5,349 MWh (12 percent) of the verified gross savings.

4 Net Impact Evaluation

In EPY6/GPY3, Navigant calculated verified net savings of 39,490 MWh, verified net demand reduction of 27.45 MW, and verified net peak demand reduction of 5.29 MW for the MCEEP. The EEPS category realized verified net energy savings of 20,469 MWh and verified net peak demand reduction of 2.39 MW. The IPA category realized verified net energy savings of 19,021 MWh and net peak demand reduction of 2.90 MW. The ComEd/PGL/NSG joint program realized net energy savings of 21,823 MWh, net demand reduction of 11.05 MW and net peak demand reduction of 3.19 MW. The ComEd/Nicor Gas joint program realized net energy savings of 17,667 MWh, net demand reduction of 16.40 MW and net peak demand reduction of 2.10 MW.

Table 4-1 presents verified net impact parameters. The NTGRs approved by the IL SAG consensus process for MCEEP EPY6/GPY3 EEPS measures were for direct install lighting (0.98), water measures (0.92), and common area measures (0.80). Navigant used 0.90 NTGR for programmable thermostats, based on findings from previous ComEd programmable thermostats and thermostat education research. PY6 IPA measures were not covered by the SAG NTG consensus decision. The evaluation determined that NTGR estimates for PY6 EEPS measures were appropriate to use for comparable PY6 IPA measures.

Table 4-1. EPY6/GPY3 Verified Net Impact Parameters

End-use	NTGR	Source
Lighting (incl. in-unit and common area direct install lighting measures)	0.98*	IL SAG
Hot Water Measures (incl. aerators, showerheads, DHW pipe insulations, and DI Vending Misers)	0.92*	IL SAG
Common Areas (incl. comprehensive lighting measures, HVACs, and custom type measures)	0.80*	IL SAG
Programmable Thermostats (incl. direct install and common areas)	0.90**	Research

Source: Navigant analysis

* Approved through IL SAG consensus process "PY5-PY6 Proposal Comparisons with SAG.xls," available on the IL SAG website here: <http://ilsag.info/net-to-gross-framework-1.html>

** Based on evaluation research findings

Table 4-2 presents the program net savings at the measure group level, including groups where the NTGR estimate is not statistically significant at the 90/10 confidence level. The EPY6/GPY3 evaluation did not include new free-ridership or spillover research.

The overall net savings from direct install measures were 16,816 MWh representing 43 percent) of the MCEEP EPY6/GPY3 net savings. The comprehensive measures contributed 22,674 MWh representing 57 percent of the EPY6/GPY3 net savings. Navigant derived measure savings from the Illinois TRM v2.0 and engineering analyses of program population-level data, so sample size and statistical significance are not applicable. .

Table 4-2. EPY6/GPY3 Verified Net Impact Savings Estimates by Measure Category

Program Channel	Net Energy Savings (MWh)	Net Demand Reduction (MW)	Net Peak Demand Reduction (MW)
Lighting (Direct Install)			
Ex Ante Gross Savings	13,085	12.84	1.59
Verified Gross Realization Rate**	106%	100%	100%
Verified Gross Savings	13,827	12.84	1.59
NTGR*	0.98	0.98	0.98
Verified Net Savings	13,550	12.58	1.56
Hot Water Measures (Direct Install)			
Ex Ante Gross Savings	2,153	11.23	0.29
Verified Gross Realization Rate**	100%	100%	100%
Verified Gross Savings	2,153	11.23	0.29
NTGR*	0.92	0.92	0.92
Verified Net Savings	1,981	10.33	0.26
Thermostats (Direct Install)			
Ex Ante Gross Savings	1,427	0.00	0.00
Verified Gross Realization Rate**	100%	0.00	0.00
Verified Gross Savings	1,427	0.00	0.00
NTGR**	0.90	0.90	0.90
Verified Net Savings	1,285	0.00	0.00
Common Areas (Comprehensive)			
Ex Ante Gross Savings	22,620	5.67	4.33
Verified Gross Realization Rate**	125%	100%	100%
Verified Gross Savings	28,343	5.67	4.33
NTGR*	0.80	0.80	0.80
Verified Net Savings	22,674	4.54	3.47
Program Total Savings			
Ex Ante Gross Savings	39,285	29.74	6.21
Verified Gross Realization Rate**	116%	100%	100%
Verified Gross Savings	45,750	29.74	6.21
Verified Net Savings	39,490	27.45	5.29

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

*A deemed value from the IL SAG consensus process "ComEd PY5-PY6 Proposal Comparisons with SAG.xls," available on the IL SAG website here: <http://ilsag.info/net-to-gross-framework.html>

**Based on evaluation research findings

Table 4-3 summarizes the breakdown of the electricity savings for EEPS and IPA programs. The EEPS category realized verified net energy savings of 20,469 MWh, verified net demand reduction of 23.64 MW, verified net peak demand reduction of 2.39 MW. The IPA category realized verified net energy savings of 19,021 MWh, verified net demand reduction of 3.81 MW verified net peak demand reduction of 2.90 MW.

