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Matrix - K-12 Private Schools and Colleges Program Evaluation Report

FINAL
Energy Efficiency / Demand Response Plan:
Plan Year 8 (PY8)
(6/1/2015-5/31/2016)

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Matrix - K-12 Private Schools and Colleges Program Evaluation Report

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E. EXECUTIVE SUMMARY

This report presents a summary of the findings and results from the impact and limited process evaluation of the PY8 [1] Matrix - K-12 Private Schools and Colleges (Matrix-Schools) program. The PY8 Matrix-Schools program focused on assisting private educational facility customers (which included private pre-schools and K-12 schools) implement both low-cost/no-cost and capital intensive measures. This program was designed for private educational facility customers with demand less than 100 kW. All targeted customers taking delivery service from ComEd were eligible for the program regardless of their choice of supplier. Matrix-Schools was implemented by Matrix Energy Services (Matrix). Matrix employed various marketing channels such as mailings, follow-up calls, website referrals, face-to-face visits, and scheduled meetings with decision makers to recruit facility managers and school administrators.

Eligible measures included lighting such as T8, T5, LED and CFLs and LED exit signs. Cost-effective capital measures were identified through energy audits. The PY8 net savings target was 5,545 MWh with an anticipated participation of 85 schools.

E.1. Program Savings

The table below summarizes the electricity savings from the PY8 Matrix-Schools program.

Table E-1. PY8 Total Program Electric Savings

Savings Category	Energy Savings (MWh)	Demand Savings (MW)	Peak Demand Savings (MW)
Ex Ante Gross Savings	227	(Not Tracked)	0.017
Verified Gross Savings	191	0.065	0.041
Verified Net Savings	181	0.062	0.039

Source: ComEd tracking data and Navigant analysis.

[1] The PY8 program year began June 1, 2015 and ended May 31, 2016.

E.2. Program Savings by Measure Category

Table E-2. PY8 Program Results by Measure Category

Category	Ex Ante Gross Energy Savings (MWh)	Ex Ante Gross Peak Demand Savings (MW)	Verified Gross Energy Savings (MWh)	Verified Gross Peak Demand Savings (MW)	Verified Gross Energy Realization Rate (%)	NTGR†	Verified Net Energy Savings (MWh)	Verified Net Peak Demand Savings (MW)
Incandescent to LED	26.7	0.0018	23.6	0.0023	88%	0.95	22.4	0.0022
CFL to LED	2.6	0.00016	2.0	0.00021	90%	0.95	1.9	0.00020
Linear fluorescent to high efficiency linear fluorescent	178.9	0.015	147.8	0.036	83%	0.95	140.4	0.034
LED exit signs	19.5	0.0005	17.6	0.0022	90%	0.95	16.7	0.0021
Total	227‡	0.017	191	0.041‡	84%	0.95	181	0.039‡

Source: ComEd tracking data and Navigant analysis.
† A deemed value. Source: "ComEd_NTG_History_and_PY8_Recommendations.xls", found on the IL SAG web site: http://ilsag.info/net-to-gross-framework.html.
‡Numbers do not sum exactly due to rounding.

E.3. Program Volumetric Detail

The program had nine participants in PY8 and installed 718 measures as shown in the following table.

Table E-3. PY8 Volumetric Findings by Measure

Category	Units
Schools with Installed Measures	9
Total LED Bulbs Installed	157
Total T-8 Fixtures Installed	513
Total LED Exit Signs installed	48
Total Measures Installed	718

Source: ComEd tracking data and Navigant analysis.

E.4. Results Summary

The following table summarizes the key metrics from PY8.

Table E-4. PY8 Results Summary

Participation	Units	PY8
Verified Net Savings	MWh	181
Verified Net Peak Demand Reduction	MW	0.039
Verified Gross Savings	MWh	191
Verified Gross Peak Demand Reduction	MW	0.041
Program Energy Realization Rate	%	84
Program NTG Ratio†	#	0.95
Total Measures Installed	#	718
Customers Touched	#	9

Source: ComEd tracking data and Navigant analysis.
† A deemed value. Source: "ComEd_NTG_History_and_PY8_Recommendations.xls", found on the IL SAG web site: http://ilsag.info/net-to-gross-framework.html. Accessed: September 30, 2016.

E.5. Findings and Recommendations

The following provides insight into key program findings and recommendations.[2]

Program Volumetric Findings.

Finding 1. Nine schools participated in the program. The PY8 target number of participating schools was 85—the program met ten percent of its participation target. In PY9, the implementer is "re-launching" the program with new marketing materials, revised outreach strategy and new staff based in Chicago.

Verified Net Impacts

Finding 2. The PY8 Matrix-Schools' program net savings target was 5,545 net MWh. The PY8 net verified energy savings were estimated to be 181 MWh—the program met three percent of the net energy savings target.

Finding 3. Replacing linear fluorescents with high-efficiency linear fluorescents comprised the majority of the units installed, and a similar proportion of the resulting energy savings, but a much larger proportion of the peak demand reduction. Incandescent to LED upgrades represented a small portion of installations, and an even smaller percentage of energy saving.

