



**Energy Efficiency / Demand Response  
Plan: Plan Year 3 (6/1/2010-5/31/2011)**

**Evaluation Report: Summary Report  
Final**

**Presented to**

**Commonwealth Edison Company**

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## Section E - Executive Summary

The goal of this report is to present a summary of the findings and results from the Impact and Process Evaluation of the energy efficiency and demand response programs offered by Commonwealth Edison Company (ComEd) in Plan Year 3 (PY3), which ran from June 1, 2010 to May 31, 2011. For the purposes of meeting statutory goal requirements, certain measure level savings have been deemed and are used instead of currently evaluated determinations. This report verifies the program year savings based on these deemed values and the current evaluations. For the current program year, residential kWh savings associated with CFL bulbs replacing incandescent bulbs have been deemed.

The ComEd Portfolio included seven residential programs and four programs targeted to business customers<sup>1</sup> in PY3. This section includes a brief overview of the Portfolio and its energy impacts.

### *E-1. ComEd PY3 Portfolio Results*

In PY3, ComEd's energy efficiency portfolio achieved 626,714.7 net MWh to meet its statutory goals.<sup>2</sup> This included 575,513.7 net MWh from funded measures in PY3 and 51,201.0 MWh from previously funded CFL bulbs installed during PY3 (see Table E-1). Savings from these bulbs were excluded from previous program year's results because they were placed into storage at that time. On a current evaluated basis, the evaluation team estimated that ComEd's efficiency programs achieved 662,139.5 MWh net energy savings in the ComEd service territory for PY3. This included 610,938.5 net MWh from funded measures in PY3, plus the same CFL Carryover (see Tables E-2).<sup>3</sup> The achieved net demand savings for PY3 was 98.7 MW from all programs, including 14.7 MW from the demand response program.

Based on these savings and portfolio expenditures, the PY3 portfolio cost effectiveness, based on the Illinois TRC test, is 1.69.

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<sup>1</sup> The Small C&I CFL Intro Kit program was offered in PY1 but not in PY2 or PY3 however carryover savings were estimated for this evaluation cycle.

<sup>2</sup> This savings estimate, 626,714.7 net MWh, uses the "deemed" lighting savings values. The Illinois Commerce Commission (ICC) addressed deeming lighting values temporarily in its Final Order in ComEd's energy efficiency Plan 1 docket. See, ICC Docket No. 07-0540, Final Order at 42, February 6, 2008. <http://www.icc.illinois.gov/downloads/public/edocket/215193.pdf>

<sup>3</sup> The evaluation team's estimate of 662,139.5 MWh of net energy savings incorporates the residential lighting hours of use (HOU) metering study results from the ComEd service territory. If the results from the metering of light bulbs in the ComEd service territory are ignored in the HOU estimates, and instead the HOU values included in ComEd's energy efficiency Plan filing are used, the net energy savings claim decreases to 626,714.7 net MWh for PY3 or 575,513.7 net MWh if carryover is excluded. The ICC addressed deeming lighting values temporarily in its Final Order in ComEd's energy efficiency Plan 1 docket. See, ICC Docket No. 07-0540, Final Order at 42, February 6, 2008.

The ComEd program tracking systems reported 901,975 MWh of gross savings for combined residential and business programs in PY3. Evaluation review of these ex-ante gross savings estimates on a program-by-program basis concluded that 90% of the estimated gross savings had been realized. Additional evaluation work to estimate free riders and spillover effects resulted in an overall net-to-gross ratio of 0.71. The result of all the individual program reviews was an ex-post estimate of 575,513.7 MWh of net energy savings.<sup>4</sup>

**Carryover Savings.** Two programs, Residential Lighting and Small Commercial and Industrial (C&I) Direct Install had measures (CFLs) sold or incented in PY1 and PY2 that were not installed at that time but were installed in PY3 according to evaluation analysis. Those measures are credited to the PY3 savings as “Late Installs” or Carryover savings.

**Table E-1 ComEd Portfolio Year 3 Results – Planned and Net Energy Savings – Verified With Deemed Values**

	Ex-Ante					Ex-Post			
	Ex-Ante Measure Gross MWh	Realization rate	Ex-Ante Gross MWh	NTG Ratio	Ex-Ante Net MWh	Ex Post Gross MWh	RR (Ex Post Gross / Measure Ex Ante Gross)	Ex Post Net MWh	NTG (Ex Post Net/Ex Post Gross)
Energy Star Lighting	456,814	0.85	388,292	0.60	232,975	373,991.0	0.82	264,631.0	0.71
Appliance Recycling	63,835	0.73	46,681	0.71	33,093	65,592.0	1.03	44,851.0	0.68
Multi-Family All-Electric Upgrade	3,722	0.75	2,792	0.95	2,652	4,678.0	1.26	4,216.0	0.90
Multi-Family Joint	7,969	0.95	7,571	0.80	6,056	7,969.0	1.00	6,455.0	0.81
Single Family Performance	469	0.90	403	0.85	361	400.6	0.85	368.5	0.92
Single Family Joint	2,740	0.90	2,218	0.75	1,961	2,680.2	0.98	2,129.7	0.7946
CACES	6,007	0.36	2,164	1.00	2,164	2,225.0	0.37	2,225.0	1.00
Home Energy Report	13,479	1.00	13,479	1.00	13,479	13,479.0	NA	13,479.0	NA
<b>Total Residential</b>	<b>555,036</b>	<b>0.82</b>	<b>463,599</b>	<b>0.64</b>	<b>292,741</b>	<b>471,014.8</b>	<b>0.85</b>	<b>338,355.2</b>	<b>0.72</b>
Prescriptive	258,386	1.00	258,386	0.70	180,870	260,236.8	1.01	188,463.0	0.72
Custom	55,555	1.00	55,555	0.70	38,889	47,432.8	0.85	26,434.5	0.56
<b>Combined Prescriptive &amp; Custom</b>	<b>313,941</b>	<b>1.00</b>	<b>313,941</b>	<b>0.70</b>	<b>219,759</b>	<b>307,669.6</b>	<b>0.98</b>	<b>214,897.5</b>	<b>0.70</b>
Mid Stream C&I Lighting	1,133	0.70	1,440	0.60	864	1,246.1	1.10	916.0	0.74
Retro-Commissioning	22,662	0.95	21,529	0.90	19,376	21,574.0	0.95	15,382.0	0.71
New Construction	9,203	0.80	7,362	0.85	6,258	9,174.0	1.00	5,963.0	0.65
<b>Total Business</b>	<b>346,939</b>	<b>0.99</b>	<b>344,272</b>	<b>0.71</b>	<b>246,257</b>	<b>339,663.7</b>	<b>0.98</b>	<b>237,158.5</b>	<b>0.70</b>
<b>ComEd Program Total</b>	<b>901,975</b>	<b>0.88</b>	<b>807,871</b>	<b>0.67</b>	<b>538,998</b>	<b>810,678.5</b>	<b>0.90</b>	<b>575,513.7</b>	<b>0.71</b>
<b>Carryover</b>									
Small C&I CFL Intro Kit PY1						5,371.0		3,008.0	
Residential Energy Star Lighting PY1						18,761.0		12,973.0	
<b>Subtotal PY1 Carryover</b>	<b>15,981</b>	<b>1.00</b>	<b>15,981</b>	<b>1.00</b>	<b>15,981</b>	<b>24,132.0</b>		<b>15,981.0</b>	
Residential Energy Star Lighting PY2	32,996	1.00	32,996	1.00	32,996	49,605.6		35,220.0	
<b>Total Carryover</b>	<b>48,977</b>		<b>48,977</b>		<b>48,977</b>	<b>73,737.6</b>		<b>51,201.0</b>	
<b>ComEd PY3 Total Portfolio</b>	<b>950,952</b>	<b>0.90</b>	<b>856,848</b>	<b>0.69</b>	<b>587,975</b>	<b>884,416.1</b>	<b>0.93</b>	<b>626,714.7</b>	<b>0.71</b>

Source: Ex Ante from ComEd. Ex-Post from evaluation analysis.

<sup>4</sup> Id.

**Table E-2. ComEd Portfolio Year 3 Results – Planned and Net Energy Savings – Evaluated**

	Ex-Ante					Ex-Post				
	Ex-Ante Measure Gross MWh	Realization rate	Ex-Ante Gross MWh	NTG Ratio	Ex-Ante Net MWh	Ex Post Gross MWh	RR (Ex Post Gross / Ex Ante Gross)	Ex Post Net MWh	NTG (Ex Post Net/Ex Post Gross)	
Energy Star Lighting	456,814	0.85	388,292	0.60	232,975	423,677.0	0.93	299,788.0	0.71	
Appliance Recycling	63,835	0.73	46,681	0.71	33,093	65,592.0	1.03	44,851.0	0.68	
Multi-Family All-Electric Upgrade	3,722	0.75	2,792	0.95	2,652	4,776.0	1.28	4,295.0	0.90	
Multi-Family Joint	7,969	0.95	7,571	0.80	6,056	8,605.0	1.08	6,970.0	0.81	
Single Family Performance	469	0.90	403	0.85	361	390.0	0.83	360.0	0.92	
Single Family Joint	2,740	0.90	2,218	0.75	1,961	2,268.0	0.83	1,812.0	0.7989	
CACES	6,007	0.36	2,164	1.00	2,164	2,225.0	0.37	2,225.0	1.00	
Home Energy Report	13,479	1.00	13,479	1.00	13,479	13,479.0	NA	13,479.0	NA	
<b>Total Residential</b>	<b>555,036</b>	<b>0.82</b>	<b>463,599</b>	<b>0.64</b>	<b>292,741</b>	<b>521,012.0</b>	<b>0.94</b>	<b>373,780.0</b>	<b>0.72</b>	
Prescriptive	258,386	1.00	258,386	0.70	180,870	260,236.8	1.01	188,463.0	0.72	
Custom	55,555	1.00	55,555	0.70	38,889	47,432.8	0.85	26,434.5	0.56	
<b>Combined Prescriptive &amp; Custom</b>	<b>313,941</b>	<b>1.00</b>	<b>313,941</b>	<b>0.70</b>	<b>219,759</b>	<b>307,669.6</b>	<b>0.98</b>	<b>214,897.5</b>	<b>0.70</b>	
Mid Stream C&I Lighting	1,133	0.70	1,440	0.60	864	1,246.1	1.10	916.0	0.74	
Retro-Commissioning	22,662	0.95	21,529	0.90	19,376	21,574.0	0.95	15,382.0	0.71	
New Construction	9,203	0.80	7,362	0.85	6,258	9,174.0	1.00	5,963.0	0.65	
<b>Total Business</b>	<b>346,939</b>	<b>0.99</b>	<b>344,272</b>	<b>0.71</b>	<b>246,257</b>	<b>339,663.7</b>	<b>0.98</b>	<b>237,158.5</b>	<b>0.70</b>	
<b>ComEd Program Total</b>	<b>901,975</b>	<b>0.88</b>	<b>807,871</b>	<b>0.67</b>	<b>538,998</b>	<b>860,675.7</b>	<b>0.95</b>	<b>610,938.5</b>	<b>0.71</b>	
<b>Carryover</b>										
Small C&I CFL Intro Kit PY1						5,371.0		3,008.0		
Residential Energy Star Lighting PY1						18,761.0		12,973.0		
<b>Subtotal PY1 Carryover</b>	15,981	1.00	15,981	1.00	15,981	24,132.0		15,981.0		
Residential Energy Star Lighting PY2	32,996	1.00	32,996	1.00	32,996	49,605.6		35,220.0		
<b>Total Carryover</b>	<b>48,977</b>		<b>48,977</b>		<b>48,977</b>	<b>73,737.6</b>		<b>51,201.0</b>		
<b>ComEd PY3 Total Portfolio</b>	<b>950,952</b>	<b>0.90</b>	<b>856,848</b>	<b>0.69</b>	<b>587,975</b>	<b>934,413.3</b>	<b>0.98</b>	<b>662,139.5</b>	<b>0.71</b>	

Source: Ex Ante from ComEd. Ex-Post from evaluation analysis.

