NAVIGANT

MULTI-FAMILY ELEVATE ELECTRIC ENERGY SAVINGS PROGRAM

FINAL

Energy Efficiency/Demand Response Plan: Plan Year 7 (6/1/2014-5/31/2015)

Presented to Commonwealth Edison Company

March 22, 2016

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E. Executive Summary

This report presents a summary of the findings and results from the impact and process evaluation of the PY7 ComEd Elevate Multi-Family Electric Heat Retrofit Program (Multi-Family Electric Program or MFEP). The Multi-Family Electric Program is a third-party behavioral energy efficiency (EE) program being implemented under the Illinois Power Agency (IPA) funding mechanism.[1] The Multi-Family Electric Program delivers cost-effective energy efficiency measures to multi-family property customers with less than 100 kW of demand that are not already served by the *ComEd Smart Ideas For Your Business (SIFYB)* portfolio. Elevate Energy is the primary implementation contractor for the MFEP in a joint partnership with the city of Chicago ("Chicago").[2]

The MFEP provides a range of energy efficiency services to ComEd's multi-family electric space heating customers to achieve energy and demand savings. The program does not directly compete with the Multi-Family Energy Savings joint program currently offered in the ComEd *SIFYB*. Rather, the MFEP complements the existing program by focusing on the delivery of cost-effective electric efficiency resources to the residential multi-family electric space heating market in the city of Chicago. The direct install path of the program provides energy audits and free energy efficiency products in residential units. Through custom energy audit reports provided to each building owner (or representative), customers are provided with financing and incentive packages, as well as solicited bids from contractors for comprehensive electric efficiency upgrades. In addition, the program distributes free energy efficiency products to residential customers through a series of programs, initiatives, and events Chicago undertakes to engage its residents on issues of sustainability and energy efficiency.

The PY7 program evaluation activities began in summer 2014, when the program kicked off with a meeting between ComEd staff, the implementation contractor staff, and the evaluation team. The PY7 evaluation activities included: an engineering review of the program tracking system; calculations of claimed savings using Illinois Statewide Technical Reference Manual (TRM 3.0)[3], and the review of PY7 and PY8 net-to-gross (NTG) values and recommendations for deeming by the Illinois Stakeholder Advisory Group (SAG) consensus process.[4]

E.1 Program Savings

Table E-1 summarizes the electricity savings from the Multi-Family Electric Program. The program achieved verified net energy savings of 908 megawatt-hours (MWh), verified net demand reduction of 0.18 megawatts (MW) and verified net summer coincidence peak demand reduction of 0.12 MW.

[1] Created by Illinois Public Acts 97-0616 ("PA 97-0616") and 97-0824 ("PA 97-0824").
[2] IPA All Electric Scope of Work_Final.docx
[3] Illinois Statewide Technical Reference Manual for Energy Efficiency Version 3.0, available at: http://www.ilsag.info/technical-reference-manual.html
[4] ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html

Table E-1. PY7 Total Program Electric Savings

Savings Category	Energy Savings (MWh)	Demand Savings (MW)	Peak Demand Savings (MW)
Ex Ante Gross Savings	1,054	0.20	0.13
Verified Gross Savings	994	0.20	0.13
Verified Net Savings	908	0.18	0.12

Source: ComEd tracking data and Navigant team analysis.

E.2 Program Savings by Measure

Table E-2 summarizes the PY7 Multi-Family Electric Program savings by measure end-use category.

Table E-2. PY7 Program Results by Measure

Measure Category	Ex Ante Gross Savings (MWh)	Ex Ante Gross Peak Demand Reduction (MW)	Verified Gross Savings (MWh)	Verified Gross Peak Demand Reduction (MW)	Verified Gross MWh Realization Rate[5]	NTGR	Verified Net Savings (MWh)	Verified Net Peak Demand Reduction (MW)
Common Area Incandescent to CFL (750-1049 lumens)	44	0.01	45	0.01	102%	0.95†	43	0.01
LED Exit Sign	19	<0.01	18	<0.01	96%	0.95†	17	<0.01
Distributed Incandescent to CFL (750-1049 lumens)	10	<0.01	10	<0.01	100%	0.62†	6	<0.01
7-plug Smart Strip Distr.	373	0.04	373	0.04	100%	0.86†	321	0.04
7-plug Smart Strip D.I	2	<0.01	2	<0.01	100%	0.95†	2	<0.01
Programmable Thermostat	369	-	308	-	84%	0.95†	293	-
1,2,3 and 4-Lamps Relamp/Reballast HPT8	202	0.03	203	0.03	101%	0.95†	193	0.03
Roof Cavity Insulation (sq.ft)	35	0.05	35	0.05	100%	0.95†	33	0.04
Total	1,054	0.13	994	0.13	94%		908	0.12

Source: ComEd tracking data and Navigant team analysis.
† A deemed value. Source: ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html

E.3 Impact Estimate Parameters for Future Use

The evaluation did not have any additional research on parameters used in impact calculations or for deeming in future versions of the Illinois TRM.

[5] The verified gross realization rate is the ratio of verified gross savings to ex ante gross savings from the program tracking system.

E.4 Program Volumetric Detail

As shown in Table E-3, the Multi-Family Electric Program completed 84 building assessments, involving 3,647 tenant units who received free direct install energy efficient measures and/or distributed products. Some properties installed additional lighting or other improvement upgrades measures and received rebates from ComEd. The program installed 5,882 unit measures, including CFLs, high-performance T-8 (HPT8) lamps, smart power strips, exit signs and programmable thermostats.

Table E-3. PY7 Volumetric Findings Detail

Participation	Direct Install	Contractor Installed	Distributed Products	Total
# Completed Buildings Assessment	-	-	-	84
Tenants Units in Assessed Buildings	397	306	3,547	3,647*
Participants (Property Address)	8	4	28	34**
Total Program Measures	714	611	4,557	5,882***

Source: ComEd tracking data and Navigant team analysis.

* Unique tenants list excludes 603 duplicate tenants with direct installed and/or contractor-installed measures who also received distributed products.

** Unique Site Address excludes 6 duplicate customer site addresses.

***Total measures include 33 tenant units who received 8,987 square feet of roof cavity insulation (each tenant unit is represented as one measure).

E.5 Results Summary

The following table summarizes the key metrics from PY7.

Table E-4. PY7 Results Summary

	Units	PY7
Net Savings	MWh	908
Net Demand Reduction	MW	0.18
Net Peak Demand Reduction	MW	0.12
Gross Savings	MWh	994
Gross Demand Reduction	MW	0.20
Gross Peak Demand Reduction	MW	0.13
Program Realization Rate	%	94%
Program NTG Ratio*	#	DI CFL Common Areas =0.95 CFL Public Event =0.62 Thermostats=0.95 Power Strip DI =0.95 Power Strip Public Event =0.86 Insulation =0.95 Comprehensive Non-CFL=0.95
Measures Installed	#	5,882
Tenant Units	#	3,647
Buildings Assessed	#	84
Customers Touched (Property Address)	#	34

Source: ComEd tracking data and Navigant team analysis.

*A deemed value. Source: ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html

E.6. Findings and Recommendations

Key findings and recommendations are included below.

Verified Net Impacts & NTGR

Finding 1. Navigant used deemed net-to-gross (NTG) ratio estimates from the Illinois SAG consensus process to calculate net verified savings for the Multi-Family Electric Program . Navigant calculated 908 MWh as the total verified net energy savings. Overall, the PY7 program met 78 percent of its net energy savings planning estimate of 1,157 MWh[6] through direct installation activities, distribution of products at events in Chicago and contractor installations of incented measures.

[6] IPA All Electric Scope of Work_Final.docx

Verified Gross Impacts and Realization Rates

Finding 2. The PY7 Multi-Family Electric Program achieved 994 MWh of verified gross energy savings and 0.13 MW of verified gross peak demand savings. The total verified gross energy savings is 60 MWh lower than the ex-ante gross savings of 1,054 MWh, which means that the verified gross savings realization rate for the program was 94 percent. The program default lookup values and ex ante savings for most measures were consistent with the TRM (v3.0), but the default savings values for programmable thermostats and LED exit signs required further review. The lighting measures had verified gross savings realization rate of 100 percent or slightly higher, but Navigant estimated 96 percent and 84 percent gross savings realization rates respectively for LED exit signs and programmable thermostats to ensure compliance with the TRM (v3.0).

Recommendation 1. The program implementer (Elevate Energy) should update the tracking database default savings assumptions to comply with the current and applicable version of the TRM. Elevate Energy should apply the heating penalty to the LED exit signs savings calculation and for other applicable measures. The savings estimate for programmable thermostats should reflect the applicable electric heating consumption input assumptions. Elevate Energy should track delta watts values for all lighting measures installed.