Table 4-3. EPY6 Verified Net Impact Savings Estimates For IPA and EEPS Programs

Savings Category	EEPS	IPA	Total
Verified Net Savings (MWh)	20,469	19,021	39,490
Verified Net Demand Savings (MW)	23.64	3.81	27.45
Verified Net Peak Demand Savings (MW)	2.39	2.90	5.29

Source: Navigant analysis of ComEd tracking data (8-27-2014 data extract)

As shown in Table 4-4, the EEPS program achieved 36 percent more realized net energy savings as compared to the program planned net savings target, and the IPA program achieved 8 percent more net savings compare to the planned net savings target. The program overall 39,490 MWh verified net savings is 21 percent more of the planned net savings target.¹⁹

Table 4-4. MCEEP EPY6/GPY3 Planned Vs. Actual Net Savings

Detail	EEPS	IPA	Total
Target Net MWh	15,000	17,617	32,617
Realized Net MWh	20,469	19,021	39,490
Percent Realization	136 (+36%)	108 (+8%)	121% (+21%)

Source: Navigant analysis of EPY6/GPY3 MCEEP tracking data (August 27, 2014 data extract); ComEd PY6 Goals.xlsx

¹⁹ ComEd PY6 Goals.xlsx (planned target for EEPS program was 15,000 MWh, and for IPA programs was 17,617 MWh).

5 Process Evaluation

Process research related to the EPY6/GPY3 evaluation was through interviews with program staff and the implementation contractor staff to verify information about program performance, measures and tracking system.

6 Findings and Recommendations

Overall, the EPY6/GPY3 MCEEP program continues to be effective in the multi-family market sector. The program achieved verified net savings of 39,490 MWh which is approximately 121 percent of the net savings planning target of 32,617 MWh.²⁰ The addition of TAPI and incentive measures in the common area component of the program contributed to the program's increased savings from this sector over previous years.

» Verified Gross Impacts and Realization Rate

- **Finding 1.** The EPY6/GPY3 MCEEP achieved verified gross savings of 45,750 MWh, verified gross demand reduction of 29.74 MW and verified gross peak demand reduction of 6.21 MW. The program's verified gross realization rate was 116 percent. The program is accurately tracking gross savings for most measures with updates recommended for common area lighting and chillers.
- **Recommendation 1.** Based on the Illinois TRM v2.0, the multi-family common area savings input should apply 1.34 waste heat factor for cooling energy savings, compared to 1.04 used in the ex ante savings calculation. The adjustment increased the program's realized savings.

» Peak Demand Reduction

- **Finding 2.** The MCEEP data extract did not track demand savings, although the tracking system has an input field for demand that could be used. Navigant observed the implementation contractor's measure default savings spreadsheet calculated the EPY6/GPY3 measure demand savings.
- **Recommendation 2.** ComEd or the implementation contractor should transfer demand savings estimates in the measure default savings spreadsheet to the tracking system to update demand savings input data. The program should estimate demand savings for all custom type measures, where applicable.

» Verified Net Impacts & NTGR

- **Finding 3.** Navigant used deemed net-to-gross ratio (NTGR) estimates from the Illinois Stakeholder Advisory Group (IL SAG) consensus process to calculate net verified savings for EEPS measures.²¹ NTGR estimates were 0.98 for direct install lighting measures and 0.92 for direct install hot water efficiency measures. The planning NTGR value of 0.80 was used for common area measures (categorized by Navigant to include comprehensive lighting measures, HVAC systems, and custom type measures). For programmable thermostats savings, Navigant referenced NTGR values for comparable programs in the

²⁰ ComEd PY6 Goals.xlsx (planned target for EEPS program was 15,000 MWh, and for IPA programs was 17,617 MWh).