Finding 4. CFL to LED upgrades represented eight percent of unit installations, but only one percent of total program energy savings and only ½ of a percent of demand savings. In addition, the CFL to LED measures often included a reduction in light output. A matched light output would yield reduced energy savings.

Recommendation 1. We recommend checking lumen levels at the task surface to determine if an area is "over lit" and warrants replacement lighting with lower lumens.

[2] Numbering on the findings and recommendations in this section are the same as the more complete list found in the Findings and Recommendations section of the evaluation report for ease of reference between each section.

1. INTRODUCTION

1.1 Program Description

The PY8 [3] Matrix - K-12 Private Schools and Colleges (Matrix-Schools) program focused on assisting private educational facility customers (which included private pre-schools and K-12 schools) implement both low-cost/no-cost and capital intensive measures. This program was designed for private educational facility customers with demand less than 100 kW. All targeted customers taking delivery service from ComEd were eligible for the program regardless of their choice of supplier. Matrix-Schools was implemented by Matrix Energy Services (Matrix). Matrix employed various marketing channels such as mailings, follow-up calls, website referrals, face-to-face visits, and scheduled meetings with decision makers to recruit facility managers and school administrators.

Eligible measures included lighting such as T8, T5, LED and CFLs and LED exit signs. Cost-effective capital measures were identified through energy audits. The PY8 net savings target was 5,545 MWh with an anticipated participation of 85 schools.

1.2 Evaluation Objectives

The evaluation team identified the following key researchable questions for PY8.

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

1. What caused the program's low participation in PY8?
2. What are the changes for PY9?

[3] The PY8 program year began June 1, 2015 and ended May 31, 2016.

2. EVALUATION APPROACH

We prepared a two-year evaluation plan to identify tasks by year on a preliminary basis (Table 2-1). Final activities will be determined annually to reflect current program conditions.

Table 2-1. Evaluation Plan Summary

Activity	PY8	PY9
Gross Impact Approach	Engineering File Review/Tracking Data Review	Engineering File Review/Tracking Data Review
Verified Net Impact Approach	Deemed Value	Deemed Value
Program Manager and Implementer Interviews/ Review Materials	Yes	Yes

2.1 Overview of Data Collection Activities

The core data collection activities included engineering reviews of the installed projects, and in depth interviews with the program manager and implementer staff. The full set of data collection activities is shown in the following tables.

Table 2-2. Primary Data Collection Activities

What	Who	Target Completes	Completes Achieved	When	Comments
Engineering Review	Participating Customers	15	9	October 2016	Only nine schools participated
In Depth Interviews	Program Manager/Implementer Staff	4	2	October 2016	

Table 2-3. Additional Resources

Reference Source	Application
Illinois Technical Reference Manual v4.0	Elementary and High Schools
Illinois Technical Reference Manual v5.0	Daycare/Preschool/Kindergarten†

†IL TRM v5.0 was used for these schools because this category of schools was not included in v4.0 of the TRM.

2.2 Verified Savings Parameters

Verified gross and net savings (energy and coincident peak demand) resulting from the PY8 program were calculated using the following algorithms as defined in the Section 4.5 of IL TRM v4.0:

CFLs

$$\Delta kWh = ((WattsBase-WattsEE)/1000) * ISR * Hours * WHFe$$

$$\Delta kW= ((WattsBase-WattsEE)/1000) * ISR * WHFd * CF$$

Where:

WattsBase = Actual (if retrofit measure) or based on lumens of CFL bulb and program year installed.

WattsEE = Actual wattage of CFL purchased or installed.

ISR = In Service Rate or the percentage of units rebated that get installed.

Hours = Average hours of use per year are provided in Reference Table in Section 4.5.

WHFe = Waste heat factor for energy to account for cooling energy savings from efficient lighting are provided below for each building type in Reference Table in Section 4.5. If unknown, use the Miscellaneous value.

WHFd = Waste heat factor for demand to account for cooling savings from efficient lighting in cooled buildings is provided in the Reference Table in Section 4.5. If unknown, use the Miscellaneous value.

CF = Summer Peak Coincidence Factor for measure is provided in the Reference Table in Section 4.5. If unknown, use the Miscellaneous value.

LED Exit Signs

ΔkWh = ((WattsBase - WattsEE) / 1000) * Hours * WHFe

ΔkW = ((WattsBase - WattsEE) / 1000) * WHFd * CF

Where:

WattsBase = Actual wattage

WattsEE = Actual wattage

HOURS = Annual operating hours, 8766

WHFe = Waste heat factor for energy to account for cooling energy savings from efficient lighting are provided for each building type in the Referecne Table in Section 4.5. If unknown, use the Miscellaneous value.

WHFd= Waste heat factor for demand to account for cooling savings from efficient lighting in cooled buildings is provided in the Reference Table in Section 4.5. If unknown, use the Miscellaneous value.

CF = Summer Peak Coincidence Factor for measure, 1.0

LED fixtures

ΔkWh = ((WattsBase - WattsEE)/1000) * Hours *WHFe*ISR

ΔkW = ((WattsBase - WattsEE)/1000) * ISR * WHFd * CF

Where:

WattsBase = Input wattage of the existing system. Reference the “LED New and Baseline Assumptions” table for default values in the TRM.