Tracking System Review

Finding 3. Navigant reviewed the program tracking database developed by Elevate Energy (spreadsheet format). The program tracking database captures most of the vital information that enables accurate tracking of the program key performance indicators including program's participation and claimed savings. The tracking database accurately records default savings and total savings estimated for most direct install and incentive measures, and the distributed products. However, the tracking database was not updated with the revised TRM values.

Recommendation 2. Elevate Energy should update the tracking database regularly with the current TRM values. Elevate Energy should consider including additional information in the tracking system, such as: unique numeric property or unit identification numbers that could be used for referencing the property; contact names and phone numbers in addition to addresses of all participating property and dwelling units which are necessary for follow up surveys. Track post-installation inspection findings and incorporate responses coming from post installation property manager and tenant surveys in an established complaint resolution strategy.

Recommendation 3. To the extent feasible, Elevate Energy should attempt to minimize hand-written data entry since it can introduce errors into the data collection process. Navigant had difficulty reading the names and addresses as well as tallying the quantities of bulbs distributed when we reviewed samples of the Distribution Product Log Sheets provided by ComEd. It appears the program tracking system's manual process of data collection and entry into the tracking spreadsheet may be cumbersome, leading to the possibility of data entry errors. Elevate Energy should consider using hand held tablets or computers that would facilitate on-site data collection and document survey findings.

Program Participation

Finding 4. The PY7 Multi-Family Electric Program completed 84 building assessments, involving 3,647 tenant units who received direct installation of energy efficient measures and distributed products. Some properties installed additional lighting or improvement upgrades and received rebates from ComEd. The PY7 program exceeded its target for the total measure count in PY7, most of which came from direct installation of smart power strips distributed at tenant spaces. Elevate Energy distributed 4,557 measures at tenant units and during community events (937 CFL bulbs were distributed at community events and 3,620 smart power strips were distributed at residential tenant units of eligible multi-family buildings) which together comprised 77 percent of the program measure volume and 39 percent of the verified gross savings in PY7. Direct installation of smart power strips, programmable thermostats, CFL bulbs, and LED exit signs in residential tenants space or in common areas of eligible buildings constituted 12 percent of the total measure volume and 37 percent of the verified gross savings in PY7. The program also had contractors install high performance T8 lighting systems (1, 2, 3 and 4-Lamps relamp/reballast HPT8s) and performed roof cavity insulation of tenants' space. The contractor installed measures constituted 10 percent of the measure volume and 24 percent of the verified gross savings in PY7.

Recommendation 4. Although the Multi-Family Electric Program achieved successes in some areas of participation (particularly the distribution products channel), the program only met 78 percent of its PY7 net savings target. Navigant recommends that to increase program savings, the program implementation should focus on the high-impact contractor installed measures. The program should engage more with trade allies to market the program to the property managers. In addition, the program should emphasize the high impact upgrades and the various incentive levels offered by the program in its marketing and outreach campaign.

Process Findings

Finding 5. Navigant's assessment shows that the program eligibility criteria are followed for the direct install and contractor install activities. Direct installation by building management occurs only in buildings that have undergone assessments performed by Elevate Energy and were confirmed to have five or more tenant units. The program's QA/QC screening process for recipients of CFLs distributed at community events did not have the same level of compliance with the program's eligibility criteria. Navigant's examination of the Distributed Products Log Sheets shows that there is no check box on the form for product recipients to confirm their status as current ComEd customers. Also, in some cases recipients did not consent that they will replace their existing incandescent bulbs with the CFLs within 30 days as required by the program.

Recommendation 5. Review eligibility screening for event attendees receiving distributed CFLs. Include a check box in the Distributed Products Log Sheet to seek confirmation of recipients' status as ComEd customers. Improve QA/QC screening of recipients to confirm the recipients' commitments to install the distributed products within 30 days as the log sheet required. Revise Scope of Work and operations procedures to include guidelines describing sampling of tenant units for post installation inspection. Define inspection rates (set a goal) for post inspection of direct install and distributed products.

1 Introduction

1.1 Program Description

This report presents a summary of the findings and results from the impact and process evaluation of the PY7 ComEd Elevate Multi-Family Electric Heat Retrofit Program (Multi-Family Electric Program or MFEP). The Multi-Family Electric Program is a third-party behavioral energy efficiency (EE) program being implemented under the Illinois Power Agency (IPA) funding mechanism.[7] The Multi-Family Electric Program delivers cost-effective energy efficiency measures to multi-family property customers with less than 100 kW of demand that are not already served by the *ComEd Smart Ideas For Your Business (SIFYB)* portfolio. Elevate Energy is the primary implementation contractor for the MFEP in a joint partnership with the city of Chicago ("Chicago").[8]

The MFEP provides a range of energy efficiency services to ComEd's multi-family electric space heating customers to achieve energy and demand savings. The program does not directly compete with the Multi-Family Energy Savings joint program currently offered in the ComEd *SIFYB*. The MFEP complements the existing program by focusing the delivery of cost-effective electric efficiency resources to the residential multi-family electric space heating market in the city of Chicago. The direct install path of the program provides energy audits and free energy efficiency products in residential units. The program provides a customized energy upgrade report by conducting an energy audits. Following the audit, the program gives a report that includes the recommended measures as well as a financing and incentive package to the building owner (or representative). The program also provides the customer with solicited bids from contractors for comprehensive electric efficiency upgrades. In addition, the program distributes free energy efficiency products to residential customers through a series of programs, initiatives, and events Chicago undertakes to engage its residents on issues of sustainability and energy efficiency.

The PY7 program evaluation activities began in summer 2014, when the program kicked off with a meeting between ComEd staff, the implementation contractor staff, and the evaluation team. The PY7 evaluation activities included: an engineering review of the program tracking system; calculations of claimed savings using Illinois Statewide Technical Reference Manual (TRM 3.0)[9], and the review of PY7 and PY8 net-to-gross (NTG) values and recommendations for deeming by the Illinois State Advisory Group (SAG) consensus process.[10]

[7] Created by Illinois Public Acts 97-0616 ("PA 97-0616") and 97-0824 ("PA 97-0824").
[8] IPA All Electric Scope of Work_Final.docx
[9] Illinois Statewide Technical Reference Manual for Energy Efficiency Version 3.0, available at: http://www.ilsag.info/technical-reference-manual.html
[10] ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html

1.2 Evaluation Objectives

The evaluation team identified the key researchable questions listed in the following sections.

1.2.1 Impact Questions

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. What updates are recommended for the Illinois Technical Reference Manual (TRM)?

1.2.2 Process Questions

The PY7 process evaluation activities for the Multi-Family Electric program included interviews with program staff and the implementation contractor staff and reviews of program materials and tracking system inputs. This process evaluation team also reviewed information about marketing and outreach strategies made in PY7 that impacted customer participation.

2 Evaluation Approach

The evaluation team reviewed the program tracking data and performed gross and net impact calculations to determine verified energy and demand savings for PY7. 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 v3.0 to ensure that they are appropriately applied, and (3) cross-checking totals.

2.1 *Overview of Data Collection Activities*

The core data collection activities included: reviewing the program's tracking data, and verifying the direct install measures savings using the Illinois TRM v3.0. The full set of data collection activities is shown in the following table.

Table 2-1. Primary Data Collection Activities

What	Who	Target Completes PY7	When	Comments
Review Program Tracking Database	Participants	All	June-October 2015	Source of information for verified gross analysis
Review Program Measures in IL TRM	Illinois Statewide Technical Reference Manual for Energy Efficiency Version 3.0	All	November 2014 - October 2015	Source of information for verified gross analysis
Program Material Review	Program Documents	All	July 2014 - October 2015	
In Depth Interviews	Program Management	3	March-May 2015	Includes interviews with staff from ComEd

2.2 *Verified Savings Parameters*

2.2.1 Verified Gross Program Savings Analysis Approach

Navigant estimated verified unit savings for each program measure using deemed impact algorithm sources in the Illinois TRM v3.0. Verified unit savings values reflect evaluation adjustments to ex ante unit savings values based on Navigant's measure review of the direct install measures (including CFLs and plug smart strips) and the comprehensive efficiency upgrades (including common area lighting measures and whole building improvement roof cavity insulation). For measures with per unit savings values deemed by the TRM, Navigant estimated the verified gross savings by multiplying deemed per unit energy and demand savings by the verified quantity of eligible measures installed. Navigant reviewed the roof cavity insulation custom savings inputs and verified the gross savings using the TRM v3.0 savings algorithm.

Navigant reviewed a sample of project documentation data to determine the level of impacts of CFL bulbs and smart power strips distributed at tenant units and Chicago community events and programs. Navigant used the assumptions in the TRM to determine the in-service rates and verified savings from the distributed products.

2.2.2 Verified Net Program Savings Analysis Approach

Verified net energy and demand (coincident peak and overall) savings were calculated by multiplying the verified gross savings estimates by a net-to-gross ratio (NTGR). In PY7, the NTGR estimates used to calculate the net verified savings were based on past evaluation research and deemed through the Illinois Stakeholder Advisory Group (IL SAG) consensus process.