**Table E-3. ComEd Portfolio Year 3 Results – Net Peak Demand Savings (MW)‡**

	Ex-Post Gross	Ex-Post Net
<b>Residential</b>		
Energy Star Lighting	39.0	27.0
Appliance Recycling	11.8	8.0
Multi-Family All-Electric Upgrade	0.3	0.3
Multi-Family Joint	0.9	0.7
Single Family Performance	0.0	0.0
Single Family Joint	0.3	0.3
CACES	3.0	3.0
Home Energy Report	NA†	NA†
<b>Total Residential</b>	<b>55.3</b>	<b>39.3</b>
<b>Business</b>		
Prescriptive	46.7	33.8
Custom	5.1	2.3
Combined Prescriptive & Custom	51.8	36.1
Mid Stream C&I Lighting	0.2	0.2
Retro-Commissioning	1.7	1.2
New Construction	2.3	1.5
<b>Total Business</b>	<b>56.0</b>	<b>39.0</b>
<b>Demand Response - Central Air Conditioning Cycling</b>	<b>14.7</b>	<b>14.7</b>
<b>ComEd Program Total</b>	<b>126.0</b>	<b>93.0</b>
<b>Carryover</b>		
Residential Energy Star Lighting	8.4	5.0
Small C&I CFL Intro Kit	1.3	0.7
<b>Total Carryover</b>	<b>9.7</b>	<b>5.7</b>
<b>ComEd PY3 Total Portfolio</b>	<b>135.7</b>	<b>98.7</b>

†No demand savings were calculated.

‡ Demand savings are set at the total for the Central Air Conditioning Cycling program alone.

### *E-2. ComEd Portfolio PY3 Energy Realization Rates by Program*

Evaluation research produces a gross realization rate and net-to-gross ratio for each program. The gross realization rate is the ratio of ex-post gross to ex-ante gross savings. Ex-ante gross values are the expected total savings as calculated from and recorded in ComEd’s data tracking system. Ex-post gross values are the accepted gross savings from program after verification by evaluators. The gross realization rates for ComEd’s programs are shown in Table E-2. In ComEd’s evaluation framework, some gross realization rates can be deemed in the second program year following evaluation, e.g., PY3 results in PY5.

The Net-to-Gross Ratio (NTG) is the ratio of ex-post net savings to ex-post gross savings. Ex-post net savings are calculated by adjusting ex-post gross savings for free ridership and spillover where free ridership reduces ex-post savings and spillover increases it. The NTG ratios for ComEd’s programs are also shown in Table E-1 or Table E-2. In ComEd’s evaluation framework, some NTG ratios can be deemed in the second program year following evaluation, e.g., PY3 results in PY5.

### *E-3. Summary*

In PY3, ComEd achieved 626,714.7 MWh of net savings based on deemed savings values and 662,139.5 MWh of net savings based on evaluated values.

Navigant has reviewed the Illinois TRC calculations provided by ComEd and agrees to their reasonableness. The Illinois TRC includes an environmental benefit adder. Given a calculated Illinois TRC of 1.69, the PY3 portfolio passes the cost-effectiveness requirement.<sup>5</sup>

Additional information on Programs’ results details, evaluation findings, evaluation approaches, and recommendations can be found in the remaining sections of this Summary Report and in individual program evaluation reports included as appendices.

### *E-4. Summary of DCEO ComEd Programs*

Energy efficiency resources are also delivered to ComEd customers through programs administered by the Illinois Department of Commerce and Economic Opportunity (DCEO). DCEO programs focused on low income customers in the residential sector, and on public facilities (like schools and government buildings) in the business sector.

The results from the DCEO programs are included in the following table.

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<sup>5</sup> 20 ILCS 3855/1-10.



**Table E-4 DCEO Programs Energy Savings – ComEd Territory**

<b>Program</b>	<b>Ex-Ante Gross MWh</b>	<b>Ex Post Gross MWh</b>	<b>RR (Ex Post Gross / Measure Ex Ante Gross)</b>	<b>Ex Post Net MWh</b>	<b>NTG (Ex Post Net/Ex Post Gross)</b>	<b>TRC</b>
EE Affordable Housing Construction	1,316	1,221	0.93	1,221	1.00	0.25
Low Income Residential Retrofit	5,020	7,438	1.48	7,438	1.00	0.75
Public Housing Authority Efficient Living	767	776	1.01	776	1.00	0.40
<b>Total Low Income</b>	<b>7,103</b>	<b>9,435</b>	<b>1.33</b>	<b>9,435</b>	<b>1.00</b>	<b>0.56</b>
Building Operator Certification†	NA	NA	NA	6,830	NA	1.11
Public Sector Custom Incentives	11,623	9,045	0.78	6,703	0.74	2.23
Public Sector RCx	1,492	1,269	0.85	1,243	0.98	1.37
Public Sector New Construction	628	537	0.86	269	0.50	2.44
Public Sector Standard Incentives	40,702	44,264	1.09	29,017	0.66	1.19
Lights for Learning	922	791	0.86	633	0.80	1.02
<b>Total Public Sector</b>	<b>55,367</b>	<b>55,906</b>	<b>1.01</b>	<b>44,695</b>	<b>0.80</b>	<b>1.37</b>
<b>DCEO Portfolio Total</b>	<b>62,470</b>	<b>65,341</b>	<b>1.05</b>	<b>54,130</b>	<b>0.83</b>	<b>1.07</b>

The following table shows the savings combining ComEd and DCEO programs in the ComEd territory.

**Table E-5 ComEd & DCEO Energy Savings – ComEd Territory**

	<b>Ex Post Gross MWh</b>	<b>Ex Post Net MWh</b>
ComEd Portfolio Total	810,678	575,514
ComEd Total Carryover	73,738	51,201
DCEO Portfolio Total - ComEd Territory	65,341	54,130
<b>Grand Total ComEd Territory</b>	<b>949,757</b>	<b>680,844</b>

*Note: Totals do not add due to rounding.*

## Section 1. Overview of ComEd Portfolio

### 1.1 Sector Level Results

#### Residential Sector Impacts — Smart Ideas

The residential sector includes seven programs designed to achieve cost-effective energy efficiency and demand savings in single family and multifamily residences. This sector includes programs that encourage and incent residential customers to improve the energy performance of their homes through whole-house retrofit upgrades, hiring qualified contractors to provide maintenance for air conditioning units, retiring and recycling old appliances, and purchasing energy efficient products. In addition, this sector includes a residential demand response program that does not contribute kWh savings.

Participating customers may receive technical or financial resources, such as a home energy audit, instant or mail-in rebates for purchasing energy efficient products, or no-cost direct installation of low-cost measures, such as faucet aerators or water efficient showerheads. ComEd ran a behavioral program where selected customers receives energy reports showing their energy consumption and those for typical households, along with energy saving suggestions.

Marketing and outreach for these programs is conducted through a variety of channels under ComEd's Smart Ideas® brand. Outreach efforts include trade allies, mass media, the internet and social media, direct mail, utility bill inserts, in-store displays, conventions, trade shows and public events. ComEd maintains a webpage for these programs with up to date information and application materials on its website:

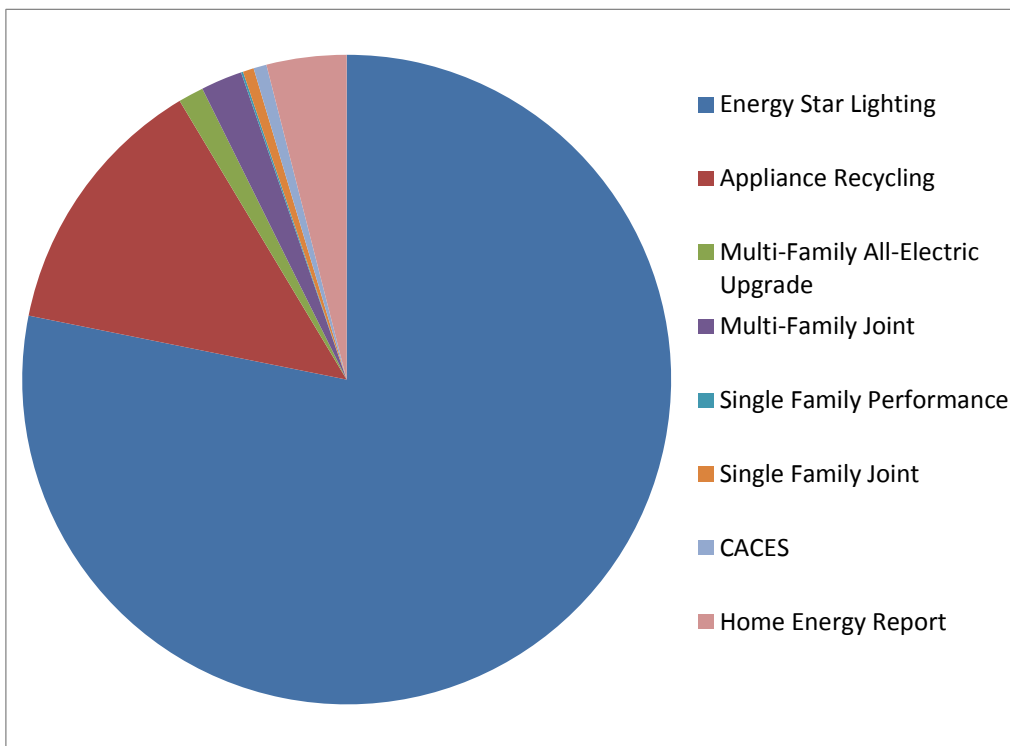
[www.comed.com/sites/HomeSavings/Pages/HomeSavings.aspx](http://www.comed.com/sites/HomeSavings/Pages/HomeSavings.aspx)

Some residential programs implemented pilot programs jointly with gas companies sharing overlapping service territories during this program year.