WattsEE = Actual wattage of LED purchased / installed. For ENERGY STAR rated lamps lumen equivalence values should be used.

Omnidirectional Lamps - ENERGY STAR Minimum Luminous Efficacy = 50Lm/W for <10W lamps and 55Lm/W for >=10W lamps.

ISR = In Service Rate or the percentage of units rebated that get installed.

Hours = Average hours of use per year are provided in Reference Table in Section 4.5.

WHFe = Waste heat factor for energy to account for cooling energy savings from efficient lighting are provided below for each building type in Reference Table in Section 4.5. If unknown, use the Miscellaneous value.

WHFd = Waste heat factor for demand to account for cooling savings from efficient lighting in cooled buildings is provided in the Reference Table in Section 4.5. If unknown, use the Miscellaneous value.

CF = Summer Peak Coincidence Factor for measure is provided in the Reference Table in Section 4.5. If unknown, use the Miscellaneous value.

Energy Efficient Fluorescent Lighting

ΔkWh = ((WattsBase - WattsEE)/1000) * Hours * WHFe * ISR

ΔkW = ((WattsBase - WattsEE)/1000) * WHFd*CF*ISR

Where:

WattsBase = Input wattage of the existing system which depends on the baseline fixture configuration (number and type of lamp) and ballast factor (if applicable) and number of fixtures.

WattsEE = New input wattage of EE fixture which depends on new fixture configuration (number of lamps) and ballast factor (if applicable) and number of fixtures.

ISR = In Service Rate or the percentage of units rebated that get installed.

Hours = Average hours of use per year are provided in Reference Table in Section 4.5.

WHFe = Waste heat factor for energy to account for cooling energy savings from efficient lighting are provided below for each building type in Reference Table in Section 4.5. If unknown, use the Miscellaneous value.

WHFd = Waste heat factor for demand to account for cooling savings from efficient lighting in cooled buildings is provided in the Reference Table in Section 4.5. If unknown, use the Miscellaneous value.

CF = Summer Peak Coincidence Factor for measure is provided in the Reference Table in Section 4.5. If unknown, use the Miscellaneous value.

The table below gives a list of deemed and evaluated parameters used for ex-post analysis.

Table 2-4. Verified Savings Parameter Data Sources

Gross Savings Input Parameter	Deemed or Evaluated	Data Source
Waste Heat Factors for Energy & Demand (WHF_e & WHF_d)	Deemed	IL TRM
Hours of Use (HOU) [by measure type and school type]	Deemed	IL TRM
Coincidence Factors	Deemed	IL TRM
Realization Rate	Evaluated	Navigant Analysis
NTGR	Deemed	IL SAG

2.2.1 Verified Gross Program Savings Analysis Approach

The program key gross impact evaluation activities for PY8 were based on (1) reviewing the tracking system to determine whether all fields were appropriately populated, (2) reviewing measure algorithms and savings values in the tracking system to ensure that the TRM v4.0 and TRM v5.0 were appropriately applied based on the building type, and (3) cross-checking measure totals and savings recorded in the tracking database.

TRM v4.0 does not define a building type for childcare/preschools. TRM v5.0 includes assumptions for childcare/preschools. Since the Technical Advisory Committee (TAC) approved using assumptions in the TRM v5.0 for childcare/preschools, Navigant used the parameter values in TRM v5.0 to estimate savings for childcare/preschools. For Elementary and High Schools, Navigant used the parameter values from TRM v4.0.

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 PY8, the NTGR estimates used to calculate the net verified savings were defined by SAG.[4]

2.3 Process Evaluation

Navigant conducted a limited process evaluation for this program to try to determine the cause of the low participation in PY8, as well as the changes for PY9, via a telephone interview with the implementation contractor's program manager and technical managers.[5]

[4] A deemed value. Source: "ComEd_NTG_History_and_PY8_Recommendations.xls", found on the IL SAG web site: http://ilsag.info/net-to-gross-framework.html.
[5] Telephone interview with Matrix program manager and technical lead, October 14, 2016.

3. GROSS IMPACT EVALUATION

3.1 Program Volumetric Findings

For the Matrix-Schools program, there were nine schools with 718 installed measures reported in the PY8 tracking system.

Table 3-1. PY8 Volumetric Findings Detail

Participation	
Participants	9
Installed Measures	718
Average Measures / Project	80

Source: ComEd tracking data and Navigant analysis.

As shown in the following table, replacing linear fluorescents with high-efficiency linear fluorescents represented 71 percent of the units installed, and a similar proportion of the resulting energy savings (78 percent), but a larger portion of the peak demand reduction (89 percent). Incandescent to LED upgrades represented 14 percent of installations, and a smaller percentage of energy savings (12 percent). LED exit signs represented seven percent of total installations and nine percent of the total energy savings.

CFL to LED upgrades represented eight percent of unit installations, but only one percent of total program energy savings and only ½ of a percent of demand savings. In addition, the CFL to LED measures often included a reduction in light output. A matched light output would yield reduced energy savings.