Table 2-2 presents the key parameters and the references used in the verified gross and net savings calculations.

Table 2-2. Verified Savings Parameter Data Sources

Verified Gross and Net Input Parameter	Value	Data Source	Deemed‡ or Evaluated
NTGR – DI CFL Common Areas NTGR – Insulation NTGR – Thermostats NTGR – Comprehensive Non-CFL NTGR – Power Strip DI	0.95	IL SAG Spreadsheet†	Deemed
NTGR – CFL Public Event	0.62	IL SAG Spreadsheet†	Deemed
NTGR – Power Strip Public Event	0.86	IL SAG Spreadsheet†	Deemed
Verified Energy Gross Realization Rate	94%	Program Tracking Data Review	Evaluated
Verified Peak Demand Gross Realization Rate	100%	Program Tracking Data Review	Evaluated
All lighting measures delta watts	Vary	Illinois TRM v3.0, Section 4.5 & 5.5	Deemed
Direct Install CFL In-Service Rate	0.969	Illinois TRM v3.0, Section 5.5.1	Deemed
Common Area CFL and Comprehensive Non-CFL In-Service Rate	1.00	Illinois TRM v3.0, Section 4.5	Deemed
Programmable Thermostats Inputs	Per Household	Illinois TRM v3.0, Section 5.3.11	Deemed
Heating Penalty for Electric Heating	Vary for measure	Illinois TRM v3.0, Section 4.5 & 5.5	Deemed
Roof Cavity Insulation Inputs	Vary	Secondary research, Illinois TRM v3.0, Section 5.6.4	Evaluated

Source: Navigant analysis of ComEd tracking data and TRM v3.0.
† Source: ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is found on the IL SAG website: http://ilsag.info/net-to-gross-framework.html

2.3 Process Evaluation

Process research related to the PY7 evaluation included interviews with program staff and the implementation contractor staff, and reviews of program materials and tracking system inputs. The process evaluation also reviewed information about PY7 marketing and outreach strategies that impacted customer participation. No customer or trade ally research was conducted for the PY7 evaluation.

3 Gross Impact Evaluation

The PY7 Multi-Family Electric Program achieved verified gross savings of 994 MWh, verified demand reduction of 0.20 MW, and verified summer coincidence peak demand reduction of 0.13 MW. The program's verified gross energy realization rate was 94 percent for energy savings. The realization rate reflects evaluation adjustments made to programmable thermostat and LED exit signs savings input assumptions using the TRM (v3.0).

3.1 Tracking System Review

Over the course of PY7, Navigant and the implementation contractor maintained close contact beginning in summer 2014, when the program evaluation kicked off with a meeting between ComEd staff, the implementation contractor staff, and the evaluation team. In fall 2014, Navigant conducted a review of PY7 and PY8 net-to-gross (NTG) values for the program measures and provided recommendations for deeming by the Illinois State Advisory Group (SAG) consensus process. Navigant also performed a preliminary impact review of the program default measure savings and compliance with the Illinois TRM input assumptions and algorithms. This exercise provided preliminary deemed savings estimates for the program measures. The final savings numbers were verified after Navigant reviewed the final PY7 tracking database in November 2015 and revised the numbers in accordance with TRM (v3.0).[11]

Navigant downloaded the final data for the Multi-Family Electric Program PY7 impact evaluation from the ComEd evaluation SharePoint site. Navigant reviewed the program tracking database developed by Elevate Energy (spreadsheet format). The program tracking database captured the vital information that enabled accurate tracking of the program's participation and claimed savings. The tracking database accurately recorded default savings and total savings estimated for most direct install and incentive measures, and the distributed products. Navigant recommends updating the tracking default savings input assumptions for some measures that did not comply with the current and applicable version of the TRM.

Key findings from the tracking system impact review include the following:

- *Programmable Thermostats (electric resistance)*: Navigant estimated 837.1 kWh as the verified unit energy savings for programmable thermostat per household based on 20,771 kWh electric

[11] From Navigant memo dated November 13, 2015, "ComEd PY7 Multi-Family Electric Heat Retrofit Program Early Impact Findings – revised." In November 2014, Navigant sent ComEd and Elevate Energy a memo (Memo to ComEd and Elevate Energy, November ComEd EMV Programs -PY7 Multifamily Electric Heat Retrofit Program Navigant Comments.xlsx, November 21, 2014) with per unit savings values which incorrectly used the TRM v.2.0. Navigant has since reviewed the savings input assumptions and revised the values according to TRM v3.0 which is applicable to PY7. In particular, the values for LED exit signs and programmable thermostats differ between the two versions of the TRM and resulted in approximately six percent decrease in verified net savings for the LED exit sign measures and a sixteen percent decrease in verified net savings for the programmable thermostat measures. The overall impact of the changes between the two TRM versions is a six percent decrease in the overall total verified net savings for the program. Navigant's verified net impact evaluation approach applied the deemed net-to-gross (NTG) ratios approved through the Illinois Stakeholder Advisory Group (SAG) consensus process.

heating consumption input assumption from the TRM (v3.0). The tracking system's default savings was 1002.5 kWh per household, which was based on 24,875 kWh electric heating consumption input assumption from the previous version of the TRM (v2.0). The measure gross realization rate was 84 percent.

- *LED Exit Signs*: Navigant estimated 288.41 kWh as the verified unit energy savings for LED exit signs. Navigant believes that using commercial input assumptions for the savings calculation is more reasonable for multi-family common area applications than residential input assumptions. The verified savings accounted for the heating penalty for the electric heated buildings as specified in the TRM (v3.0). The tracking default savings was 300.8 kWh per exit sign without the heating penalty calculation. The measure gross realization rate was 96 percent.
- *Replacing Common Area Incandescents with CFLs (750-1049 lumens)*: The tracking system's default unit energy savings was 168.6 kWh, based on replacing a 60W incandescent bulb with a 14W CFL. Navigant estimated 172.0 kWh as the verified unit savings, based on verified delta watts values and deemed input assumptions from the TRM (v3.0). Navigant's verified savings was slightly higher than the ex-ante savings, which produced a measure gross realization rate of 102 percent.
- *1, 2, 3, 4-Lamps Relamp and Reballast HPT8*: Navigant verified the delta watts for each of the 1, 2, 3 or 4 lamp T12 which replaced lamps and ballasts in HPT8s. Using the TRM (v3.0) deemed savings interactive factors and hours of usage, Navigant estimated the verified savings for each retrofit configuration. Navigant's verified per unit energy savings were slightly higher than the ex-ante savings, which produced a measure gross realization rate of 101 percent
- *Roof Cavity Insulation*: Using project files and invoices, Navigant verified the custom input assumptions for the 8,987 square feet of roof cavity insulation performed through the program. Navigant verified the ex-ante savings were consistent with the TRM (v3.0), with no further adjustments.
- *Distributed Smart Power Strips and CFL Bulbs*: Navigant reviewed the program documentation to verify the events and locations where smart power strips and CFLs bulbs were distributed. Navigant verified that the measures were distributed according to the program requirements and also verified the measure quantities and claimed savings.

Navigant performed additional due diligence analysis on the program processes including administration and implementation based on interviews with program stakeholders and review of program marketing materials and operating procedures. Details of the due diligence analysis are provided in Section 5 of this report.

3.2 Program Volumetric Findings

Table 3-1 shows the program volumetric findings disaggregated by program delivery channel. The Multi-Family Electric Program completed 84 building assessments, providing free direct install energy efficient measures in 3,647 tenant units, and distributing products at Chicago events. Trade allies installed additional lighting or improvement upgrades measures which qualified for rebates from ComEd in some properties. Overall, the program installed 5,882 unit measures, including CFLs, HPT8 lamps, smart power strips, exit signs and programmable thermostats.