The Residential Lighting program was the biggest program as measured by energy savings, representing over  $\frac{3}{4}$  of the total savings (Figure 1).

The Net-to-Gross Ratio (NTG) for the group of residential programs was 0.72. Individual NTG ratios varied from 0.68 for Appliance Recycling to 1.0 for the Central Air Conditioning Efficiency Services program (CACES). Some evaluation efforts were able to calculate NTG ratios for specific measure types, as seen in Tables 1 and 2. The program-specific evaluation data collection efforts were typically designed to produce statistically significant results at the program level. As a result, the measure-specific NTG values are not necessarily statistically significant.

**Figure 1. Residential Ex-Post Net Energy Savings**



**Table 1. Residential Programs Net-to-Gross Ratios**

Program	Program NTG	Free Ridership	Spillover	Measure Level NTG †
Energy Star Lighting	0.71	31%	2%	Standard 0.72 Specialty 0.71
Appliance Recycling	0.68	32%	0%	Refrigerator 0.67 Freezer 0.75 Room AC 0.70
Multi-Family All-Electric Upgrade	0.90	11%	1%	CFLs 0.81 Water Efficiency 0.93
Multi-Family Joint	0.81	NA	NA	Not available
Single Family Performance	0.92	11.6%	3.8%	See Table 2
Single Family Joint	0.79	NA	NA	See Table 2
CACES	1.00	0%	0%	Not available
Home Energy Report	NA	NA	NA	Not available
<b>Total Residential</b>	<b>0.72</b>			

† Not necessarily statistically significant

For further details on the free ridership and spillover see the methodology chapter in program-specific EM&V reports for methods and the end of the impacts section of the Program Level Results chapter for results.

**Table 2. Residential Programs Net-to-Gross Ratios – Single Family Program**

Program	Measure	Measure Level NTG †
All-Electric	CFL	0.89
	Low Flow Showerhead	0.93
	Kitchen Aerator	0.95
	Faucet Aerator	0.95
	Hot Water Heater Turndown	1.00
	Hot Water Pipe Insulation	0.96
Sub-total All-Electric		0.92
Air Sealing Pilot	CFL	0.76
Direct Install Pilot	CFL	0.81
Retrofit Pilot	CFL	0.68
	Water Measures	0.94
	Weatherization Measures	0.98
	Sub-total Retrofit Pilot	

*† Not necessarily statistically significant*

### **Commercial & Industrial Sector Impacts – Smart Ideas for Your Business**

The Commercial & Industrial (C&I) Sector includes four programs (Mid-Stream C&I Lighting was launched within the Prescriptive Program) designed to achieve cost-effective energy efficiency and demand savings in commercial and industrial facilities. This sector includes programs that encourage and incent customers to make energy efficiency improvements at their facilities by providing technical and financial resources.

Participating customers may receive technical resources such as expert design consultation for new construction projects or energy audits and recommendations for performance improvement at existing facilities from qualified contractors. Customers may qualify for financial incentives by implementing recommendations from program representatives. In addition, customers may receive rebates by purchasing and installing qualified energy efficient products at their facilities.

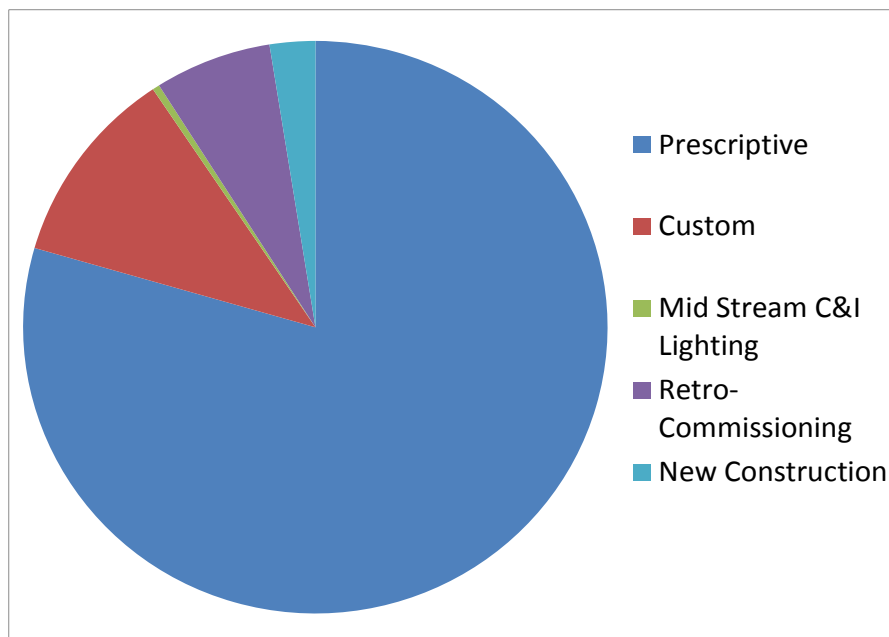
Commercial & Industrial programs are marketed under the Smart Ideas for Your Business® brand. Many C&I programs work closely with ComEd’s account managers, energy efficiency program managers and trade allies to recruit qualified participants. These programs also conduct outreach through mass media, social media, direct mail, utility bill inserts, conventions, trade shows and public events. ComEd maintains a webpage for these programs with up to

date information and application materials on its website:  
[www.comed.com/sites/BusinessSavings/Pages/BusinessSavings.aspx](http://www.comed.com/sites/BusinessSavings/Pages/BusinessSavings.aspx)

The Business Prescriptive program was the largest C&I program as measured by energy savings, representing over ¾ of the total savings (Figure 2).

The Net-to-Gross Ratio (NTG) for the group of Business programs was 0.70. Individual NTG ratios varied from 0.56 for Custom to 0.74 for Mid-Stream C&I Lighting. Some evaluation efforts were able to calculate NTG ratios for specific measure types, as seen in Table 3. The program-specific evaluation data collection efforts were typically designed to produce statistically significant results at the program level. As a result, the measure-specific NTG values are not necessarily statistically significant.

**Figure 2. C&I Ex-Post Net Energy Savings**



**Table 3. Business Programs Net-to-Gross Ratios**

Program	Program NTG	Free Ridership	Spillover	Measure Level NTG †
Prescriptive	0.72	28%	0%	Lighting 0.74 Non-Lighting 0.62
Custom	0.56	44%	0%	Not available
Combined Prescriptive & Custom	0.70	NA	NA	Not available
Mid-Stream C&I Lighting	0.74	26%	0%	Not available
Retro-Commissioning	0.71	29%	0%	Not available
New Construction	0.65	35%	0%	Systems 0.69 Comprehensive 0.54

† Not necessarily statistically significant

### 1.2 ComEd PY3 Portfolio Process Evaluation Results

The primary objective of the process evaluation effort is to gather market intelligence to help program designers and managers structure their programs to achieve cost-effective savings while maintaining high levels of customer satisfaction. Specific process evaluation methods and objectives vary based on each individual program’s needs and stage of development, and detailed process findings are reported separately for each program in the individual evaluation reports.

### 1.3 ComEd PY3 Portfolio Level Cost Effectiveness

Cost effectiveness was determined for individual programs and for the portfolio of programs as a whole. It is assessed through the use of the Total Resource Cost (TRC) test. The TRC test is defined in the Illinois Power Agency Act SB1592 as follows:

*‘Total resource cost test’ or ‘TRC test’ means a standard that is met if, for an investment in energy efficiency or demand-response measures, the benefit-cost ratio is greater than one. The benefit-cost ratio is the ratio of the net present value of the total benefits of the program to the net present value of the total costs as calculated over the lifetime of the measures. A total resource cost test compares the sum of avoided electric utility costs, representing the benefits that accrue to the system and the participant in the delivery of those efficiency measures, to the sum of all incremental costs of end-use measures that are implemented due to the program (including both utility and participant contributions), plus costs to administer, deliver, and evaluate each demand-side program, to quantify the net savings obtained by substituting the demand-side program for supply resources. In calculating avoided costs of power and energy that an electric*

*utility would otherwise have had to acquire, reasonable estimates shall be included of financial costs likely to be imposed by future regulations and legislation on emissions of greenhouse gases.<sup>6</sup>*

ComEd uses DSMore™ software for the calculation of the TRC test.<sup>7</sup> The DSMore model accepts information on program parameters, such as number of participants, gross savings, free ridership and program costs, and calculates a TRC which fits the requirements of the Illinois legislation.

One important feature of the DSMore model is that it performs a probabilistic estimation of future avoided energy costs. It looks at the historical relationship between weather, electric use and prices in the PJM Northern Illinois region and forecasts a range of potential future electric energy prices. The range of future prices is correlated to the range of weather conditions that could occur, and the range of weather is based on weather patterns seen over the historical record. This method captures the impact on electric prices that comes from extreme weather conditions. Extreme weather creates extreme peaks which create extreme prices. These extreme prices generally occur as price spikes and they create a skewed price distribution. High prices are going to be much higher than the average price while low prices are going to be only moderately lower than the average. DSMore is able to quantify the weighted benefits of avoiding energy use across years which have this skewed price distribution.

All of the individual ComEd programs, except CACES, Home Energy Report, C&I Retrocommissioning,<sup>8</sup> are cost effective, with TRC values greater than one, which means that total benefits are greater than total costs (Table 4) and the programs are estimated to be cost effective as defined by the Illinois TRC test. The cost effectiveness of the portfolio is dependent on a number of assumptions and these are described in the PY3 TRC Summary in the appendices. A modified TRC calculation is being used for Illinois, which includes an environmental benefit for CO2 reductions valued at \$0.013875/kWh. The Illinois TRC for ComEd's portfolio is 1.69.

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<sup>6</sup> 20 ILCS 3855/1-10.

<sup>7</sup> Demand Side Management Option Risk Evaluator (DSMore) software is developed by Integral Analytics.

<sup>8</sup> The Home Energy Report program was in its first full year in PY3.

**Table 4. Cost Effectiveness of the ComEd Portfolio**

Program	Illinois Total Resource Cost Test
Residential ENERGY STAR® Lighting	4.85
Appliance Recycling	3.53
Multifamily All-Electric Efficiency Upgrade	2.75
Multifamily Joint (electric measures only)	2.58
All-Electric Single Family Home Energy Performance Tune-Up	1.01
Single Family Joint (electric measures only)	1.28
Central Air Conditioning Efficiency Services	0.52
Home Energy Report <sup>9</sup>	0.39
Central Air Conditioning Cycling	2.46
Business Prescriptive	1.05
Business Custom	0.99
C&I Retro-Commissioning (electric measures only)	0.70
C&I New Construction	1.41
<b>ComEd Total</b>	<b>1.69</b>

Source: ComEd DSMore analysis. Details on the assumptions used can be found at the end of the Results section in each program-specific report and in the TRC Summary Report.