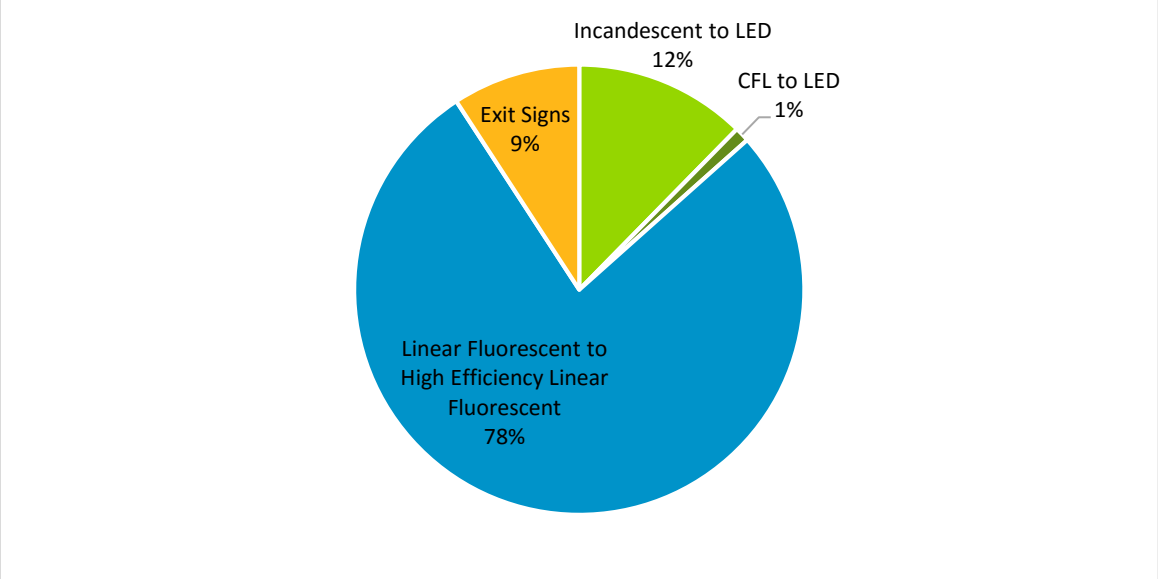
Table 3-2. PY8 Verified Volumetric Findings Detail by Measure Type

Participation	Number of Units Installed	% of Total Units Installed	% of Total Energy Savings	% of Total Peak Demand Savings
Linear fluorescent to high efficiency fluorescents	513	71%	78%	89%
Incandescent to LED	101	14%	12%	6%
LED exit signs	48	7%	9%	5%
CFL to LED	56	8%	1.1%	0.5%

Source: ComEd tracking data and Navigant analysis.

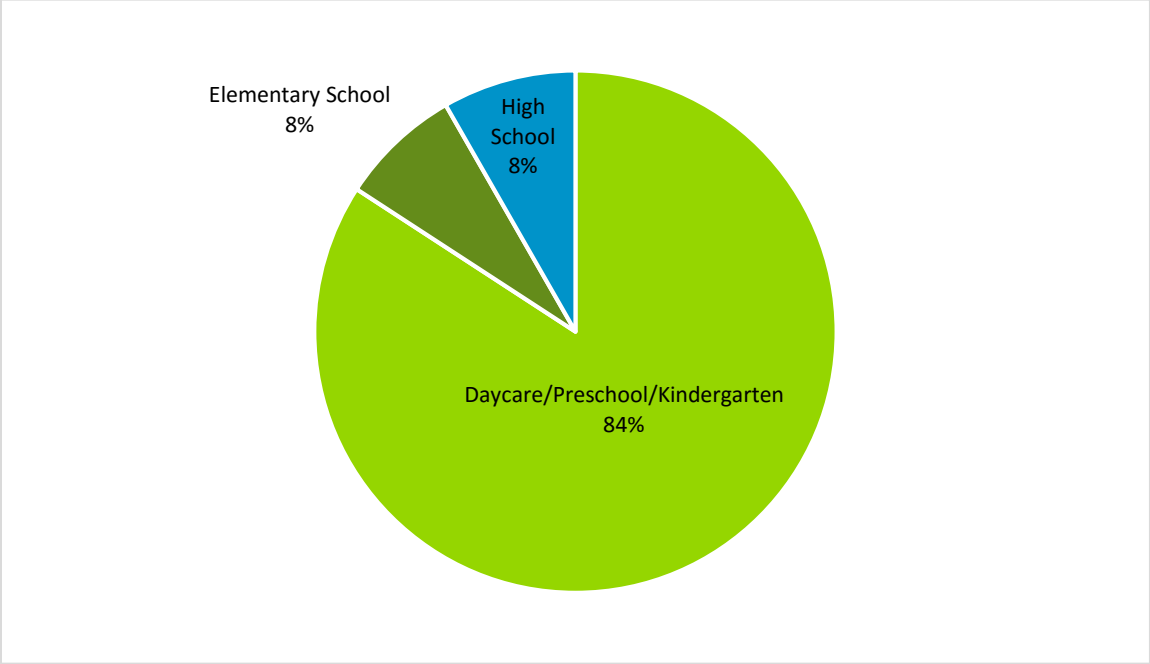
As shown in the following figures, the majority of the savings were from replacements of linear fluorescent lamps with high efficiency linear fluorescent lamps. Also the majority of the savings were from installations in childcare centers, preschools, and kindergartens.