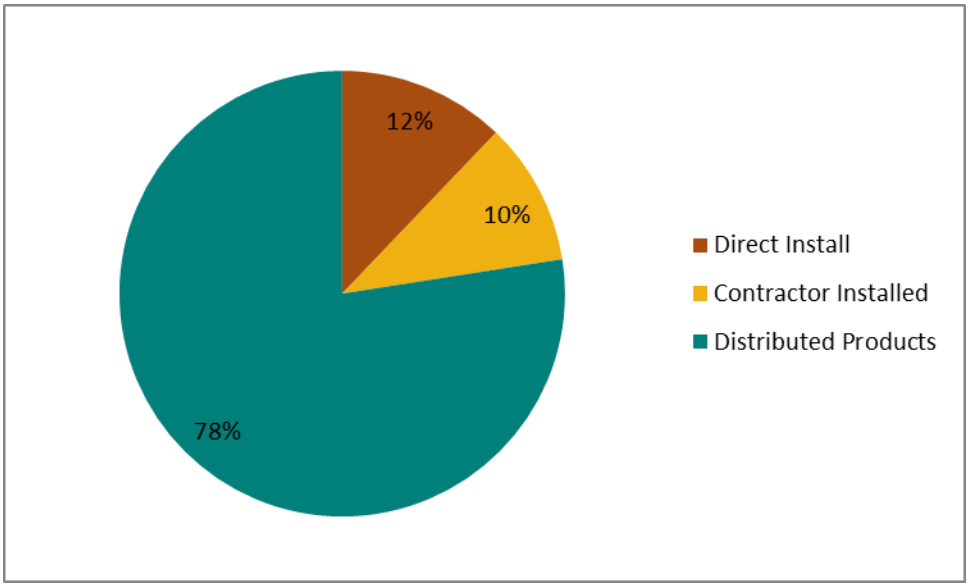
Table 3-1. PY7 Volumetric Findings Detail

Participation	Direct Install	Contractor Installed	Distributed Products	Total
# Completed Buildings Assessment	-	-	-	84
Tenants Units in Assessed Buildings	397	306	3,547	3,647*
Participants (Property Address)	8	4	28	34**
Total Program Measures	714	611	4,557	5,882

Source: ComEd tracking data and Navigant team analysis.
*Unique tenants list excludes 603 duplicate tenants with direct installed and/or contractor installed measures installed who also received distributed products.
**Unique Site Addresses excludes six duplicate customer site addresses.
***Total measures include 33 tenant units who received 8,987 square feet of roof cavity insulation (each tenant unit is represented as one measure).

Figure 3-1 disaggregates the measure mix by program delivery channel.

Figure 3-1. Number of Measures Installed by Program Channel



Source: Navigant analysis of ComEd tracking data

For PY7, 78 percent of the program measures included distributed 4,557 measures distributed by Elevate Energy. These measures included 937 CFL bulbs distributed at community events and 3,620 smart power strips distributed to tenants in eligible buildings. These free measures were distributed at events and initiatives organized by the city of Chicago as well as other agencies in Chicago focusing on engaging residents on issues of sustainability and energy efficiency. In addition, the program installed smart power strips, programmable thermostats, CFL bulbs, and LED exit signs in residential tenant space or common areas. These directly installed measures represented 12 percent measures. Contractors also installed or retrofitted high-performance T8 lighting system (1, 2, 3 and 4-Lamps relamp/reballast HPT8s) and insulated roof cavities in tenants' units. The contractor-installed measures represented 10 percent of the measures in PY7.

Table 3-2 provides details on the program measures. As indicated above, ex ante and verified measure counts matched.

Table 3-2. PY7 MFEP Measure Count

Measure	Unit	Install Type	Ex ante Measure Count	Verified Measure Count
Incandescent to CFL (750-1049 lumens)	Each	Common Area DI*	261	261
LED Exit Sign	Each	Common Area DI	62	62
Incandescent to CFL (750-1049 lumens)	Each	Distributed at Event	937	937
7-plug Smart Strip Distr.	Each	Distributed at Tenant Units	3,620	3,620
7-plug Smart Strip D.I	Each	In-unit DI	23	23
Programmable Thermostat	Each	In-unit DI	368	368
1,2,3,4-Lamps Relamp/Reballast HPT8	Each	Common Area CI**	578	578
Roof Cavity Insulation	sq. ft.	Common Area CI	8,987	8,987

Source: Navigant analysis of ComEd tracking data
*DI=Direct Install
**CI=Contractor Installed

3.3 Gross Program Impact Parameter Estimates

As described in Section 2, Navigant estimated verified unit savings for each program measure using impact algorithm sources in the Illinois TRM v3.0. Table 3-3 presents the key parameters and the references used in the verified gross and net savings calculations (energy and summer coincident peak demand).

Table 3-3. PY7 MFEP Ex ante and Verified Gross Savings Parameters

Program Measures	Ex ante Gross Savings (kWh/unit)	Verified Gross Savings (kWh/unit)	Verified Gross Savings (kW/unit)	Method	Source (Illinois TRM v3.0)
Common Area - Incandescent to CFL, 750-1049 Lumens (60W to 13W)	168.60	172.03	0.034	Deemed	Sections 5.4 and 5.5
Exit Sign: Incandescent to LED (35W to 2W)	300.80	288.41	0.035	Deemed	
Incandescent to CFL, 750-1049 lumens (43W to 13W)	11.17	11.17	0.002	Deemed	
7-plug Smart Strip Distributed	103.00	103.00	0.012	Deemed	
7-plug Smart Strip D.I	103.00	103.00	0.012	Deemed	
Programmable Thermostat - Resistance Heat	1,002.46	837.07	-	Deemed	
1-Lamp F40T12 (Mag) to 1-Lamp Relamp/Reballast HPT8	186.10	189.83	0.038	Deemed	
2-Lamp F40T12 (Mag) to 2-Lamp Relamp/Reballast HPT8	261.60	266.95	0.053	Deemed	
2-Lamp F40T12 (Mag) to 2-Lamp Relamp/Reballast HPT8 24 Hrs	393.02	393.02	0.053	Deemed	
4-Lamp F40T12 (Mag) to 4-Lamp Relamp/Reballast HPT8	511.60	522.03	0.104	Deemed	
Roof Cavity Insulation - Resistance Heat	custom	custom verified		Evaluated/TRM (v3.0)	

Source: Navigant analysis of ComEd tracking data

* Deemed values are from Illinois TRM v3.0, available at http://www.ilsag.info/technical-reference-manual.html.

3.4 Verified Gross Program Impact Results

The PY7 Multi-Family Electric Program achieved verified gross savings of 994 MWh, 0.20 MW demand reduction and 0.13 MW summer coincidence peak demand reduction, as shown in Table 3-4. The table presents savings at the measure group level including groups where the estimate is not statistically significant at the 90/10 level. The program achieved a 94 percent gross realization rate on electricity savings and a 100 percent gross realization rate on demand reduction.[12]

[12] The verified gross realization rate is the ratio of verified gross savings to ex-ante gross savings from the program tracking system.

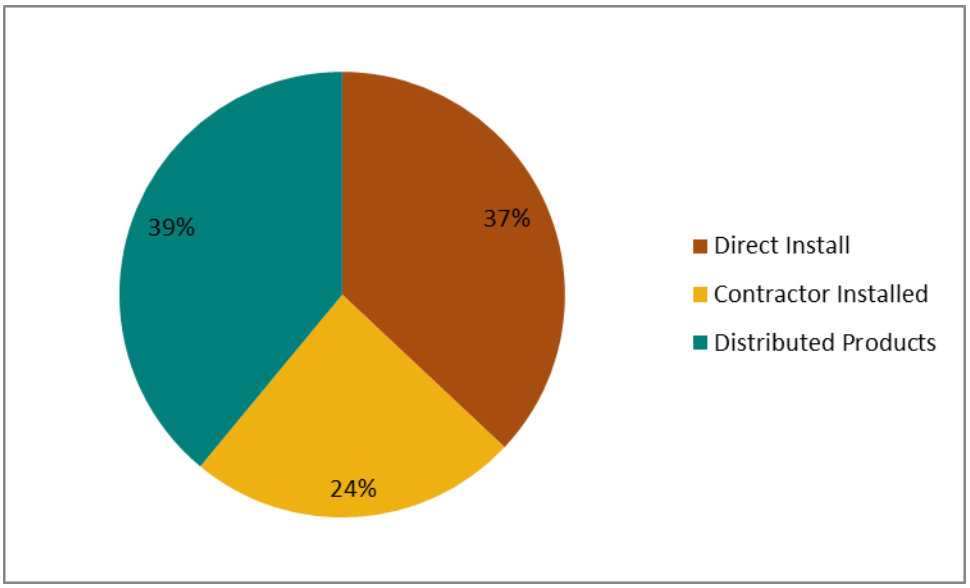
Table 3-4. PY7 Verified Gross Impact Savings Estimates by Measure End-use

Program Channel	Gross Energy Savings (MWh)	Gross Demand Reduction (MW)	Gross Coincident Peak Demand Reduction (MW)	Sample (90/10 Significance?)
Lighting				
Ex Ante Gross Savings	275	0.08	0.04	
Verified Gross Realization Rate	100%	100%	100%	NA†
Verified Gross Savings	276	0.08	0.04	
Plug Power Smart Strips				
Ex Ante Gross Savings	375	0.05	0.04	
Verified Gross Realization Rate	100%	100%	100%	NA†
Verified Gross Savings	375	0.05	0.04	
HVAC (P-Thermostats & Insulation)				
Ex Ante Gross Savings	404	0.07	0.05	
Verified Gross Realization Rate	85%	100%	100%	NA†
Verified Gross Savings	343	0.07	0.05	
Program Total Savings				
Ex Ante Gross Savings	1,054	0.20	0.13	
Verified Gross Realization Rate	94%	100%	100%	NA†
Verified Gross Savings	994	0.20	0.13	

Source: Navigant analysis of ComEd tracking data
NA† indicates that the Illinois TRM v3.0 determines the gross savings.