Additional costs are included in the determination of the TRC ratio at the portfolio level. These are costs related to the overall delivery of energy efficiency and demand response programs that cannot be assigned to any of the individual evaluated programs, like evaluation, measurement and verification costs, portfolio-level administration costs, research and development costs, educational outreach costs and Energy Insight Online (EIO) costs. In addition, the portfolio level TRC also includes benefits associated with residential lighting savings from PY1 and PY2 that were not previously counted.

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<sup>9</sup> When ComEd ran the TRC test for the Home Energy Report program using only incremental costs instead of the full costs including start-up costs, the TRC came to 1.61.



## Section 2. Evaluation Methods

The ComEd evaluation, measurement and verification (EM&V) team developed an evaluation work plan for each program in the portfolio. Within each program’s evaluation plan, the level of rigor and evaluation methods were selected based on findings from each program’s previous evaluation reports, including anticipated program impacts and planned changes to program design or implementation. Generally, impact evaluation methods included reviewing program tracking databases and other program methodology for calculating reported savings, conducting secondary research for verification and due diligence reviews, sampling projects for engineering reviews and/or on-site data collection, communicating with implementation contractors and/or trade allies their participation, and contacting program participants and non-participants via telephone surveys. Frequent process evaluation methods included in-depth interviews with program staff, implementation contractors and trade allies, reviewing program materials and contacting program participants and non-participants via telephone surveys.

Tables 5 and 6 summarize each program’s main evaluation tasks conducted during PY3. Due to the nature of the programs, the Home Energy Report and Central Air Conditioning Cycling programs were subject to a different evaluation approaches and are not included in this table. The Home Energy Report program was analyzed with a regression-based billing analysis and the Cycling program was analyzed by comparing the characteristics of incremental participants to the population of participants.

**Table 5. Evaluation Approaches – Residential Programs**

Evaluation Tasks	Residential Lighting	Single Family	Multifamily	CACES	Appliance Recycling
<b>Reporting</b>					
Verification and Gross Realization Rate	X	X	X	X	X
Measure-Level Deemed Savings Review	X	X	X	X	X
NTG Ratio	X	X	X	X	X
Process Analysis	X	X	X	X	X
<b>Impact Analysis</b>					
Participant Surveys - Impact†	X				
• Participant Self-Report NTG Analysis	X†	X	X		X
• Installation Rate Analysis	X	X	X	X	X
• ANCOVA Modeled HOU/CF	X†				
In-store Intercept Surveys - Impact	X				
• Self-Report NTG Analysis	X				
• Installation Rate Analysis	X	X	X		

Evaluation Tasks	Residential Lighting	Single Family	Multifamily	CACES	Appliance Recycling
• Demand Modeling NTG	X†				
Shelf Surveys - Impact	X				
Multi-State NTG Study	X†				
Metering study for lighting HOU/Peak	X				
Trade Ally Interviews - NTG	X†	X		X	X
<b>Process Analysis</b>					
ComEd Program Manager and Implementation Contractor Interviews	X	X	X	X	X
General Population Surveys – Process	X				
In-store Intercept Surveys – Process	X				
Shelf Surveys - Process	X				
Stakeholder Interviews				X	X
Participant Telephone Interviews	X	X	X	X	X

† Not used in the final NTG calculations.

‡ This was a survey of the general population for the Residential Lighting Program.

**Table 6. Evaluation Approaches – C&I Programs**

Evaluation Tasks	Prescriptive	Custom	RCx	NC
<b>Reporting</b>				
Verification and Gross Realization Rate	X	X	X	X
Measure-Level Deemed Savings Review	X	X		X
NTG Ratio	X	X	X	X
Process Analysis	X	X		
<b>Impact Analysis</b>				
General Population Surveys - Impact	X	X	X	X
• Customer Self-Report NTG Analysis	X	X	X	X
• Installation Rate Analysis	X	X	X	X
Trade Ally Interviews - NTG		X		
<b>Process Analysis</b>				
Program Manager and Implementer Interviews	X	X	X	X
Stakeholder Interviews	X	X	X	X
Participant Telephone Interviews	X	X	X	X
	X	X	X	X

## Section 3. Program Level Findings and Recommendations

This section includes program-level detail for ComEd's PY3 portfolio of programs including a brief program description, key conclusions and recommendations for each program.

### 3.1 Residential ENERGY STAR® Lighting

The Residential ENERGY STAR® (ES) Lighting Program provides incentives to increase the market share of Energy Star (ES) qualified compact fluorescent lamp (CFL) bulbs and fixtures sold through retail sales channels. It also seeks to distribute educational materials that will increase customer awareness and acceptance of energy-efficient lighting technology, as well as promote proper bulb disposal.

The revised goal of the Residential ES Lighting program for PY3 was to sell 11.1 million<sup>10</sup> discounted CFLs and CFL fixtures to residential customers within ComEd's service territory. A total of 9,893,196 standard CFL bulbs, 1,217,723 specialty CFL bulbs and 86,943 fixtures were sold as part of the program for a grand total of 11,197,862 bulbs.

The PY3 net claimed ex ante energy savings for this program, excluding carryover savings for previous program year uninstalled bulbs, was estimated to be 232,975 MWh<sup>11</sup>. The evaluation TRM Verified net estimated ex-post savings was 264,631 MWh<sup>12</sup> reflecting a gross realization rate of 0.82 and a NTG ratio of 0.71.

A summary of the evaluation results for each of the key program impact parameter estimates is provided below.

**Delta Watts (DW).** For this evaluation, delta watts were deemed for CFL bulb sizes and lumens, resulting in an average of 48.7 watts based on ICC-adopted guidelines<sup>13</sup>, however an additional lumen-based method was employed to calculate the ex-post evaluation delta watts estimate. This lumen-only based method result in an average delta watts estimate of 48.1, which was just 1% lower than the deemed DW estimate. Going forward the evaluation team recommends using this lumen-based method to estimate the displaced watts from all program bulbs (including any additional technologies added to the program such as LEDs). This approach will require that manufacturers provide lumen output for all program bulbs and that the lumen data is included in the program tracking data.

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<sup>10</sup> The original goal was to sell approximately 5 million bulbs in PY3.

<sup>11</sup> The original goals for the PY3 Residential ES Lighting program were 149,322 MWh and 14.2 MW (coincident peak). The revised target energy goal was 181,155 MWh.

<sup>12</sup> Excluding PY1 and PY2 late CFLs installs.

<sup>13</sup> <http://www.icc.illinois.gov/downloads/public/edocket/215193.pdf>

**Hours-of-Use (HOU).** The ex-post HOU estimate used to calculate the evaluation verified savings came from the PY3 metering study. The average overall HOU estimate from this study was 2.74 hours per day, which was 17% higher than the deemed ex-ante estimate of 2.34 hours per day. The indoor HOU estimate from the metering study was calculated to be 2.57<sup>14</sup> hours per day and the exterior HOU estimate was calculated to be 5.0 hours per day.

**Peak Coincidence Factor (CF).** Similarly, the ex-post Peak CF estimate used to calculate the evaluation verified savings also came from the PY3 metering study. The average overall Peak CF estimate from this study was 0.102, which was 26% higher than the deemed ex-ante estimate of 0.081. The indoor CF estimate from the metering study was calculated to be 0.095<sup>15</sup> hours per day and the exterior CF estimate was calculated to be 0.184 hours per day.

**Residential/Non-Residential Installation Split.** The PY3 evaluation found a portion of program bulbs were being installed in non-residential locations (approximately 3% of program bulb sales) and thus the non-residential HOU and Peak CF estimates, which are much higher than residential HOU and Peak CF estimates, were applied for the percentage of bulbs estimated to be installed in non-residential locations. The resulting residential and non-residential weighted HOU estimate is 2.98 hours per day, and the Peak CF estimate is 0.121.

**Partial Gross Realization Rate (RR).** The partial<sup>16</sup> Gross Realization Rate for PY3 was calculated as follows:

$$RR = \text{Installation Rate} * \text{Leakage Rate}$$

The installation rate in PY3 was found to be down slightly from the PY2 estimate (71% across all bulb types<sup>17</sup> in PY3 versus 74% in PY2). Leakage of program bulbs outside of ComEd service territory was again found to be very minimal (less than 1%). The gross realization rate across all program bulb types was estimated to be 71%. By bulb type the gross realization rates were estimated to be 70% for standard bulbs, 77% for specialty bulbs and 85% for fixtures. This differentiation between bulb type realization rates is entirely driven by the installation rate as the leakage rate applied was consistent across bulb types.

**Interactive Effects (IE).** The PY3 evaluation estimated the energy cooling benefits, or interactive effects, resulting from a decrease in the cooling required as a result of a CFL retrofit. The

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<sup>14</sup> The interior HOU estimate of 2.57 hours per day would be the appropriate value for bulbs installed in interior locations through ComEd direct install programs.

<sup>15</sup> The interior Peak CF estimate of 0.095 hours per day would be the appropriate value for bulbs installed in interior locations through ComEd direct install programs.

<sup>16</sup> The full realization rate is (ex post gross/ex ante gross) and is 0.82.

<sup>17</sup> Installation rates by bulb type were estimated to be 71% for standard CFLs, 78% for specialty CFLs and 86% for CFL fixtures.

average energy IE across all home types was estimated to be 2.4%. The results by home type ranged from a high of 3.1% for single-family detached homes to a low of 0.9% for single-family attached homes or duplexes.

**Net-to-Gross Ratio (NTGR).** As part of the PY3 evaluation, a total of five methods were used to estimate the Residential ES Lighting program NTGR. The final overall recommended NTGR is 0.71 which is roughly 20% higher than the PY2 NTGR estimate (0.58 in PY2). This PY3 estimate was calculated as the retailer sales-weighted average of in-store intercept self-report results.

**Late Installs.** The overall annual gross and net program savings show an increase when the savings associated with the PY1 and PY2 late installs are added (48,193 MWh). Ex-Post Gross peak demand reduction from late installs is estimated to be 8.4 MW; Ex-Post Net peak demand deduction is estimated to be 5.0 MW.

**Process Evaluation.** The following list summarizes the key process findings from the study:

- ComEd customers are very aware of CFLs and the level of familiarity continues to increase.
- Approximately 70% of ComEd customers have at least one CFL installed in their home and the average number of CFLs per home is around 9.
- Approximately half of ComEd customers purchase at least one CFL per year.
- The ComEd lighting program is reaching customers with relatively low CFL socket saturation prior to purchasing the program bulbs, as well as those who already have a lot of CFLs installed.
- ComEd customers who have ComEd discounted CFLs installed report high levels of satisfaction with the program bulbs
- The primary barriers for the 20% of ComEd customers who have never purchased a CFL include concerns about mercury, light quality and bulb brightness. Price was also reported to be a very important reason for not purchasing CFLs.
- Program awareness seems to be increasing in the general population, although still less than 30% of customers know about the program and many program bulb purchasers are unaware the bulbs they are purchasing are discounted.
- In-store marketing appears to be more effective than the out-of-store marketing and customers who see the materials reported that the materials were highly influential in their purchase decision.