Figure 3-1. Verified Gross Energy Savings by Measure Type



Source: Navigant analysis

Figure 3-2. Verified Gross Energy Savings by School Type



Source: Navigant analysis

3.2 Tracking System Review

Navigant received two sets of tracking data for the program that comprised of measures installed in the months of April[6] and May,[7] 2016. The spreadsheet tracking system adequately captures the salient

[6] Matrix_Schools_April_2016.xlsx
[7] Matrix_Schools_May_2016.xlsx

information needed to implement the program and verify the resulting savings. The tracking data includes school type, measure location, and input parameters used for each measure.

The tracking data indicates total ex ante gross energy and peak demand savings of 227 MWh and 0.0172 MW respectively. Using the deemed NTG value of 0.95, the ex ante net energy and peak demand savings are 216 MWh and 0.0164 MW respectively. The impact analysis of the tracking data yielded verified total gross energy and peak demand savings of 191 MWh and 0.0410 MW respectively, and net energy and peak demand savings of 181 MWh and 0.0389 MW. The realization rates resulting from the impact analysis were 84 percent for energy savings and 238 percent for peak demand savings.

The energy and demand realization rate differs from 100 percent due to changes in HOU, WHFe, WHFd, CF and baseline and energy efficient wattage values found through evaluation. Since Daycare/ Preschool/Kindergarten building type is not mentioned in TRM v4.0, Navigant used the parameter assumptions from the Section 4.5 of TRM v5.0 per TAC's approval to calculate the ex-post savings. Navigant used TRM to verify the wattages of baseline and energy efficient fixtures. The tables below shows the reported (ex-ante) and the TRM (ex-post) values used for evaluation.

Table 3-3. Reported and Verified Wattages for Linear Fluorescent Fixtures

Measure	Reported Wattages (W)	TRM Wattages (W)
FL-T12, 4' 4 Lamp, 40 Watt	188	182
FL-T8, 4' 3 Lamp, 25 Watt	65	72
FL-T8, 4' 4 Lamp, 32 Watt	112	114
FL-T8, 4' 2 Lamp, 25 Watt	43	49
FL-T8, 4' 4 Lamp, 25 Watt	85	94
FL-T8, 4' 3 Lamp, 32 Watt	89	88

Source: ComEd Tracking Data and IL TRM v4.0

Table 3-4. Summary of Ex Ante and TRM Input Parameters for School Types

School/Measure Type	Ex Ante Screw-in HOU	Ex Ante Fixture HOU	Ex Ante WHF_e	Ex Ante WHF_d	Ex Ante CF	IL TRM Screw-in HOU	IL TRM Fixture HOU	IL TRM WHF_e	IL TRM WHF_d	IL TRM CF
Childcare / Preschool / Kindergarten†	2,161	2,814	1.31	1.4	0.22	2,860	2,860	1.17	1.29	0.72
Elementary School	2,118	2,422	1.31	1.4	0.22	2,118	2,422	1.31	1.4	0.22
High School	2,327	4,311	1.25	1.44	0.22	2,327	4,311	1.25	1.44	0.22
Exterior	4,903	4,903	1.31	1.4	0.22	4,903	4,903	1	1	0
LED Exit Signs	8,760	8,760	1.31	1.4	0.22	8,766	8,766	‡	‡	1

Source: Tracking Data and IL TRM v4.0

† IL TRM v4.0 did not include parameters for the Childcare / Preschool / Kindergarten school set. For these Navigant used the TRM v5.0 data.

‡ LED exit signs were only installed in Childcare / Preschool / Kindergarten and Elementary Schools. The implementer used the WHF_e and WHF_d meant for Elementary Schools for Childcare / Preschool / Kindergartens as well. The TRM provides different WHF_e and WHF_d for different school types. Navigant used the appropriate school type for each LED Exit Sign's installation.

Additionally, the CFL to LED and linear fluorescent upgrade measures did not reflect lumen-to-lumen pre and post parity. The ex-ante calculations used a CF of 0.22 (which is the value for elementary schools) for all the measures in the tracking system. Navigant used the CF values from the TRM v4.0 and TRM v5.0 based on different building types to estimate the ex-post savings.

3.3 Gross Program Impact Parameter Estimates

Navigant used IL TRM v4.0 and TRM v5.0 algorithms based on building types to estimate the energy and demand savings. Per TAC's approval, we used the assumptions in TRM v5.0 to estimate savings for Childcare/Preschools since parameter assumptions for Childcare/Preschools are not available in TRM v4.0. For Elementary and High Schools, Navigant used the parameter values from TRM v4.0. Navigant verified gross energy and coincident peak demand resulting from the program using the algorithms mentioned in Section 2.2 as defined by the Illinois TRM versions 4.0 and 5.0[8].

3.3.1 Input Parameter Type

Table 3-5. Verified Gross Savings Parameters

Gross Savings Input Parameters	Value	Deemed † or Evaluated?
Quantity	Unit	Evaluated
Measure Type and Eligibility	Unit	Evaluated
Gross Savings per Unit, Deemed Measures	kWh	Deemed
Gross Demand Reduction per Unit, Deemed Measures	kW	Deemed
Verified Realization Rate on Ex-Ante Gross Savings (Lighting)	Percent	Evaluated

†State of Illinois Technical Reference Manual version 4.0 from http://www.ilsag.info/technical-reference-manual.html.