Figure 3-2 shows the PY7 Multi-Family Electric Program verified gross savings by program delivery channel. In PY7, 39 percent of the verified gross savings were due to distributed CFL bulbs and smart power strips represented. Also, 37 percent of the verified gross savings were from the direct install measures. In addition, 24 percent of the verified gross savings were from the contractor installed measures.

Figure 3-2. PY7 MFEP Verified Gross Savings by Program Channels



Source: Navigant analysis of ComEd tracking data

4 Net Impact Evaluation

Based on the Illinois Stakeholder Advisory Group (IL SAG) consensus process, NTG values for this program are deemed prospectively and used to calculate verified net savings.[13] Table 4-1 shows deemed NTG values from the IL SAG consensus process.

Table 4-1. PY7 Verified Net Impact Parameters

End-use	NTGR	Source
DI CFL Common Areas	0.95	IL SAG
Comprehensive Non-CFL	0.95	IL SAG
Thermostats	0.95	IL SAG
Power Strip DI	0.95	IL SAG
Insulation	0.95	IL SAG
CFL Public Event	0.62	IL SAG
Power Strip Public Event	0.86	IL SAG

Source: "ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx," available on the IL SAG website: http://ilsag.info/net-to-gross-framework-1.html

The verified net savings for the PY7 Multi-Family Electric Program was 908 MWh. The verified net demand reduction was 0.18 MW. The verified net summer coincidence peak demand reduction of 0.12 MW.

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 PY7 evaluation did not include new free-ridership or spillover research.

[13] Source: ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, found on the IL SAG website: http://ilsag.info/net-to-gross-framework.html

Table 4-2. PY7 Verified Net Impact Savings Estimates by Measure End use

Program Channel	Gross Energy Savings (MWh)	Gross Demand Reduction (MW)	Gross Coincident Peak Demand Reduction (MW)	Sample (90/10 Significance?)
Lighting				
Ex Ante Gross Savings	275	0.08	0.04	
Verified Gross Realization Rate	100%	100%	100%	
Verified Gross Savings	276	0.08	0.04	NA†
NTGR*	DI & CI=0.95, Distributed=0.62			
Verified Net Savings	259	0.07	0.04	
Plug Power Smart Strips				
Ex Ante Gross Savings	375	0.05	0.04	
Verified Gross Realization Rate	100%	100%	100%	
Verified Gross Savings	375	0.05	0.04	NA†
NTGR*	DI=0.95, Distributed=0.86			
Verified Net Savings	323	0.05	0.04	
HVAC (P-Thermostats & Insulation)				
Ex Ante Gross Savings	404	0.07	0.05	
Verified Gross Realization Rate	85%	100%	100%	
Verified Gross Savings	343	0.07	0.05	NA†
NTGR*	0.95	0.95	0.95	
Verified Net Savings	326	0.07	0.05	
Program Total Savings				
Ex Ante Gross Savings	1,054	0.20	0.13	
Verified Gross Realization Rate	94%	100%	100%	NA†
Verified Gross Savings	994	0.20	0.13	
Verified Net Savings	908	0.18	0.12	

Source: Navigant analysis of ComEd tracking data
*A deemed value from the IL SAG consensus process "ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx," available on the IL SAG website: http://ilsag.info/net-to-gross-framework.html
NA† indicates that the Illinois TRM v3.0 determines the gross savings.

The program met 78 percent of the PY7 net savings target of 1,157 MWh with overall net energy savings of 908 MWh.[14]

[14] IPA All Electric Scope of Work_Final.docx

5 Process Evaluation

Navigant conducted a limited process review in PY7 which included:

- Interviewing with program staff and the implementation contractor staff,
- Reviewing the program tracking system, and
- Reviewing the program materials to verify information about program measures...

In addition, Navigant conducted a due diligence review of the Multi-Family Electric Program's quality assurance and quality control (QA/QC) activities and compared the program's QA/QC activities to national best practices Navigant reviewed:

- Program documentation and procedures,
- The tracking system input fields, and
- Implementation processes as outlined in the program Scope of Work and operating procedures.

The primary areas of inquiry of the due diligence activity was to determine whether:

- The program participants complied with the eligibility criteria and applications were appropriately completed and documented.
- Savings were calculated correctly compared with program assumptions.
- Project information was entered in the tracking system in an accurate and timely manner.
- The data needed for program evaluation were thoroughly captured by the program tracking system.
- The QA/QC activities, customer satisfaction and complain resolution strategies were adequate.

5.1 Data Collection

Navigant collected data for this verification and due diligence task through interviews with program implementation staff and reviewing program documentation covering the period from program launch in July 2014 through October 2015 when we received the final tracking data for PY7 evaluation. Navigant's due diligence findings and recommendations were based on our review of the following program activities and materials:

- Interviews with program stakeholders.
- Program application forms and documentation (scope of work and operating procedures, marketing materials, etc.).
- Project files and program tracking system.
- Comparison of program activities and materials to national best practices for similar programs.

5.1.1 Interview with Program Stakeholders

Navigant conducted a telephone interview with representatives from ComEd, and the implementation contractor (Elevate Energy) during the program launch in summer 2014 to discuss the program's administration and implementation strategy and the evaluation activities. The telephone interview

included prepared question topics such as program outreach and marketing strategy, program delivery mechanisms, and the role of participants and contractors. Navigant engaged with ComEd and the Elevate Energy staff through emails and telephone communications to discuss the distributed products scenarios and proposed PY7 and PY8 net-to-gross (NTG) values and recommendations for deeming by the Illinois State Advisory Group (SAG) consensus process. Upon Elevate Energy's request, Navigant conducted a preliminary review of the program's proposed measures savings default assumptions. This type of request was in accordance with best practices since it helped to define and identify key information needed to track and report early in the program development process.

5.1.2 Review Program Documentation and Procedures

Navigant reviewed the following program documentation:

- The Multi-Family Electric Program's Implementation Scope of Work's operational procedures [15],
- ComEd Monthly Scorecard,
- Distributed Products Log Sheets,
- Program tracking database (spreadsheet showing monthly property summary reports of building assessment, tenant units completed, installations and distributed products),
- Property Assessment Application and Agreement,
- Information sheets for smart power strips and programmable thermostats, and
- Energy Savers Loan information sheet.

In addition, Navigant reviewed the marketing and outreach materials on Elevate Energy's website. The marketing and outreach documents included marketing brochures, newsletters, mail-in forms, leave-behind flyers and post cards.

Navigant's assessment indicated that the program implementation of the distributed products (CFLs) at community events took place between July and December 2014, and were probably discontinued, according to the dates examined on the Distributed Products Log Sheets. On the other hand, the completion dates of the direct installation by building management and those from contractors mostly occurred between January and May 2015. Navigant did not find adequate reason from the program documentation if there were challenges in the program implementation and marketing strategy that probably led to early completion for the CFLs distributed at events, or late participation for the installation by building management and contractors. Navigant recognized these lapses could happen for a new program in implementation and transition. Navigant recommends that Elevate Energy document any operational challenges including late starts, surveys and complain resolutions to gauge the program performance.

Navigant's assessment showed that generally, the program followed the eligibility criteria especially for the direct install and contractor install activities. The program used the eligibility criteria also for the projects with direct installation of measures by building management which required an energy assessment of the building and confirmation that the building has five or more tenant units. The program QA/QC screening process for recipients of CFLs distributed at community events could be modified to better match with national best practices. Navigant observed that there is no simple way to determine whether each individual recipient of CFLs at the events were Chicago residents and/or had ComEd

[15] Revised Scope of Work_03242015.docx

residential accounts. Our examination of the Distributed Products Log Sheets submitted by Elevate Energy showed that some of the handwritten names and addresses were difficult to read or were blank although it appears the individuals may have received CFL bulbs. There was no check box on the form for participants to confirm their status as current ComEd customers. Navigant recommends a review of the eligibility screening for participants receiving distributed CFLs. The Elevate Energy representatives at these events could ask the potential participants about their eligibility or the program could include a check box in the Distributed Products Log Sheets to ask for confirmation of eligibility from participants.

5.1.3 Review Program Marketing and Outreach Materials

Navigant verified that program marketing and outreach activities were generally consistent with the program's marketing plan. The documentation showed that Elevate Energy distributed post cards, flyers and other marketing materials during community events. The products information sheet provided adequate information about how to use smart power strips and programmable thermostats. Likewise, the Energy Savers Loan information sheet provided adequate information about financial options, loan eligibility requirements, names of loan partners and contact information. Navigant recommends the best practice of limiting the time required for the property manager to complete a participant application to a few minutes, either for a paper form or an on line form.

Navigant did not find participant survey forms or other records of any participants' satisfaction survey conducted by Elevate Energy. Limited information was available about program contractors who participated in the PY7 program. Navigant recommends a marketing strategy that closely involves trade allies in the sales process to promote the program to their service providers who own or manage multifamily complexes. This type of market strategy would emphasis the high impact contractor installed measures. Elevate Energy should regularly conduct participant surveys and include the findings in the monthly scorecard to ComEd.