**Recommendations.** Before offering recommendations for future program improvement, the evaluation team would like to acknowledge the impressive and consistent success of the ComEd Residential ES Lighting Program. The program was again successful in PY3 in meeting its goals in terms of number of bulbs sold. Spiral CFLs in particular are selling at very high rates. Manufacturers and retailers are almost universally pleased with the program and its implementation. ComEd successfully put plans in place to expand the program to discount

stores in PY4, which was a specific recommendation in the PY2 evaluation report. The program has also been successful at getting CFLs into homes with lower socket saturation, another of the recommendations from the PY2 evaluation.

Because of this success, the recommendations below are more in the nature of fine-tuning. These recommendations are based on findings from the current evaluation and upcoming changes in the CFL market.

- Increase focus on using EISA 2007 to educate customers about proper CFL replacement.
- Consider language-based program outreach to non-English speaking households.
- Improve recording and reporting of lumen output in the program tracking data.
- Improve recording of retail price per package in the program tracking data.
- Screen key tracking data fields for incorrect or missing entries.
- Encourage retail participants to participate more actively in the program evaluation.
- Increase promotion of the CFL disposal program.

### 3.2 *Appliance Recycling*

The Residential Appliance Recycling program was designed to achieve energy savings through the retirement and recycling of older, inefficient refrigerators, freezers, and room air conditioners. The Appliance Recycling program collected 41,024 units during PY3, over 80% of which were refrigerators; another 15% were freezers; and just 2% were room air conditioners.

The starting PY3 net energy savings goal for this program was 30,900 MWh, which represents a steep 31% increase over the final PY2 goal of 23,628 MWh. The program-reported net energy savings was 33,093 MWh. The verified net energy savings is actually significantly higher than this – 44,851 MWh.

Gross savings per unit (without adjustment for the part-use factor) are very close for the ex-ante and ex-post program-verified savings estimates, since ComEd used virtually the same approach to calculate ex-ante gross savings per unit as was used in this evaluation. Key differences are with respect to the part-use factor and net-to-gross ratio assumptions. Program verified part-use factors were 90% for refrigerators, and 75% for freezers, while the ex-ante assumption was 75% for refrigerators and 65% for freezers. The net-to-gross ratio for the ex-ante estimates was somewhat higher than ex-post for refrigerators (0.70 ex-ante vs. 0.68 for ex-post), identical for freezers, and higher for room ACs (1.00 for ex-ante vs. 0.70 for ex-post).

#### **Impact Recommendations**

- As part of the PY4 evaluation activities, an in situ metering study is currently underway. We recommend that the results of that study be used to validate the gross kWh savings values coming from the regression equations for PY4. In addition, we recommend the

study results be used to set kW savings values in PY4, in lieu of using ComEd's planning estimates, as is currently being done.

- As in PY1 and PY2, we continue to recommend the program tracking data receive periodic data quality reviews for data quality and completeness. Data exported for the evaluation team should also be checked for anomalies. Incomplete data fields need to be populated, particularly those data fields that are critical to the evaluation, such as appliance brand, model number, age/year manufactured, size, configuration and location.
- A full market assessment should be conducted in the PY4 evaluation. The objective is to assess the state of both the new and used appliance markets with respect to disposal and recycling of older units.

**Key Process Findings.** In order to meet aggressive PY3 goals, ComEd enrolled two new retailers into its program in PY3, Sears and Best Buy (in addition to Abt Electronics, a local appliance retailer, which has been participating since PY1), and used a combination of higher incentives and 'specials' to promote the program. ComEd increased the program incentive amount in PY3, from \$25 per unit at the beginning of the program to \$35 in November of 2010. In addition, ComEd continued to partner with the ARRA-Illinois Energy Star Rebates program as it did in PY2. Finally, ComEd pursued an additional marketing strategy to further publicize the program that involved sending marketing collateral to approximately 200 retailers.

- Customer survey results and retail partner interviews suggest that these program changes were both well planned and well executed. Overall satisfaction among participants was quite high again this year, with 98% of participants indicating they are satisfied with the program (as shown by satisfaction ratings ranging from 7 to 10 on a 0-10 scale, where 0 is very dissatisfied and 10 is very satisfied). Customers indicate that their satisfaction is driven by the cash incentive as well as the convenience of the pickup service and overall ease of participation, with 97% saying they would recommend the program to a friend or colleague.
- The three appliance retailers currently partnering with the program implementer are highly satisfied with program processes, program communication, and training. In particular, all three partners indicate that hands-on training (including webinars) and frequent store visits from the program implementer are useful and very effective in training staff. Additionally, these retailers suggest that frequent communications (weekly or as needed) between the program implementer and corporate contacts keeps stores well-informed of program information and changes.
- All in all, the challenge for the program moving forward would appear to be a very welcomed one—maintain the high levels of customer and participating retailer service that was provided in PY3.

## Process Recommendations

- Customers and retailer partners are highly satisfied with the program. Maintaining such high levels of satisfaction, given the growth of the program, is an outstanding accomplishment. It will be important, as the program continues to progress, to routinely review program processes and procedures in order to maintain these satisfaction levels.
- All three retail partners who participate in the program are motivated by the environmental benefits of the program in addition to the competitive advantage that an additional rebate provides. If the program wishes to pursue additional retail partnerships, the program's tie-in to green corporate practices may be one benefit to highlight. A previous relationship with JACO for other recycling programs or disposal services was also a key factor in two retail partnerships.
- The cost to operate the recycled unit is viewed as an important reason for disposal by just over one-third of recyclers of both unit types. This is an area where further education of ComEd customers is needed, to make them aware of the considerable expense associated with running these older units. We recommend that ComEd include messaging in its program marketing literature and advertising to highlight the cost per year of operating older refrigerators and freezers.
- The program may wish to consider a tiered incentive structure to motivate Energy Star purchases. Such a structure would involve a higher incentive or bonus for those that replace their old unit with a new Energy Star rated unit.
- ComEd should ensure that JACO picks up program units for all 3 participating retailers from their corporate warehouses. Currently, this is only done for two of the three retailers.
- If feasible, ComEd may wish to consider developing program advertising that mentions retail partners by name. This will boost awareness of retail partners and lead additional customers to sign up for the retail program.

### *3.3 Multifamily Residential All-Electric Efficiency Upgrade*

ComEd's All-Electric Efficiency Upgrade Program targets multifamily buildings with both electric heat and hot water and provides site visits to improve the building's energy efficiency.

Ex-Post adjustments to gross energy savings estimates from CFL measure installations resulted in a 108 percent realization rate due to the increased hours of use (HOU) estimate (from 2.34 HOU for PY2 to 2.57 HOU for PY3) based on the indoor installation estimate in the ComEd PY3 Residential Lighting Meter Study. Ex-Post adjustments to gross savings estimates from water efficiency measure installations resulted in a 138 percent realization rate due to new measure equipment installations in PY3 including 1.5 gpm showerheads and 1.0 gpm bath faucet aerators. However, when the program updates its tracking system to reflect energy savings



from the new water measures, the realization rate for the program should be adjusted accordingly.

**Net Savings Estimates.** Results from the PY3 participant surveys and in-depth interviews with multifamily building owners/property managers resulted in measure-specific net-to-gross (NTG) ratios for the All-Electric Efficiency Upgrade program's water efficiency measures of 0.93 and CFL measures of 0.81. These NTG ratios are similar to evaluation findings from previous years.

The evaluation team recommends that the ComEd program staff consider the following recommendations for the program:

### **Impact Recommendations**

- Revise ex-ante gross impact assumptions to the following: 2.1 people/unit, 2.57 hours of use for CFLs, 0.095 peak coincidence factor.
- Gross impact parameters for CFLs, including delta watts, hours of use, installation rate, peak coincidence factor and interactive effects are sufficiently established to enable ComEd to deem these parameters for future years' planning assumptions.
- Realization rates for CFLs are the same in electric and natural gas heated units.
- Net-to-gross ratios for CFLs are the same in electric and natural gas heated units.
- Navigant reviewed and provided comments on the document ("*Multi-Family Nicor ComEd Data Needs 062011 (FINAL).xls*") provided by ComEd. This document provides sufficient guidance for gas companies to collect necessary information for reporting CFL savings to ComEd.
- Field data should be checked periodically for quality and accuracy and communication put in place to minimize the likelihood that obtaining this information doesn't provide an undue burden for customers or implementers.
- Consider expanding program measures to common areas, such as water efficiency measures in public bathrooms and lighting measures in hallways, to attract more participants.

### **Process Recommendations**

- Implementation contractors, program staff, and evaluators should work together to ensure that systems are in place for efficiently merging data and reporting on participation and savings from different program databases used by implementation contractors.
- As the program upgrades its data-tracking capabilities, implement handheld electronic devices or laptop computers to minimize manual data entry.
- Add additional screening questions to identify properties that receive housing subsidies directly or tenants who receive subsidies to reduce the risk that projects will be hit with a high free ridership rate.

- Coordinate with state and federal programs that service the multifamily markets to avoid overlapping incentives and duplication of efforts.
- When working with a large property management firm, program representatives should target on-site staff with information to help get their buy-in to the project.
- Develop additional marketing material, such as case studies, that participants could share with colleagues.
- Develop procedures to follow up with participants to measure program satisfaction, provide technical information on the measures, and solicit referrals.

### *3.4 All-Electric Single Family Home Energy Performance Tune-Up*

The All-Electric Single Family Home Energy Performance Tune-Up Program is a residential direct install and educational program offering low cost energy saving measures as well as a home energy survey to the single-family all-electric home market. The home energy survey provides recommendations for cost effective energy saving equipment upgrades, as well as maintenance and other every-day practices. The PY3 evaluation covered the all-electric program as well as three single family pilot programs that were run in cooperation with Gas Utilities that share ComEd's service territory. The pilots evaluated include:

- Joint Single Family Retrofit Pilot Program, implemented cooperation with Nicor Gas ("Retrofit Pilot")
- The Joint Single Family Direct Install Pilot Program is implemented in cooperation with Peoples Gas and the Chicagoland Natural Gas Savings program. ("Direct Install Pilot")
- The Joint Single Family Air Sealing Pilot Program is implemented in cooperation with Peoples Gas and the Chicagoland Natural Gas Savings Program. ("Air Sealing Pilot")

Across all four programs, the single family efforts have net savings of 2,171 MWh. More than half of which is associated with the Direct Install Pilot, which achieved 1,440 MWh. The total program year net kWh per home is fairly similar between PY2 and PY3, with PY3 being slightly lower (824 kWh for PY3 and 839 kWh for PY2). Gross impact realization rates range from 81% for the Retrofit Program to 97% for the Air Sealing Pilot. The overall gross impact realization rate for all four programs together is 83%. Net-to-gross ratios range from 74% for Air Sealing Pilot and the Retrofit Pilot, to a high of 92% for the All-Electric Home Program. The program achieved net savings of 360 MWh, most of which arise from CFL installations (39%) and showerheads (23%). Gross impact realization rates range from 67% for faucet aerators to 119% for pipe insulation.