3.3.2 Deemed Values by School Type

The following table summarizes parameter values by school type.

Table 3-6. Verified Gross Savings Algorithm Input Parameters

School/Measure Type	Fixture HOU	Screw-based Bulb HOU	WHF_e	WHF_d	CF
Childcare Center/ Preschool/ Kindergarten†	2,860	2,860	1.17	1.29	0.72
Elementary School‡	2,422	2,118	1.31	1.40	0.22
High School‡	4,311	2,327	1.25	1.44	0.22
Exterior‡	4,903	4,903	1.00	1.00	0.00
LED exit signs‡	8,766	NA	§	§	1.00

† State of Illinois Technical Reference Manual version 5.0 from http://www.ilsag.info/technical-reference-manual.html.
‡ State of Illinois Technical Reference Manual version 4.0 from http://www.ilsag.info/technical-reference-manual.html.
§Dependent on School type.

[8] Source: http://www.ilsag.info/technical-reference-manual.html

Hours of use (HOU): The implementer used custom values of HOU for childcare centers/preschools that Navigant estimated through online research during the PY6 evaluation of the Wildan Sustainable Schools program[9] since TRM v4.0 does not define a building type for childcare centers/preschools. TRM v5.0 provides assumptions for childcare centers/preschools. Since the Technical Advisory Committee (TAC) approved using assumptions in the TRM v5.0 for childcare/preschools, Navigant used the parameter values in TRM v5.0 to estimate savings for childcare/preschools. For Elementary and High Schools, Navigant used the parameter values from TRM v4.0.

Waste Heat Factors for Energy and Demand (WHF_e and WHF_d): For childcare/preschools, TRM v5.0 was used to estimate energy and demand savings as approved by TAC for PY8. The WHF_e and WHF_d values from TRM v4.0 were used to estimate savings for Elementary and High schools.

3.4 Verified Gross Program Impact Results

The resulting total program verified gross savings is 227 MWh and 0.017 peak MW as shown in the following tables, both by school type and by measure type.

Table 3-7. PY8 Gross Impact Savings Estimates by School Category

	Gross Energy Savings (MWh)	Gross Peak Demand Savings (MW)
Childcare / Preschool		
Ex-Ante Gross Savings	192.8	0.01477
Verified Gross Savings	160.8	0.03873
Verified Gross Realization Rate	83%	262%
Elementary Schools		
Ex-Ante Gross Savings	15.6	0.00131
Verified Gross Savings	14.4	0.00128
Verified Gross Realization Rate	92%	98%
High Schools		
Ex-Ante Gross Savings	18.9	0.00115
Verified Gross Savings	15.8	0.00097
Verified Gross Realization Rate	84%	84%
Total		
Ex-Ante Gross Savings	227.3	0.01723
Verified Gross Savings	191.0	0.04098
Verified Gross Realization Rate	84%	238%

Source: Navigant analysis.

[9]http://ilsagfiles.org/SAG_files/Evaluation_Documents/ComEd/ComEd%20EPY6%20Evaluation%20Reports/ComEd_Sustainable_Schools_PY6_Evaluation_Report_2015-01-22_Final.pdf.

Table 3-8. PY8 Program Results by Measure Type

Savings Category	Ex Ante Gross Energy Savings (kWh)	Ex Ante Gross Peak Demand Savings (kW)	Verified Gross Energy Savings (kWh)	Verified Gross Peak Demand Savings (kW)	Verified Gross Energy RR (%)	Net to Gross Ratio†	Verified Net Energy Savings (kWh)	Verified Net Peak Demand Savings (kW)
Incandescent to LED	26,685	1.832	23,585	2.2951	88%	0.95	22,406	2.1803
CFL to LED	2,257	0.1639	2,027.7	0.2073	90%	0.95	1,926	0.1969
Linear fluorescent to high efficiency linear fluorescent	178,930	14.710	147,784	36.2698	83%	0.95	140,395	34.4563
LED exit signs	19,463	0.5223	17,566	2.2032	90%	0.95	16,688	2.0930
Total	227,334	17.228	190,963	40.975	84%	0.95	181,415	38.927

Source: ComEd tracking data and Navigant analysis.
† A deemed value. Source: "ComEd_NTG_History_and_PY8_Recommendations.xls", found on the IL SAG web site: http://ilsag.info/net-to-gross-framework.html.