5.1.4 Review of Project Files

Navigant reviewed the documentation of distributed CFLs at community events and workshops from September through December 2014 (pdf format) to verify whether information gathered by Elevate Energy from its direct install technicians, community event representatives, building maintenance staff and program contractors were accurately transferred to the tracking database. Navigant also reviewed project files of five properties which received direct installations and distributed products in April 2015. Navigant reviewed files for Distributed Products Log Sheets, Completed Upgrades Verification Forms, Power Strip Receipts, Energy Sub-Grant Agreements, Energy Reduction Invoices, and other invoices for retrofits and replacements.

5.1.4.1 Direct Installation by Building Management and Contractors

Navigant compared entries in the project files to corresponding entries in the program tracking database for accuracy and completeness. Navigant compared the monthly checklist (spreadsheet) of properties with completed installations in April 2015, and with the records in the tracking database. Navigant determined (using on site assessment reports from Elevate Energy's field technicians and feedback from property maintenance staff) that Elevate Energy delivered materials to the building managers, along with clear guidelines and a form for them to record the exact number and type of all devices installed in each unit. Upon completion, Elevate Energy committed to checking a sample of units to verify the installation

of the specified items in corresponding units. Elevate Energy collected any extra CFLs, thermostats and smart power strips and other measures and only claimed savings on the measures with documentation that the measures were installed (not on the number initially delivered). Navigant reviewed the proposals and invoices for each measure purchased and installed, and the number of buildings and tenant units that received the installations. Navigant reviewed the copies of the scopes of work and incentives grant agreements for the contractor installed measures. Navigant also reviewed the records from the Completed Upgrades Verification Forms and reviewed the post inspection results conducted by Elevate Energy.

Through this review, Navigant determined two areas that merit further examination. Although the Multi-Family Electric Program offered free direct installation of hot water efficiency measures like showerheads and aerators, none of these measures were installed in tenant units in PY7. It is not clear from the records whether property managers or tenants refused these measures or the program implementation eventually decided to not offer these measures in PY7. Navigant also found (using verification forms and sign-off sheets/Power Strip Receipts), the smart power strips were distributed to building complexes by Elevate Energy technicians placing at least one power strip in each tenant unit identified and signed off by the building management agent. Navigant did not find any record of tenant contact information except the apartment number indicated on the Power Strip Receipts. Navigant suggests that Elevate Energy collects tenant level contact information. This contact information is necessary for administering tenant satisfaction surveys and also for the program evaluation and verification process research. Also, Navigant recommends that all the property level information (including contact information details collected in the application forms) are transferred to the tracking system.

5.1.4.2 Distributed Products Events

According to the program operational procedures, attendees of community events receiving CFL bulbs are supposed to fill out the Distributed Products Log Sheets providing their name, current address, and phone number. The Distributed Products Log Sheet also required that the potential participant check a box that confirms their status as current ComEd customers. Additionally, each recipient would also need to confirm that they currently use incandescent bulbs in their home and the new CFLs would replace the incandescent bulbs within 30 days. The quantity of bulbs provided to each person is recorded (with a maximum of five bulbs per account holder or household) along with the date and location of the event.

Navigant's evaluation of the Distributed Products Log Sheets revealed several discrepancies in the implementation data collection process as described above. Navigant did not find a check box on the log sheets that confirmed the status of CFL recipients as current ComEd customers. There seemed to be lack of understanding among recipients when completing the log sheets. It was not clear whether the input field for bulb quantity or wattage is supposed to be the existing or the replacement measure. For example, from the Senior Fest event that occurred on 9/18/2014, there are several entries in the log sheet that had the bulb wattages recorded in the field for bulb quantity. In some cases the bulb quantities received were not recorded or the bulb wattages recorded (example 88W, 63W or 67W) did not reflect the program approved measure wattages. Another discrepancy Navigant saw occurred in the t Smart Strip and Retrofit Workshop on 12/11/2014. The records showed that most of the event attendees received twelve (12) CFL bulbs although the program maximum is five bulbs per account holder or household. It is not clear from the records why attendees were given more bulbs than the program allowed. Again, these

recipients did not indicate if they would be replacing their existing incandescent bulbs with the provided CFLs within 30 days.

Navigant did not reduce the program claimed total quantity of CFLs distributed or the claimed savings since we did not have sufficient information to make an informed judgment about the claimed savings. Navigant recognized the difficulty in monitoring the requirements for the distributed products program delivery channel. Navigant suggests Elevate Energy review the data collected on the Distributed Products Log Sheets and improve the QC/QA screening process for eligibility. The Elevate Energy representatives at community events should have the responsibility to ensure recipients are entering information in the log sheets including legible contact information; names, address, emails and contact phone numbers.

5.2 Review Tracking System

Navigant reviewed the tracking system's data entry process as well as the tracking system itself. The data entry process was that all information collected and recorded during the field installation were entered into a reporting tool developed by Elevate Energy and then transferred to ComEd monthly via automated transfer process. The monthly reporting tool was an Excel spreadsheet with worksheets titled "Building-unit kWh," "Detailed Measures," and "Completed Measures per Building."

The worksheet titled "Building-unit kWh" had two sections. The first section of the worksheet recorded the bi-weekly number of applications received, the number of buildings assessed associated with the applications as well as the number of tenant units associated with the assessed buildings. The second section of the worksheet contained the cumulative data at the monthly level for the same inputs above and included the cumulative kWh savings. The "Detailed Measures" worksheet tracked the type of program measures, the total measure units installed, the calculated per unit measure kWh savings and the total program kWh savings, with a percentage automatically calculated for units completed towards the target. The "Completed Measures per Building" worksheet tracked each building's address separately and included the type and quantity of measures installed, installation completion dates, and the calculated gross and net savings from each building address. Navigant verified that the program is adequately using the Illinois TRM v3.0 to calculate program savings.

However, Navigant determined that the "Building-unit kWh" worksheet which had the schedule tracking did not provide information about properties in the pipeline that were scheduled to receive installations. Also, there were no lists, names or a unique property or unit identification number for participating properties and tenant units. Hence, Navigant could not identify which specific properties or dwelling units were participating in the program although the building addresses were recorded as an identity for the buildings that participated.

Incorporating a QA/QC check into the tracking database would improve the accuracy of the participant information. This QA/QC check could include: records of the post installation inspections and property surveys performed in relation to the number of units completed, and tracking of the number of warranty issues, emergency phone calls, and complaints received and resolutions. If the program had a lead referral mechanism, then the tracking system could record the number of leads that were provided to other utility programs for verification about other opportunities.

The following is a summary of additional data fields that Elevate Energy can consider to include in the tracking system:

- Unique numeric property and dwelling unit identification numbers
- Contact names, phone numbers in addition to addresses of all participating property and dwelling units
- Pipeline projects, indicating the status of enrollment and installation schedule
- Post installation inspections findings, including customer surveys and complaint resolution notes that document key Program performance metrics
- Trade ally information and marketing and outreach performance.

5.3 Benchmarking

To conduct the best practices benchmarking assessment, Navigant compared the program implementer's practices (shown as a bullet list) with the *Best Practices Self-Benchmarking Tool*[16] from the *National Energy Efficiency Best Practices Study* (numbered items in *italic* font) for multi-family programs. For benchmarking categories, Navigant used Quality Control and Verification, and Reporting and Tracking.

5.3.1 Quality Control and Verification

- *Assure quality of product through independent testing procedures.* The Multi-Family Electric Program sourced equipment (e.g. smart power strips, CFLs, programmable thermostats, HPT8s, showerheads and faucet aerators) that meet or exceed product quality standards through various standards and certifications for such equipment.

- *Use measure product specifications in program requirements and guidelines. P*rogram requirements and guidelines outlined in the Scope of Work did not include product specifications. Contractor requirements to honor warranties and replace failed products could increase the likelihood that quality products are selected and installed properly. The program Scope of Work did not specify that the CFL replacements meet the lumen equivalent of the existing lighting.

- *Develop inspection and verification procedures during the program design phase.* The program Scope of Work outlined QA/QC site inspections procedures for verification of contractor installed measures, but similar procedures were not provided for the direct install activities and distributed products.

  Standardized inspection forms were designed and used for the contractor installed measures (Completed Upgrade Verification Form). Inspection rating was not based on numeric rating (i.e. 0-5 or 0-10 rating scale) but based on qualitative description (i.e., excellent, good, poor). Inspection forms were not developed for other direct install and distributed products.

- *Conduct quality assurance and verification inspections to improve the overall understanding of how multi-family buildings function.* Inspection goals or percentages of inspection for direct installation

[16] See the Best Practices Self-Benchmarking Tool developed for the Energy Efficiency Best Practices Project: http://www.eebestpractices.com/benchmarking.asp

activities and customer survey were not clearly defined. Post-installation QA/QC reporting did not include (or at least not provided in the tracking database) field technicians' feedback and observations about successes and challenges that occurred during the direct installation activity.