Altogether, nearly 7,500 homes participated in one of the three single family pilot programs resulting in an ex-post net energy impact of 1.8 GWh. Across all three pilots, the overall gross impact realization rate is 83% and the overall net-to-gross ratio is 80%. Individual pilot program gross energy impact realization rates range from 81% for the Retrofit Pilot to 97% for the Air

Sealing Pilot. Net-to-gross ratios are 74% for both the Retrofit Pilot and the Air Sealing Pilot, and 81% for the Direct Install Pilot.

**Impact Recommendations.** Impact recommendations are presented below for the Retrofit Pilot program only, as it is the only single family program addressed in this evaluation that is slated to continue into PY4.

### Tracking System.

- If the current software specifications allow it, it is recommended that demand impact figures associated with Retrofit Pilot weatherization measures be generated for the tracking system.
- Ensure pre- and post-retrofit R-values are recorded for all insulation measures. The savings associated with installing insulation measures is highly dependent on the levels of pre-existing insulation.
- Other data that would be useful to evaluators include number of stories above grade, leakage type, and insulation type.
- KWh and kW savings from weatherization and air sealing measures arise largely from reduced cooling loads. For this reason, they rely on specifications of air conditioning type and efficiency. *To support future impact evaluation, it is recommended that the tracking system store key information regarding the cooling system. Ideally, this would include air conditioning type, capacity and efficiency. However, efficiency can be difficult to determine on-site, but the age and make / model information serves as an excellent reference.*
- Lastly, the program provides the direct installation of water savings measures, but does not store the water heater fuel type in the tracking system. *It is recommended that the tracking system record the water heater fuel type of participating homes.*
- In developing cost savings estimates for the audit report presented to customers, an annual kWh savings of 51 was assumed for all CFLs installed. The average annual kWh savings for bulbs installed through the program is 44.5. *To avoid presenting overestimates of the annual energy cost savings, it is recommended that the assumed savings for CFLs be reduced from 51 kWh to 44.5 kWh for the purpose of customer audit report generation.*

### CFLs

- It is recommended that the PY4 program take care to make sure that CFLs installed through the program are replacing incandescent bulbs and not other CFLs.

- It is recommended that program contractors make sure the CFLs keep within prescribed wattage ranges of the incandescent bulb they are replacing.
- It is recommended that program contractors make sure the CFLs are installed in high use areas or that the estimated HOU be collected in the tracking system.
- It is recommended that ComEd monitor the levels of pre-existing CFLs in participating homes. Customers with high CFL saturation prior to participating are somewhat more likely to be free riders, and less likely to have high-use sockets qualifying for CFL retrofit. If ComEd observes a marked change in pre-existing saturation levels among participants, perhaps a change in program marketing, or even a new participant screening criteria, may help to preserve program impact.
- It is recommended that all of the above CFL guidelines and policies be documented in program operations manuals, and highlighted in related contractor training material.

## **Weatherization Measures**

- It is recommended that ComEd request the new model slated for use in PY4 to estimate weatherization measure impact, take into account the interactive effects of installing multiple measures, if it doesn't do so already.
- It is also recommended that one of the following options be used in future program year evaluations to assess the impact achieved by the weatherization measures: evaluate the ex-ante model calculations, conduct a billing analysis, or create more refined building simulation models on a subset of the population by either collecting more detailed home characteristic information at the time of participation or over the phone at a later date.
- To improve the overall cost effectiveness and impact performance of the attic insulation measure ComEd may consider capping pre-existing R-values for attic insulation at R-11.

## **Deemed Savings**

- It is recommended that ComEd use a partially deemed approach for the Single Family program over the next cycle. It is not recommended that net-to-gross ratios be deemed at this time, as they are tightly bound to delivery characteristics which may evolve as the program moves out of the pilot stages. In addition, the deemed savings values do not include an adjustment for invalid installations of CFLs (where CFLs replace CFLs). It is recommended that ComEd continue to monitor this parameter and consider measurement in future evaluations.

- Deemed values are not recommended for the weatherization measures because the savings are subject to wide variation depending on the specific home characteristics. Moreover, the pre-retrofit condition has a significant impact on the magnitude of the measure savings.

## Process Recommendations

Due to their experience with the Retrofit Pilot program, program staff is aware of several PY3 implementation issues and possible solutions. Here, we present key recommendations based on findings from interviews with program staff as well as a survey of participants.

- To meet participant demand in PY4, ComEd should consider providing more appointments during the evenings and on Saturdays, since customers may otherwise need to miss work on multiple days to participate in the program.
- To maximize the conversion rate (audit to retrofit) and increase participant satisfaction, ComEd should closely track and monitor key steps participants take in advancing through the program to retrofit installation. The program can address this key issue in the following specific ways:
  - Consider providing participants a “next steps” sheet indicating how to proceed after the audit. Email communications, already planned for PY4, should be one way to deliver these “next steps.”
  - Quickly convert audit results into work orders.
  - Consider tracking unconverted participants by group (e.g., safety repairs pending; ready for retrofits, etc.) and target each with regular email reminders.
- Consider regularly reviewing participant satisfaction with the auditors. Direct Install-only participants were significantly less satisfied with the auditors than full participants were (8.3 vs. 9.2). Although ComEd will use different implementers in PY4, it is worth underscoring the importance of the auditors in their roles as the “face of the program” and of ComEd.
- As much as possible, attempt to take advantage of planned program changes to increase participant education in energy-saving tips, CFL information, and other ComEd programs. In PY3, ComEd leave-behind materials contained substantial amounts of information, but auditors were too busy to fully present these materials to participants. Additionally, program staff should use email communication (planned for PY4) to provide participants with further exposure to this information.

### 3.5 Central Air Conditioning Efficiency Services

The main goals of the CACES program are to increase the efficiency of existing air conditioning equipment and promote the quality installation of high-efficiency equipment in replacement situations and in new construction. The program also seeks to improve the overall quality of residential HVAC services by increasing the visibility of participating independent contractors as vendors focusing on quality and using state-of-the-art diagnostic tools.

The residential CACES program consists of two distinct programs serving different markets through a common marketing and delivery infrastructure. The Diagnostics and Tune-Up program targets improved efficiency for existing residential air conditioning equipment. The Quality Installation program addresses high-efficiency equipment installations for new and replacement air conditioning equipment.

Participation in the CACES programs were mixed in PY3. Quality installation participation met its revised goals, but those goals were revised down to less than 10% of the original plan based on PY2 results.

Diagnostics and Tune-Up program participation fell short of goals by more than 50%; however, savings *per participant* was very close to planned values. Planned savings per participant was sharply reduced during PY3 to reflect the evaluation results from PY2<sup>18</sup>. The factors contributing to low savings in PY2 appear to persist. These include:

1. Poor economic conditions might mean that mostly homes with annual service contracts were tested with this program. Annual service should serve to increase the initial baseline efficiency of central air conditioners.
2. Conversely, homes that might have less efficient equipment perhaps did not get tune-ups because of the economy.
3. Hours of operation have been over-estimated in *ex ante* simulations. Residential behavior is extremely difficult to capture in simulations.

Persistence of tune-up savings is notably high. Many program participants tuned-up equipment in both PY2 and PY3, probably due to having annual service contracts. By comparing PY2 post-installation performance to PY3 pre-installation performance we see very little decrease in the efficiency index. A drop of 2-3% in performance from one year to the next is typical.

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<sup>18</sup> PY2 results were lower than the original *Commonwealth Edison 2008-2010 Energy Efficiency and Demand Response Plan*, November 15, 2007 due to lower estimates of hours of operation and baseline equipment efficiency that was better than anticipated during PY2.

The Quality Installation program was greatly scaled back in the revised program goals. Actual participation did exceed the reduced goals. The weather-normalized billing analysis of the savings show realized savings per unit comparable to the PY2 analysis<sup>19</sup>.

In general, Navigant notes that the PY3 results are consistent with the PY2 results on a per participant basis.

An assessment of net-to-gross was made through interviews with independent participating and non-participating air conditioning contractors. Since the incentive is paid to the contractors, changes in contractor behavior is used to determining the net-to-gross ratio. Most responses support NTG near 1.0: contractors have improved their tune-up techniques using more sensors and data to optimize equipment. When sizing and installing equipment they are more likely to use more rigorous and accurate techniques than they were without the program.

### 3.6 *Home Energy Report*

The Home Energy Report pilot was designed to determine if residential customer energy use can be altered by providing particular sets of information about customer energy use and energy conservation. The information is provided in the form of Home Energy Reports, which give customers various types of information, including: a) how their recent energy use compares to their energy use in the past; b) tips on how to reduce energy consumption, some of which are tailored to the customer's circumstances (e.g. customers with pools receive information on how to reduce energy use by pools); and c) information on how their energy use compares to that of neighbors with similar homes. This set of information has been shown in other studies to stimulate customers to reduce their energy use, creating average energy savings in the 1% to 3% range, depending on local energy use patterns. ComEd started the pilot for 50,000 residential customers on July 14, 2009.

The Home Energy Reports Program appears to be performing at a level comparable to what has been found in published analyses of other applications of the program. Key findings:

- Total annual program energy savings for PY3 was approximately 13,479 MWh.
- On a percentage basis, average energy savings for the second year of the program was 2.02% for high energy users (Group 1), 1.80% for low energy users receiving bimonthly reports since the inception of the program (Group 2), and 1.55% for low energy users who initially received monthly and then quarterly reports (Group 3).

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<sup>19</sup> *Ex ante* per unit savings in PY3 was based on the results of the PY2 evaluation

- In PY3, high energy users (Group 1) contributed about twice as much savings on a per customer basis (445 kWh/year) as low energy users (215 kWh/year for Group 2 households, 186 kWh/year for Group 3 households).
- In PY3, savings for Groups 2 and 3 were *not* statistically different at the 90% confidence level. This indicates that, although the two groups initially received reports at different frequencies, any effects from this differential treatment has not carried over into PY3, in which both groups receive reports bimonthly.
- Among Group 1 households, the estimate for average savings in PY3 for customers in the lowest income category (\$0k-\$30K annual income) appear to be lower than for households with intermediate and high incomes, though due to the small sample of households in the low income category it is not possible to assert this result with confidence. Also due to the small sample size it is not possible to conclude that savings for low income households are different than zero.
- After controlling for differences in weather, annual savings increased from the first year of the HER program to the second, indicating that behavioral changes generated increased savings across the two program years. The increase in weather-controlled annual savings is driven by increased savings in the fall and summer seasons, indicating that it is in these seasons that behavioral changes have been greatest.