3.5 Program Savings by Measure

Table 3-9. PY8 Program Results by Measure

Savings Category	Ex Ante Gross Savings (kWh)	Ex Ante Gross Peak Demand Savings (kW)	Verified Gross Savings (kWh)	Verified Gross Peak Demand Savings (kW)	Verified Gross Energy RR (%)	Verified Net Savings (kWh)†	Verified Net Demand Savings (kW)
CFL 14W to 6.5W LED	170	0.018	201	0.056	118%	191	0.053
CFL 15W to 9W LED	319	0.035	344	0.065	108%	327	0.062
CFL 19W to 9W LED	233	0.025	233	0.025	100%	221	0.024
CFL 23W to 12W LED	187	0.020	221	0.061	118%	210	0.058
CFL 26W to 12W LED	1,349	0.065	1,030	0.000	76%	978	0.000
Exit 30W to 3.8W LED	601	0.016	537	0.068	89%	511	0.064
Exit 40W to 3.8W LED	11,632	0.312	10,396	1.308	89%	9,876	1.242
Exit 40W to 5W LED	7,230	0.194	6,633	0.828	92%	6,302	0.787
Inc 100W BR to 17W LED	2,666	0.128	2,035	0.000	76%	1,933	0.000
Inc 60W to 8W LED	1,178	0.128	1,392	0.386	118%	1,322	0.367
Inc 60W to 9W LED	5,309	0.583	5,729	1.090	108%	5,443	1.035
Inc 75W BR to 11W LED	4,111	0.197	3,138	0.000	76%	2,981	0.000
Inc 75W BR to 12W LED	357	0.039	422	0.117	118%	401	0.111
Inc 75W PAR to 12W LED	13,066	0.757	10,870	0.702	83%	10,326	0.667
T12 4' 2x34W to T8 4' 2x25W	822	0.080	689	0.067	84%	654	0.063
T12 4' 2x40W to T8 4' 2x25W	1,837	0.113	1,606	0.127	87%	1,525	0.121
T12 4' 4x34W to T8 4' 2x25W	7,053	0.685	6,691	0.650	95%	6,357	0.617
T12 4' 4x34W to T8 4' 3x25W	301	0.029	279	0.027	93%	265	0.026
T12 4' 4x40W to T8 4' 2x25W	3,742	0.313	3,115	0.865	83%	2,960	0.821
T12 4' 4x40W to T8 4' 3x25W	129,897	10.664	107,251	27.565	83%	101,888	26.187
T12 8' 2x75W to T8 4' 2x25W	2,396	0.200	2,075	0.576	87%	1,971	0.547

Savings Category	Ex Ante Gross Savings (kWh)	Ex Ante Gross Peak Demand Savings (kW)	Verified Gross Savings (kWh)	Verified Gross Peak Demand Savings (kW)	Verified Gross Energy RR (%)	Verified Net Savings (kWh)†	Verified Net Demand Savings (kW)
T12 8' 2x75W to T8 4' 4x25W	5,424	0.461	4,467	1.149	82%	4,243	1.092
T12 8' 4x75W to T8 4' 4x25W	962	0.080	843	0.234	88%	801	0.222
T8 4' 2x32W to 4' 2x25W	236	0.020	134	0.037	57%	127	0.035
T8 4' 3x32W to 4' 2x25W	4,070	0.340	3,132	0.869	77%	2,975	0.826
T8 4' 3x32W to 4' 3x25W	5,173	0.304	3,449	0.203	67%	3,276	0.193
T8 4' 4x32W to 4' 3x25W	15,247	1.274	12,368	3.433	81%	11,749	3.261
T8 4' 4x32W to 4' 3x28W	1,769	0.148	1,686	0.468	95%	1,602	0.445
Total	227,334	17.228	190,963	40.975		181,415	38.927

Source: ComEd tracking data and Navigant analysis.

† A deemed value. Source: "ComEd_NTG_History_and_PY8_Recommendations.xls", found on the IL SAG web site: http://ilsag.info/net-to-gross-framework.html.

4. NET IMPACT EVALUATION

SAG determined[10] that the NTG value for this program, 0.95, should be deemed prospectively and used to calculate verified net savings. The table below shows the PY8 verified net savings.

Table 4-1. PY8 Verified Net Impact Savings Estimates by School Category

	Verified Net Energy Savings (MWh)	Verified Net Peak Demand Savings (MW)
Childcare / Preschool / Kindergarten		
Ex-Ante Net Savings	183.2	0.01403
Verified Net Savings	152.7	0.03679
Elementary Schools		
Ex-Ante Net Savings	14.8	0.00124
Verified Net Savings	13.7	0.00121
High Schools		
Ex-Ante Net Savings	18.0	0.00110
Verified Net Savings	15.0	0.00092
Total		
Ex-Ante Net Savings	216.0	0.01637
Verified Net Savings	181.4	0.03893

Source: Evaluation analysis.

[10] A deemed value. Source: "ComEd_NTG_History_and_PY8_Recommendations.xls", found on the IL SAG web site: http://ilsag.info/net-to-gross-framework.html.

5. PROCESS EVALUATION

Navigant conducted a limited process evaluation for this program. Through a telephone interview with the implementation contractor's program manager and technical lead[11], Navigant learned that the previous program manager, who had conceived of the program, had left the company in the spring of 2016. Also, the staff member that had conducted the majority of the outreach and school energy audits in Chicago also left the company in the spring of 2016 leaving the company without a presence in Chicago. The new program manager determined that the marketing and outreach was not sufficient to meet the target participation levels in PY8. The new program manager, in conjunction with WECC, is relaunching the program with a broader outreach plan, refreshed marketing materials, and a better understanding of the decision-making process of school administrators. The implementation contractor is also seeking staff in Chicago for this program. Another reason the new program manager believed contributed to the low participation numbers is that often there were long periods of time in between the initial contact with the customer and the follow-up.