Program Scope of Work did not clearly outline safety training for all staff involved in the program, particularly driving and personal safety training for field technicians participating in direct installation activities. Also, the customer service complaints and responses were supposed to be documented and made available to ComEd program staff in a tracking log.

- *Conduct an independent audit or pre- and post-installation inspections.* Pre-inspections were conducted to confirm the property's eligibility for the direct install measures. The pre-inspection form for the distributed products required a check box to confirm status as a ComEd customer.

  Post-installation inspections and verifications were conducted by the program implementer for the PY7 program. Program staff could consider hiring an independent third-party to conduct post-installation inspections and customer surveys in future program years, as a QC/QA measure.

- *Conduct inspections in a timely manner.* The program appeared to conduct inspections of contractor installed devices in a timely manner. This inspection was indicated for all participant properties, but the success rate (percent of goal) was not readily available for evaluation review. Timely inspection or inspection rate for direct install measures and distributed products were not evaluated due to lack of information.

- *Tie staff performance to independently verified results.* It is unclear if staff performance was connected to independently verified results.

- *Assess customer satisfaction with the product through evaluation.* The program Scope of Work required the program implementer to conduct customer satisfaction surveys, e.g. leave-behind post-cards, telephone or on-line surveys, however Navigant did not find any record of activities that would have assessed customer satisfaction with the product

5.3.2 Reporting and Tracking Benchmarking

- *Define and identify key information needed to track and report early in the program development process.* Program data requirements were defined early in the program development process and were tracked in the program tracking database.

- *Base reporting and tracking system design on how information will be used and data needs unique to multi-family programs.* The tracking and reporting system design only met a portion of the program's information and data needs. Some of the characteristics of multifamily buildings were incorporated into the tracking system, others were not. For example the number of buildings or units at a given address were tracked, however the number of bedrooms per apartment, the building or apartment square footage were not tracked). The program implementer documented and retained the knowledge obtained from the multi-family building sector for ComEd, and lessons learned from PY7 will be helpful for further program refinement in future years.

- *Set reasonable and accurate expectations for energy savings and measure performance.* The program implementer met with potential participants before installations to discuss their expectations for energy and bill savings.

- *Assure that tracking systems are intuitive, straightforward, integrated and comprehensive.* The data tracking system was not comprehensive, but it was well designed and fulfilled most of the needs of program staff and evaluators. The system tracked some key performance indicators like completed building assessments and impact savings, but did not fully integrate customer responses and audit data, names and contacts of program participants, and information about the pipeline projects.

- *Develop accurate algorithms and assumptions on which to base savings estimates.* Savings algorithms were based on the Illinois statewide TRM approved for the program.

- *Use automated or otherwise regularly scheduled notification to achieve close monitoring and management of project progress.* The implementation contractor reported once a month to ComEd on all projects. These reports were not automatically generated. The reports highlighted potential and realized energy savings, summarized program key performance and application and any marketing challenges.

5.4 Overview of Findings and Recommendations

Navigant determined that the Multi-Family Electric Program's overall quality assurance and verification procedures developed by Elevate Energy met many but not all aspects of national best practices. Table 5-1 is a summary of the Multi-Family Electric Program quality assurance and verification activities in place and Navigant's recommendations for program improvement based on the review of the Scope of Work and operating procedures and the tracking system.

Table 5-1. Summary of QA/QC Activities in Place and Recommendations

QA/QC Activities in Place		Recommended Changes
Pre-Approval ▪ Eligibility and completeness checks ▪ Site Assessment ▪ Technical Review ▪ Data Tracking	→	**Pre-Approval** ▪ Review eligibility screening for event attendees receiving distributed CFLs. Include a check box in the Distributed Products Log Sheet and seek confirmation of recipient status as ComEd customers. Improve QA/QC screening of recipients to confirm recipients' commitments to install the distributed products within 30 days as required. ▪ Revise Scope of Work and operations procedure to include guideline description of sampling of tenant units for post installation inspection. Define inspection rates. ▪ Create and track unique numeric property and tenant unit identification numbers. Track pipeline projects and provide timeline progression from site assessment to measure installation and project completion. ▪ Outline safety training for all staff involved in the program, particularly driving and personal safety training for field technicians participating in direct installation activities. ▪ Track tenant level contact information including names, phone numbers and addresses. Ensure all property level information collected on the paper application are transferred to the tracking system.
Final Approval ▪ Post Inspection ▪ Safety and Complain Resolution ▪ Data Tracking	→	**Final Approval** ▪ Incorporate responses coming from post installation customer and property manager satisfaction surveys in the complaint resolution strategy. Responses with lower ratings should be reviewed and followed on up by Elevate Energy. ▪ Adequately document and report promptly to ComEd any operational challenges including late starts, survey response rates and complaint resolutions to gauge program performance. ▪ Minimize hand-written data entry. The manual process of data collection and entry into the tracking spreadsheet appears to be cumbersome, leading to the possibility of data entry errors. Consider using hand held tablets or computers to facilitate on-site data collection and document survey findings.
Marketing and Outreach ▪ Contractors and Trade Allies ▪ Referrals	→	**Marketing and Outreach** ▪ Involve Trade Allies closely in the sales and marketing strategy. Consider creating a list of program contractors and trade allies, their services offered and contact details. This should be accessible online by program participants upon referral after a technician visit. ▪ Develop a referral mechanism where participants interested in other utility programs are referred. Include in the tracking system customer leads referrals, if possible.

Source: Navigant analysis

6 Findings and Recommendations

This section summarizes the key impact and process findings and recommendations.

Verified Net Impacts & NTGR

Finding 1. Navigant used deemed net-to-gross (NTG) ratio estimates from the Illinois SAG consensus process to calculate net verified savings for the Multi-Family Electric Program . Navigant calculated 908 MWh as the total verified net energy savings. Overall, the PY7 program met 78 percent of its net energy savings planning estimate of 1,157 MWh[17] through direct installation activities, distribution of products at events in Chicago and contractor installations of incented measures.

Verified Gross Impacts and Realization Rates

Finding 2. The PY7 Multi-Family Electric Program achieved 994 MWh of verified gross energy savings and 0.13 MW of verified gross peak demand savings. The total verified gross energy savings is 60 MWh lower than the ex-ante gross savings of 1,054 MWh, which means that the verified gross savings realization rate for the program was 94 percent. The program default lookup values and ex ante savings for most measures were consistent with the TRM (v3.0), but the default savings values for programmable thermostats and LED exit signs required further review. The lighting measures had verified gross savings realization rate of 100 percent or slightly higher, but Navigant estimated 96 percent and 84 percent gross savings realization rates respectively for LED exit signs and programmable thermostats to ensure compliance with the TRM (v3.0).

Recommendation 1. The program implementer (Elevate Energy) should update the tracking database default savings assumptions to comply with the current and applicable version of the TRM. Elevate Energy should apply the heating penalty to the LED exit signs savings calculation and for other applicable measures. The savings estimate for programmable thermostats should reflect the applicable electric heating consumption input assumptions. Elevate Energy should track delta watts values for all lighting measures installed.

Tracking System Review

Finding 3. Navigant reviewed the program tracking database developed by Elevate Energy (spreadsheet format). The program tracking database captures most of the vital information that enables accurate tracking of the program key performance indicators including program's participation and claimed savings. The tracking database accurately records default savings and total savings estimated for most direct install and incentive measures, and the distributed products. However the tracking database was not updated with the revised TRM values.

Recommendation 2. Elevate Energy should update the tracking database regularly with the current TRM values. Elevate Energy should consider including additional information in the tracking system, such as: unique numeric property or unit identification numbers that could be used for referencing the property; contact names and phone numbers in addition to addresses of all participating property and dwelling units which are necessary for follow up

[17] IPA All Electric Scope of Work_Final.docx

surveys. Track post-installation inspection findings and incorporate responses coming from post installation property manager and tenant surveys in an established complaint resolution strategy.

Recommendation 3. To the extent feasible, Elevate Energy should attempt to minimize hand-written data entry since it can introduce errors into the data collection process. Navigant had difficulty reading the names and addresses as well as tallying the quantities of bulbs distributed when we reviewed samples of the Distribution Product Log Sheets provided by ComEd. It appears the program tracking system's manual process of data collection and entry into the tracking spreadsheet may be cumbersome, leading to the possibility of data entry errors. Elevate Energy should consider using hand held tablets or computers that would facilitate on-site data collection and document survey findings.