**Recommendations.** Navigant recommends that the HER program remain in its current form for another year. Program savings appear to be rising, and continuing the program for another year will allow an examination of the persistence of program effects and provide a clearer picture of the effect (if any) of income on program savings.

To investigate whether program savings persist after Home Energy Reports are terminated, Navigant recommends randomly removing from the program one-half of the Group 1 (high use) households at the start of PY5 (Summer 2012), and replacing this group with an equal number of additional high-use households. By comparing the electricity consumption of the four sets of households thereby generated –treatment households that continue in the program, treatment households removed from the program, new treatment households, and original control households—ComEd can test persistence of savings for both those households that remain in the program and those households removed from the program. We propose removing half of the Group 1 households –as opposed to removing treatment households from a different group, or removing a different fraction of households—for the following reasons:

1. Group 1 has the highest savings rate (2.02% in PY3), and the highest number of treatment households, and so the probability of statistical detection of persistence effects is greatest. Statistical detection is maximized by splitting the sample of Group 1 households evenly.



2. Based on previous simulation analysis done for ComEd, we estimate that splitting the sample in this way will allow statistical detection, at the 95% confidence level, of any difference in savings between Group 1 treatment households and Group 1 “removed” households that is 0.75% or greater. So, for instance, if Group 1 households that continue to receive the report generate savings of 2.0% in PY5, while savings for households removed from the program drop to 1.25%, statistical analysis is highly likely to detect that average savings by the removed households is indeed less than that of the continuing households.

### *3.7 Central Air Conditioning Cycling*

Central Air Conditioning Cycling is ComEd’s residential direct load control program. The program allows ComEd to cycle off and on a participant’s home central air conditioner condenser so it safely uses less electricity to ensure the reliability and stability of the electrical grid. It is an on-going program that Commonwealth Edison began in 1996. At the end of Program Year 3, there were approximately 73,000 participants in the program.

Impact evaluation of this program is regularly performed by GoodCents Solutions, the installation contractor, based on a sample of approximately 250 customers that have whole house interval meters installed.

ComEd has a target of recruiting an additional 22,682 participants over three years for the Central Air Conditioning Cycling program as part of the Energy Efficiency and Demand Response Plan. Their plan calls for 8,092 new customers in Program Year 1 (PY1), 7,695 in Program Year 2 (PY2) and 6,896 in Program Year 3 (PY3). Since this is a demand response program, there are no associated energy savings goals. The demand reduction achieved from these additional participants is expected to meet the statutory Demand Response goal, which is to reduce peak demand by 0.1% over the prior year for eligible customers.

This study uses billing and program tracking data analysis to evaluate the similarities between old and new participants in the Central Air Conditioning Cycling program. Upon examining the data for old and new participants in the Central Air Conditioning Cycling program, the characteristics of the participants are uniform for all groups. The annual energy use characteristic changed this year with more participants joining at the extreme ends of the annual energy use spectrum. Characteristics that were examined for similarities were geographic location, energy use, and selection of cycling level.

Overall the distribution of annual energy use is very similar for the old and new participant groups. Given this similarity, the impact estimates for new participants are not expected to be different from the impacts of the old participants. The normalized PY3 participant data shows consistency with the other groups.

ComEd's ex-ante impact estimate was based on the assumption that 40.9% of new participants will choose the 50% cycling option while 59.1% will choose the 100% load shed option. This is equivalent to 1.446 kW per participant. The biggest difference between ex-ante and ex-post savings comes from the increase in the number of customers that joined the program compared to the PY3 program participation goal. A smaller difference comes from the fact that the 100% cycling option was chosen by 62.8% of new customers, compared to the original estimate of 59.1%. There is no free ridership or spillover expected in a direct load control program as a result, the Net-to-Gross ratio for this program is one and the net savings equal the gross savings.

### *3.8 Business Prescriptive*

The ComEd Smart Ideas for Your Business program provides incentives for business customers who upgrade their facilities with energy efficient equipment. There were two program elements that were available to ComEd customers during PY3: a Custom program and a Prescriptive program.

The Business Prescriptive program provides an expedited incentive application approach targeting retrofit and replacement opportunities in lighting, HVAC equipment, variable speed drives, refrigeration, motors, and food service equipment. In the second half of PY3, ComEd expanded its offering for Prescriptive variable speed drives by adding a new measure incentives for HVAC pumps, fans, and chillers, process pumps and fans, compressed air, and "other" fans and pumps. Also in the second half of PY3, ComEd introduced a Midstream Incentive Pilot program that worked with prequalified distributors to offer their customers a discounted price on CFL purchases.

The PY3 Prescriptive evaluation found that verified gross energy savings were 1 percent higher than savings in ComEd's tracking system, as indicated by the realization rate (realization rate = verified gross / tracking system gross), while peak demand impacts were 11 percent lower. These realization rates are lower than PY2, where the energy realization rate was estimated to be 1.21 and peak demand was 0.99. The verified net-to-gross ratio (NTGR) for PY3 of 0.72 was slightly lower than the PY2 value of 0.74.

The Prescriptive realization rate for peak demand was 0.89, reflecting primarily the impact of relatively lower demand realization rates for some sampled variable speed drive measures, the removal of HVAC interaction factors on some sampled lighting projects that were not installed in conditioned spaces as assumed in the default values, and baseline adjustments applied to several projects that received on-site verification.

The primary factors lowering the demand realization rates also resulted in lower energy realization rates on individual projects. The primary factor that raised the Prescriptive energy realization to 1.01 was a common finding, through on-site verification and telephone

interviews, of longer hours of use than assumed in the default savings. Longer hours of use has a disproportionately greater impact on energy than demand – for example, if an industrial plant is found to operate continuously throughout the year, the energy realization rate will increase by 104% over the default value (8,760 ex post hours / 4,290 ex ante hours), whereas the peak demand realization rate will only increase the coincident-diversity factor by 1% (1.00 ex post / 0.99 ex ante).

Impacts for the Midstream Incentive Pilot program show that the gross realization rate on energy is 10 percent higher than ComEd claimed savings because the evaluation team included an HVAC interaction factor for energy impacts. The net-to-gross ratio (NTGR) for PY3 of 0.74 was assumed based on results for lighting-only measures in the Business Prescriptive program.

### **Key Impact Findings and Recommendations.**

**ComEd should consider conducting a detailed review and testing of the implementation of the tracking system’s handling of variable speed drive (VSD) projects.** The ex ante impacts for variable speed drives did not match expected values in many instances, and contributed to significant deviations between ex ante and ex post findings on a project by project basis even when the evaluation team agreed with ComEd on the project details. Since there were a number of evaluator recommendations regarding VSDs in PY3 and ComEd has acted upon some of them since closing out PY3 projects, the evaluation team will assist ComEd in this effort in PY4 by producing updated recommendations and guidance for addressing VSD applications.

**ComEd should consider working with the evaluation team to review PY3 site M&V and telephone survey data to identify potential refinements to default values that may be applied to PY5.** Measures that weight baseline scenarios of wide variation into a single average, such as permanent lamp removal, contributed to significant deviations between ex ante and ex post findings even when default values were properly applied.

**ComEd should consider placing tight restrictions on new construction projects admitted into the Prescriptive program, such as restricting maximum motor horsepower size for VSD measures.** On four of nine variable speed drive measures claimed in a sampled new construction project (those involving larger motors 50 horsepower and above) the evaluation team concluded that system design and final control strategy as implemented by the customer did not produce savings beyond code requirements. This resulted in a significant reduction in energy and demand impacts for the project.

**When ComEd is adding a new end-use or new measure types to an existing end use, consider alerting the evaluation team who may need to revise data handling routines.**

**During PY4, prior to closing out year-end ex ante savings estimates, ComEd should consider working with the evaluation team to review multiple factors that can affect ex ante savings.** The evaluation team can review default lookup values coded into the tracking system and check

the values against the default values documentation, and advise ComEd on any differences. The evaluation team could also review the output of changes to ex ante calculations that are made in the tracking system.

**ComEd should consider investigating customer satisfaction with light levels and consider strategies to reduce under-lit designs if dissatisfaction is common.** Seven of 79 respondents in the CATI survey reported that they installed additional lighting fixtures in the same space at a later time to increase the amount of lighting. ComEd indicates they have taken steps to identify potential under-lit designs in the pre-approval stage and contact those customers to make them aware of the potential for lighting level reductions.

**ComEd should consider discussing their experiences with potential spillover candidates and projects with the evaluation team.** The Prescriptive evaluation team will be conducting an enhanced effort to identify potential spillover candidates and quantify spillover in PY4. If participant spillover can be reliably characterized and quantified, it may be possible for ComEd to develop strategies to encourage it.

**For CFLs installed through the Midstream Incentive, the evaluation team recommends that ComEd consider including energy and demand interaction factors with the HVAC system when estimating claimed savings.** If additional measures are added to the Midstream delivery approach, ComEd should consider including HVAC interaction factors, depending on the measure type.

## **Key Process Findings and Recommendations**

### **Program Participation**

**Consider removing or increasing project incentive caps.** Given the increasing program goals and the decreasing average project size, increasing project incentive caps may be beneficial in bringing in larger Prescriptive projects. ComEd has raised the per-premise cap from \$400,000 in PY3 to \$1,000,000 in PY4.

**Consider special offerings for sectors with limited participation but high savings potential.** The medical and lodging sectors have experienced stagnant participation growth, but they have had relatively high per project savings. Further research might be required to identify industries to target for special promotions and identify their specific barriers to participation.

**Consider offering special promotions for non-lighting measures.** While lighting projects will continue to be critical to the success of the program, the program should consider offering special promotions for non-lighting measures to further encourage their implementation.

### **Trade Ally Network**

**Consider attempting to enhance and better communicate the benefits of becoming a trade ally.** While the program was not actively seeking to add more trade allies to its network, providing attractive benefits for trade allies and disseminating this information will be important in further strengthening the network.

**Consider options for Basic Training that reduce the time-burden for trade allies.** While most interviewed trade allies saw no problems with the new trade ally requirements, active non-trade allies most often cite the time burden (including travel) of attending training in person as the main reason for not becoming a trade ally. While ComEd offers Basic Training as a webinar in certain situations, they consider in-person training to be more effective. The program should consider options such as offering a limited number of trainings via a web portal (in-whole or in-part) or in locations other than the KEMA office in Wheaton.

### **Trade Ally Bonus**

**Consider increasing the promotion of the trade ally bonus.** Knowledge of the bonus offering was not widespread amongst interviewed contractors.