[11] Telephone interview with Matrix program manager and technical lead, October 14, 2016.

6. FINDINGS AND RECOMMENDATIONS

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

Program Volumetric Findings.

Finding 1. Only nine schools participated in the program. The PY8 target number of participating schools was 85—the program met ten percent of its participation target. In PY9, the implementer is "re-launching" the program with new marketing materials, revised outreach strategy and new staff based in Chicago.

Verified Gross Impacts

Finding 2. The PY8 Matrix Schools' program net savings target was 5,545 net MWh. The PY8 gross verified energy savings were estimated to be 191 MWh—the program met three percent of the energy savings target.

Finding 3. Replacing linear fluorescents with high-efficiency linear fluorescents comprised the majority of the units installed, and a similar proportion of the resulting energy savings, but a much larger proportion of the peak demand reduction. Incandescent to LED upgrades represented a small portion of installations, and an even smaller percentage of energy saving.

Finding 4. CFL to LED upgrades represented eight percent of unit installations, but only one percent of total program energy savings and only ½ of a percent of demand savings. Additionally these savings are likely overstated as the CFL to LED measures often included a reduction in light output. A matched light output would yield reduced energy savings

Recommendation 1. We recommend checking lumen levels at the task surface to determine if an area is "over lit" and warrants replacement lighting with lower lumens.

Tracking System Findings

Finding 5. Navigant could not verify the baseline and energy efficient wattages for T-12 and T-8 linear fluorescents reported in the tracking system. No documentation was provided to validate the reported wattage values. The ballast type for these measures are also missing from the project files.

Recommendation 2. Navigant recommends that the implementation team include measure specification sheets and/or any supporting documentation in the project files that can help verify the reported measure wattages. Additionally, Navigant suggests using the TRM to report wattage values and estimate energy and demand savings.

Finding 6. The Technical Advisory Committee approved the assumptions for building types mentioned in TRM v5.0[12] which are not available in TRM v4.0[13], including childcare/preschools. The implementer did not use the assumptions from TRM v5.0 for childcare/preschools and instead used custom values for hours of use (HOU), waste heat factor of energy (WHFe) and waste heat factor of demand (WHFd) to estimate ex-post savings for energy and demand for measures.

Recommendation 3. Navigant recommends that the implementer follow the TAC's guidance and use the assumptions for childcare/preschools from the TRM v5.0 since these building types are not available in the TRM v4.0.

[12] State of Illinois Technical Reference Manual version 5.0 from http://www.ilsag.info/technical-reference-manual.html.
[13] State of Illinois Technical Reference Manual version 4.0 from http://www.ilsag.info/technical-reference-manual.html.

Finding 7. The tracking data uses the same waste heat factors (WHFe and WHFd) and Coincidence Factor (CF) for all measures at a given school, regardless of the type of school. This approach does not follow the TRM guidance.

Recommendation 4. The implementer should use the assumptions based on the building type mentioned in the TRM.

7. APPENDIX

7.1 Evaluation Research Impact Findings

Table 7-1. Energy Efficient Installed Measure Counts and Savings

	Number of Lamps per Fixture	Unit	Unit Count	Verified Gross Savings (kWh)	Verified Gross Peak Demand Savings (kW)
LEDs					
6.5W LED	1	Bulb	8	201	0.056
8W LED	1		8	1,392	0.386
9W LED	1		64	6,306	1.180
12W LED	1		21	1,250	0.061
11W BR LED	1		10	3,138	0.000
12W BR LED	1		2	422	0.117
17W BR LED	1		5	2,035	0.000
12W PAR LED	1		39	10,870	0.702
LED Exit Signs					
3.8W LED		Fixture	30	10,933	1.375
5W LED			18	6,633	0.828
T8 Fluorescents					
4' 25W T8 Fluorescent	2	Fixture	73	17,441	3.191
4' 25W T8 Fluorescent	3		410	123,346	31.227
4' 25W T8 Fluorescent	4		18	5,310	1.383
4' 28W T8 Fluorescent	3		12	1,686	0.468
Totals			718	190,963	40.975

Source: Navigant analysis of tracking data

Table 7-2. Savings and Realization Rates by School

School Number	School Type	Ex Ante Gross Energy Savings (kWh)	Verified Gross Energy Savings (kWh)	Energy Realization Rate	Verified Gross Peak Demand Savings (kW)
1	Childcare/Preschool/Kindergarten	27,552	23,450	85%	5.843
2	Childcare/Preschool/Kindergarten	44,214	35,864	81%	6.053
3	Childcare/Preschool/Kindergarten	3,909	3,868	99%	0.910
4	Childcare/Preschool/Kindergarten	7,827	6,986	89%	1.714
5	Childcare/Preschool/Kindergarten	9,631	8,141	85%	2.091
6	Elementary School	15,596	14,392	92%	1.276
7	Childcare/Preschool/Kindergarten	49,763	41,694	84%	10.974
8	High School	18,916	15,807	84%	0.971
9	Childcare/Preschool/Kindergarten	49,928	40,763	82%	11.145
	Totals	227,334	190,963	84%	40.975

Source: Navigant analysis of tracking data