²¹ "ComEd PY5-PY6 Proposal Comparisons with SAG.xls," available on the IL SAG website here: <http://ilsag.info/net-to-gross-framework.html>

Northeast.²² ²³ PY6 IPA measures were not covered by the SAG NTG consensus decision. The evaluation team determined that NTGR estimates for PY6 EEPS measures were appropriate to use for comparable PY6 IPA measures.

- **Finding 4.** Overall, the program achieved verified net savings of 39,490 MWh, verified net demand reduction of 27.45 megawatts (MW) and verified net peak demand reduction of 5.29 M.Th. EEPS category realized verified net energy savings of 20,469 MWh, verified net demand reduction of 23.64 MW and verified net peak demand reduction of 2.39 MW. The IPA category realized verified net energy savings of 19,021 MWh, verified net demand reduction of 3.81 MW and verified net peak demand reduction of 2.90 MW. The ComEd/PGL/NSG joint program realized net energy savings of 21,823 MWh, net demand reduction of 11.05 MW and net peak demand reduction of 3.19 MW. The ComEd/Nicor Gas joint program realized net energy savings of 17,667 MWh, net demand reduction of 16.40 MW and net peak demand reduction of 2.10 MW.

» **Program Volumetric Findings**

- **Finding 5.** The MCEEP in EPY6/GPY3 implemented 42,876 projects and 391,884 measures. In addition to direct install CFLs (269,456 units) and hot water measures (11,541 units), the EPY6/GPY3 program included new measures such as DHW pipe insulations (3,859 linear feet) and programmable/reprogrammed thermostats (9,116 units) which together represented 4 percent of the direct install measure mix. The comprehensive program component had 101,771 lighting and HVAC measures which represented 26 percent of the overall program measures. Multi-family measures installed in common areas represented 28 of the program measures and 5 percent of the total projects.

²² "2010 Gas Energy Efficiency Annual Report," Boston Gas Company, Colonial Gas Company, and Essex Gas Company, each doing business as National Grid, August 2011, page 67.

²³ "Year 2010 Savings Claim," Efficiency Vermont, April 1, 2011, page 162.

7 Appendix

7.1 Evaluation Research Impact Approaches and Findings

7.1.1 Evaluation Research Gross Impact Parameter Estimates

As described in Section 2, gross energy and demand savings for lighting measures are estimated using the following formula as specified in the TRM:

Verified Gross Annual kWh Savings = Program bulbs * Delta Watts/1000 * HOU * IEe* ISR

Verified Gross Annual kW Savings = Program bulbs * Delta Watts/1000 * ISR

Verified Gross Annual Peak kW Savings = Gross Annual kW Savings * Peak Load CF * IEd * ISR

Where:

- Delta Watts = Difference between the Baseline Wattage and CFL Wattage
- HOU = Annual Hours of Use
- ISR = Installation Rate
- Peak Load CF = Peak Load Coincidence factor is calculated as the percentage of program bulbs turned on during peak hours (weekdays from 1 to 5 p.m.) throughout the summer.
- IEe = Energy Interactive Effects
- IEd = Demand Interactive Effects

For the HVAC air cooled and centrifugal chillers the evaluation team reviewed the assumptions found in the TRM and compared with ComEd's work paper. Navigant found the assumptions as reasonable. From the ComEd work paper "qualifying chillers must have a kW/ton IPLV that is 10 percent below the IECC 2012 standards. Additional incentives are provided also for 0.01 kW/ton IPLV improvement. The savings were the same for each building type per the IL TRM v2.0".

Savings values were calculated using the methodology and default values found in the IL TRM, IECC 2012, and with weighting estimations provided by ComEd/KEMA.

$\Delta kWh = \text{Tons} * ((12/IPLV_{base}) - (12/IPLV_{vee})) * EFLH$

Where:

- Tons = chiller nominal cooling capacity in tons (note: 1 ton = 12,000 Btu/h), = Actual installed
- 12 = conversion factor to express Integrated Part Load Value (IPLV) EER in terms of kW per ton
- IPLVbase = efficiency of baseline equipment expressed as Integrated Part Load Value EER. Dependent on chiller type.
- IPLVee = efficiency of high efficiency equipment expressed as Integrated Part Load Value EER
- EFLH = equivalent full load hours dependent on location as below

$$\Delta kW_{SSP} = \text{TONS} * ((12/PE_{base}) - (12/PE_{ee})) * CF_{SSP}$$

$$\Delta kW_{PJM} = \text{TONS} * ((12/PE_{base}) - (12/PE_{ee})) * CF_{PJM}$$

Where:

- PE_{base} = Peak efficiency of baseline equipment expressed as Full Load EER
- PE_{ee} = Peak efficiency of high efficiency equipment expressed as Full Load EER
- CF_{SSP} = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour), = 91.3%
- CF_{PJM} = PJM Summer Peak Coincidence Factor for Commercial cooling (average during peak period), = 47.8%

ComEd used the following Chiller EFLH IL TRM for Zones in ComEd Service Territory.