Program Participation

Finding 4. The PY7 Multi-Family Electric Program completed 84 building assessments, involving 3,647 tenant units who received direct installation of energy efficient measures and distributed products. Some properties installed additional lighting or improvement upgrades and received rebates from ComEd. The PY7 program exceeded its target for the total measure count in PY7, most of which came from direct installation of smart power strips distributed at tenant spaces. Elevate Energy distributed 4,557 measures at tenant units and during community events (937 CFL bulbs were distributed at community events and 3,620 smart power strips were distributed at residential tenant units of eligible multi-family buildings) which together comprised 77 percent of the program measure volume and 39 percent of the verified gross savings in PY7. Direct installation of smart power strips, programmable thermostats, CFL bulbs, and LED exit signs in residential tenants space or in common areas of eligible buildings constituted 12 percent of the total measure volume and 37 percent of the verified gross savings in PY7. The program also had contractors install high performance T8 lighting systems (1, 2, 3 and 4-Lamps relamp/reballast HPT8s) and performed roof cavity insulation of tenants' space. The contractor installed measures constituted 10 percent of the measure volume and 24 percent of the verified gross savings in PY7.

Recommendation 4. Although the Multi-Family Electric Program achieved successes in some areas of participation (particularly the distribution products channel), the program only met 78 percent of its PY7 net savings target. Navigant recommends that to increase program savings, the program implementation should focus on the high-impact contractor installed measures. The program should engage more with trade allies to market the program to the property managers. In addition, the program should emphasize the high impact upgrades and the various incentive levels offered by the program in its marketing and outreach campaign.

Process Findings

Finding 5. Navigant's assessment shows that the program eligibility criteria are followed for the direct install and contractor install activities. Direct installation by building management occurs only in buildings that have undergone assessments performed by Elevate Energy and were confirmed to have five or more tenant units. The program's QA/QC screening process for recipients of CFLs distributed at community events did not have the same level of compliance with the program's eligibility criteria. Navigant's examination of the Distributed

Products Log Sheets shows that there is no check box on the form for product recipients to confirm their status as current ComEd customers. Also, in some cases recipients did not consent that they will replace their existing incandescent bulbs with the CFLs within 30 days as required by the program.

Recommendation 5. Review eligibility screening for event attendees receiving distributed CFLs. Include a check box in the Distributed Products Log Sheet to seek confirmation of recipients' status as ComEd customers. Improve QA/QC screening of recipients to confirm the recipients' commitments to install the distributed products within 30 days as the log sheet required. Revise Scope of Work and operations procedures to include guidelines describing sampling of tenant units for post installation inspection. Define inspection rates (set a goal) for post inspection of direct install and distributed products.

Process Findings

Finding 6. Navigant's assessment shows that the program eligibility criteria are followed for the direct install and contractor install activities. Direct installation by building management occurs only in buildings that have undergone assessments performed by Elevate Energy and were confirmed to have five or more tenant units. The program's QA/QC screening process for recipients of CFLs distributed at community events did not have the same level of compliance with the program's eligibility criteria. Navigant's examination of the Distributed Products Log Sheets shows that there is no check box on the form for product recipients to confirm their status as current ComEd customers. Also, in some cases recipients did not consent that they will replace their existing incandescent bulbs with the CFLs within 30 days as required by the program.

Recommendation 6. Review eligibility screening for event attendees receiving distributed CFLs. Include a check box in the Distributed Products Log Sheet to seek confirmation of recipient status as ComEd customers. Improve QA/QC screening of recipients to confirm the recipients' commitments to install the distributed products within 30 days as the log sheet required. Revise Scope of Work and operations procedures to include guideline description of sampling of tenant units for post installation inspection. Define inspection rates (set a goal) for post inspection of direct install and distributed products.

Finding 7. Navigant's assessment shows that the program requirements and guidelines outlined in the Scope of Work do not include product specifications. The program Scope of Work does not specify whether CFL replacements are to meet the lumen equivalent of the existing lighting.

Recommendation 7. Contractor requirements to honor warranties and replace failed products could increase the likelihood that quality products are selected and installed properly. The program Scope of Work should clarify whether CFL replacements are to meet the lumen equivalent of the existing lighting.

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 (Central Time Zone weekdays from 1 to 5 p.m. for summer and between 6am-8am and 5pm-7pm for winter).
- IEe = Energy Interactive Effects
- IEd = Demand Interactive Effects

Table 7-1 presents the measure level gross impact findings.

Table 7-1. Measure Level Gross Impact Results

Measure	Ex Ante Gross Savings (MWh)	Verified Gross Energy Savings (MWh)	Gross Energy RR	Notes on RR	Recommendation	Priority
Common Area Incandescent to CFL (750-1049 lumens)	44	45	102%	Using TRM (v3.0) delta watts and assumptions produced more savings	Track delta watts values in tracking system. Check for compliance with TRM	Low
LED Exit Sign	19	18	96%	Included heating penalty in savings calculation	Account for heating penalty for the electric heated buildings as specified in the TRM (v3.0)	High
Distributed Incandescent to CFL (750-1049 lumens)	10	10	100%	No action	NA	
7-plug Smart Strip Distr.	373	373	100%	No action	NA	
7-plug Smart Strip D.I	2	2	100%	No action	NA	
Programmable Thermostat	369	308	84%	Used electric heating consumption input assumption from the TRM (v3.0) instead of TRM (v2.0) used for ex ante.	Update tracking database to use current applicable electric heating consumption input assumption	High
1,2,3,4-Lamps Relamp/Reballast HPT8	202	203	101%	Using TRM (v3.0) delta watts and assumptions produced more savings	Track delta watts values in tracking system. Check for compliance with TRM	Low
Roof Cavity Insulation (sq.ft)	35	35	100%	No action	NA	

Source: Navigant Team Analysis

7.2 PJM Data and Findings

Multi-Family Electric Program (MFEP)
Program Year 7 (PY7) – June 1, 2014 – May 31, 2015

Ex-Post Gross Peak Demand (MW) Savings
The PJM summer ex-post gross coincident peak demand savings was 0.13 MW.
The PJM winter ex-post gross coincident peak demand savings was 0.11MW.

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

(a) PY7 program bulbs and hot water measures installed
(b) Non-coincident kW reduction
(c) kW of baseline equipment and replacement equipment
(d) Summer PJM coincidence factor (CF) defined by weekday's 1-5pm Central Prevailing Time Zone, between June 1 and August 31, and non-holidays
(e) Winter PJM coincidence factor (CF) defined by weekdays between 6am-8am and 5pm-7pm Central Prevailing Time Zone, between January 1 and February 28, and non-holidays
(f) Demand interactive effect
(g) kW of baseline equipment during Performance Hours
(h) kW of replacement equipment during Performance Hours
(i) Installation Rate

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 * Installation Rate*

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 coincident peak demand savings for both baseline and post retrofit conditions are defined as the average demand kW savings for the 1 PM CPT to 5 PM CPT non-holiday weekday time period for summer, and 6 AM CPT to 8 AM CPT and 5 PM CPT to 7 PM CPT non-holiday weekday time period for winter.[18] If this energy savings measure is determined to have weather dependency then the summer peak kW savings are based on the zonal weighted temperature humidity index (WTHI) standard, and the winter peak kW savings are based on the zonal wind speed-adjusted temperature (WWP) standards posted by PJM (there is also PJM Zonal Winter Weather Standards similar to summer WTHI).[19] The zonal WTHI and WWP are the mean of the zonal WTHI values or WWP values on the days in which PJM peak load occurred in the past sixteen years (1998-2014). This mean ComEd WTHI value is 81.6 demand savings for summer is the difference in kW between the baseline and post retrofit conditions. Similarly,

[18] The Winter Weather Standard is the dry bulb temperature adjusted (by 0.5 °F) for wind speed above 10 mph. The measurements were for Hour Ending 19:00 on RTO peak days."
[19] This is in accordance with the PJM manual 18, PJM Capacity Market, effective October 16, 2015.

the ComEd WWP value is 14.5 demand savings for winter is the difference in kW between the baseline and post retrofit conditions.

The IL TRM doesn't list winter peak coincidence factors and winter peak savings. ComEd did not track winter peak savings in PY7. Navigant determined the winter peak estimates for lighting measures using the winter peak coincidence factors from the Connecticut TRM. Winter peak coincidence factors for other non-lighting residential measures were sourced from the Efficiency Maine Multifamily TRM.[20] Navigant determined in the absence of reliable metered data in PY7, the Connecticut and Maine TRMs appears to be reliable sources for referencing winter peak coincidence factors. The IL TRM references the Connecticut TRM in several instances for peak demand calculations.

ComEd's Multi-Family Electric Program tracking database was not setup to track gross coincident peak demand savings. The ex-post gross coincident peak demand savings for the program year PY7 was 0.13 MW for summer and 0.11MW for winter.

[20] Winter peak coincidence factors for residential lighting were taken from Connecticut TRM (Connecticut TRM (2013 PSD_ProgramSavingsDocumentation-Final110112). Winter peak coincidence factors for other non-lighting residential measures were sourced from the Efficiency Maine Multifamily TRM (EMT-TRM_MEP_v2016_1.pdf).