Table 7-1. Chiller EFLH IL TRM for Zones in ComEd Service Territory

System Type	Rockford	Chicago
CV reheat, no economizer	2723	4206
CV reheat, economizer	870	1343
VAV reheat, economizer	803	1241

Source: Illinois TRM v2.0

ComEd used the following estimated weightings for Chillers system types in ComEd Service Territory. ComEd also used estimated zone weights shown in Table 7-3 below.

Table 7-2. Chiller System Types in ComEd Service Territory

System Type	Estimated System Type Weightings
CV reheat, no economizer	7.5%
CV reheat, economizer	7.5%
VAV reheat, economizer	85.0%

Source: ComEd PY6 Measure Work papers 5-29-13.docx

Table 7-3. Estimated Zone Weights, by 2010 City Population

	Rockford	Chicago
2010 Population	152,871	2,695,598
2010 Population %	5.37%	94.63%

Source: ComEd PY6 Measure Work papers 5-29-13.docx

7.1.2 Evaluation Research Net Impact Findings

NTGR Estimate for Future Use

The NTGR for PY6 was deemed for direct install lighting measures, water measures, and common area measures based on a Statewide Advisory Group consensus process. Navigant recommends using 0.90 NTGR value for programmable thermostats. This value is based on findings from previous evaluation research. PY6 IPA measures were not covered by the SAG NTG consensus decision.

Table 7-4. Impact Estimate Parameters for Future Use

Parameter	Value	Data Source
Programmable Thermostats NTGR – ComEd	0.90	Research Findings Sources: 2010 Gas Efficiency Annual Report by the Massachusetts Joint Utility and Efficiency Vermont Year 2010 Savings Claim

Source: Evaluation research

7.2 TRM Recommendations

During the PY6 study a number of work papers were created to either correct errata or make other significant changes to v4.0 of the IL TRM through the ComEd Residential Lighting evaluation. Some measures included installations in multifamily residences, referenced below. These work papers included the following (date of work paper included in parentheses):

- Update the C&I Lighting section with Res/NonRes Split from Final PY5 Results and Include MF Common Area Parameters where missing (August 4, 2014)
- Revise Residential Interactive Effects Estimates for CFLs installed in MF Common Areas (August 4, 2014)
- Residential Lighting Changes: Remove Residential MF Common Area parameters from Residential Section of TRM, Fix Typo in LED Downlights DW tables (August 4, 2014)
- Update HOU and Peak CF for Residential Lighting Measures (September 9, 2014)

7.3 PJM Data and Findings

Multi-Family Comprehensive Energy Efficiency Program (MCEEP)
Program Year 6 (EPY6/GPY3) – June 1, 2013 – May 31, 2014

Ex-Post Gross Peak Demand (MW) Savings

The PJM ex-post gross coincident peak demand savings was 6.02 MW.

List parameters included in the ex-post gross peak demand calculation.

- (a) PY6 program bulbs and HVAC measures installed
- (b) Non-coincident kW reduction
- (c) kW of baseline equipment
- (d) kW of replacement equipment
- (e) Coincidence Factor

- (f) Demand interactive effect
- (g) kW of baseline equipment during Performance Hours
- (h) kW of replacement equipment during Performance Hours

For lighting measures, the algorithms used to calculate demand savings were:

- (a) *Non-coincident kW reduction = kW of baseline equipment - kW of replacement equipment*
- (b) *PJM Coincident kW reduction = non-coincident kW savings * Coincidence Factor * Demand interactive effect*

For non-lighting measures, the algorithms used to calculate demand savings were:

- (c) *PJM Coincident kW reduction = kW of baseline equipment during Performance Hours - kW of replacement equipment during Performance Hours*

ComEd's program tracking database is setup to track gross coincident peak demand savings. The ex-post gross coincident peak demand savings for the program year EPY6/GPY3 was 6.02 MW