**Consider additional communication of the new two-tiered bonus structure and bonus timing.** Additional research into bonuses offered by Ameren Illinois and other utilities found that apart from the bonus structure, strong communication and clear expectations are crucial to the success of such an effort. The program should strive to communicate the modified bonus program early and clearly to both trade allies and non-ally contractors, and provide sufficient lead time for contractors to increase their promotion and take advantage of the offering to the fullest extent.

### **Account Managers**

**Consider implementing a formal process for tracking leads.** No formal process for tracking customer leads exists in the Smart Ideas Program, although ComEd indicates systems are under development. Interviewed Account Managers indicated that such a system would be a useful tool for Account Managers and Smart Ideas staff alike.

### **Marketing and Outreach**

**Consider offering new attractions for future Energy Efficiency Expos.** The program should find ways to keep the Expo attractive for returning customers and reflect that in outreach efforts, or consider adjusting Account Manager goals with respect to Expo recruitment.

### 3.9 Business Custom

The Custom Business program offers incentives to business customers who upgrade their facilities with equipment or processes that are not included in the Business Prescriptive program. These projects frequently include more complex efforts that require engineering analysis and on-site measurement and verification in order to determine energy and demand savings. Customers may receive technical resources from expert engineers and contractors. Customers qualify for financial incentives based on the estimated energy and demand savings from their custom project upon verification of installation.

Combined the Custom and Prescriptive programs exceeded PY3 goals.

The gross impact results yielded an energy realization rate of 0.85 which is considered to be high for a custom program. This shows that ComEd is continuing to do a good job of estimating gross impacts for Custom energy efficiency projects in the program. In general the implementation team did a very good job of ensuring that all measures are installed and operational. PY3 energy savings realization rate results indicate that the smallest projects (stratum 3, RR = 1.14) realized a greater proportion of the ex ante claims than the largest (stratum 1, RR = 0.81) and medium projects (stratum 2, RR = 0.57). The evaluation team hypothesizes that this may be due to the complexity and additional uncertainty associated with the large projects in strata 1 and strata 2. The program can further improve the gross impact results by using improved data collection methods and enhanced calculation models. Key evaluation conclusions and recommendations include the following:

#### Improvements to Ex Ante Impact Estimates

**Finding.** The program savings calculations did not always represent annual operating conditions. For example, the ex ante calculations were found to not accurately represent facility operating hours.

- **Recommendation.** To improve program calculations and realization rates, the program could do a better job of verifying operating hours and to examine whether or not the data collected represents typical annual operating conditions for the installed equipment. Adjustments should be made to energy usage calculations (if appropriate) based on information provided by the customer or other available sources.

**Finding.** The program calculations (specifically for compressed air projects) are not normalized to account for changes in facility production levels or equipment load profiles.

- **Recommendation.** Determine whether pre or post measurement data will require normalization to properly adjust for production differences including appropriate adjustments for weekly or seasonal variation or for market fluctuations. For compressed

air projects energy usage calculations should be normalized if the airflow profile has changed from pre retrofit period to the post retrofit period.

**Finding.** The program calculations did not perform reasonable sanity or reality checks to verify the reasonableness and the range of estimated savings for projects that involved estimation of critical parameters.

- **Recommendation.** Where possible collect site specific data through measurements in support of critical model parameters. Avoid using rules of thumb or percent savings from manufacturer literature. At a minimum verify all assumptions and estimates with appropriate considerations of site specific conditions. Additionally, implementers can obtain manufacturer performance data sheets or use Air Master+ software for compressor units and use them as needed to aid the ex ante calculations. When performing billing analysis, collect information to ensure that other factors (that might skew the savings) are accounted (i.e. miscellaneous loads, other energy efficiency measures and addition of new loads, etc.).

**Finding.** The peak kW calculations were not always consistent with PJM requirements or were not representative of the actual operation of the system during the peak period. Peak kW estimates were often set to zero.

- **Recommendation.** Calculate peak kW savings for all projects and ensure that the estimated savings meet PJM peak demand calculation requirements for weather and non weather dependent projects.

**Finding.** There were a number of cases where the sources of inputs used in the program calculations were not documented. Also, sources for electric unit cost (\$/kWh) were not available and were found to vary considerably site-to-site.

- **Recommendation.** Provide sources for all the inputs and assumptions used for program calculations (especially for any critical parameters such as load factors, power factor, full load amps, temperature set points and operating hours). Collect nameplate or manufacturer information for all the equipment; the nameplate information can be used to verify inputs used for ex ante savings calculations.

### Baseline Selection Issues

**Finding.** The baseline condition was adjusted (in the evaluation) for four projects, which had a significant effect on the total realized savings for two projects. The most common problem observed is the use of pre-existing equipment as the baseline.

- **Recommendation.** One step that would improve the realization rate would be adjusting the baseline condition consistent with the evaluation approach when the existing

equipment being removed has a relatively short remaining useful life or generally requires replacement.

- Identify projects explicitly in program files as replace-on-burnout, natural turnover, or early replacement.
- The age, remaining useful life, operating condition of the existing equipment and the estimated time at which the existing equipment would have been replaced in the future should be verified before selecting the existing equipment as the baseline condition.
- The true test for early replacement should be whether or not there is strong evidence pointing to program induced accelerated adoption.
- For the replace-on-burnout and natural turnover cases, baselines should be based on the efficiency of alternative new equipment or code requirements and not the existing in situ equipment.

### **Program Eligibility Requirements**

- **Recommendation.** Program implementers should provide strong evidence and supporting documentation that clearly demonstrates that the installed higher efficiency equipment exceeds the efficiency of standard practice.

### **Data Collection**

**Finding.** When the program collects measured data in support of ex ante impact calculations and uses that as a source for estimating savings or for model calibration, the resulting ex ant savings estimates were found to be more accurate.

- **Recommendation.** The program should continue to take measurements for pre retrofit and post retrofit equipment. Measured performance of PY3 projects resulted in accurate savings calculations and high realizations rates (also reflected by the resulting high program RR). Projects with measured program data (obtained from logging or from a customer's SCADA system) were used by the evaluators to inform modeling and assign values to critical parameters. Evaluators do not have access to pre-installation equipment and conditions; therefore, ex ante measured data can greatly benefit the accuracy of ex post savings calculations. However, it is recommended that the program collect kW measurements and use amperage metering sparingly, such as when the panel size is too small to install kW current transducers or when only amperage data is collected in the SCADA system.



## Net Impacts

**Finding.** Free-ridership levels for PY3 custom program are 44%, which represents a significant increase from 24% in PY2. Mean free-ridership was relatively high across the two largest projects (sampling strata 1).

- **Recommendation.** One approach to reducing free ridership is for program administrators to simply exclude projects from the program that they believe have a high probability of being free riders. For example, incentives should not be provided to projects that are already installed. Similarly, if there is evidence that the program did not contribute significantly to the decision to install a particular project or equipment type then an incentive may not be warranted. Incentives might only be provided if the program process leads to a higher efficiency level than initially planned. Consider tying performance of the program implementation staff (or implementer in general) not only with the gross impact but also with the verified net savings.

## **Key Process Findings and Recommendations**

### Trade Ally Network

**Finding.** PY3 marked the introduction of new trade ally requirements. While most interviewed trade allies saw no problems with these requirements, active non-trade ally contractors most often cite the time burden of attending the training in person as the main reason for not becoming a trade ally.

- **Recommendation.** Consider offering basic trainings online. If disseminating the information provided in the training is considered important to continue to increase the quality of applications, then the program should consider offering trainings via a web portal. This will allow more contractors to take advantage of the training opportunities and would reduce a barrier to becoming a trade ally.

### Trade Ally Bonus

**Finding.** Additional research into trade ally bonuses offered by other utilities found that apart from the bonus structure, strong communication and clear expectations are crucial to the success of such an effort.

- **Recommendation.** The Smart Ideas program has already modified its bonus offering for PY4, adopting a tiered system modeled after Ameren Illinois' trade ally incentive structure. The program should strive to communicate the new bonus program early and clearly to both trade allies and non-ally contractors, and provide sufficient lead time for contractors to increase their promotion and take advantage of the offering to the fullest extent.

### Program Marketing and Outreach

**Finding.** Lack of program awareness is still a key barrier to participation in the Smart Ideas program. In addition, reaching the correct decision-maker is a major hurdle both in increasing awareness of the program and encouraging participation. However, opportunities exist to increase participation in the Smart Ideas program among current non-participants. Almost two-thirds of non-participants indicate that there have been installations of equipment, or other upgrades, at their facility in the past three years. Despite the economic climate, customers are active in installing new equipment and have an interest in energy efficiency.

- **Recommendation.** The program should attempt to develop a more targeted database of energy decision makers for their larger customers. To start this database, Account Managers could be engaged to provide decision maker contact information for each of their managed accounts.

### 3.10 *C&I Retro-Commissioning*

This Program provides a platform to assist commercial and industrial customers improve performance and reduce energy consumption through the systematic evaluation of existing building and industrial systems. Low- and no-cost measures are targeted and implemented to improve system operation, reduce energy use and demand, and, in many cases, improve occupant comfort. Program Year 3 represented the second full year of implementation for the Smart Ideas Retro-Commissioning Program. A total of 34 sites and buildings participated in the program, including 3 large industrial sites, one small industrial site and one participant in the monitoring-based retro-commissioning pilot. More than 200 measures were implemented among those sites.

The PY3 gross *ex ante* energy savings for this program were 22,662 MWh. The gross savings *ex ante* savings exceeded program goals<sup>20</sup> by about 21%. The evaluation adjusted gross saving realization rate for electric energy savings is 95%. The reasons for a realization rate less than 100% include: infrequent errors in engineering calculations and inaccurate assumptions that affect those estimates. Among these factors are:

1. Not systematically including ventilation savings when air handling equipment is turned off.
2. A single large-impact measure that was based on the average measured fan speed rather than average power at the measured fan speed.

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<sup>20</sup> Program goals based on “Revised Target Net MWh” by program in a spreadsheet supplied by ComEd, July 2011.

3. A few measures that were implemented during the verification phase were found inoperative or disabled during the evaluation.

Each of the items that result in a measure or project-level realization rate other than 100% represents isolated errors. In this respect they show that efforts to encourage universal defaults and methods have been generally successful. Instances of these errors are less frequent than during PY2, and in future program years we would expect these sorts of problems will diminish further. Consistent application of methods and assumptions will enhance the repeatability, consistency, and veracity of savings estimates as the program expands the number of third party Retro-Commissioning Service Providers (RSPs) as the primary delivery and savings estimation entities.

**Persistence.** Persistence of measure installation and thus savings appears to be strong. Telephone interviews with PY2 participants found previously verified measures 100% in place. Furthermore, participants have implemented additional retro-commissioning-type measures or have improved savings of previously verified measures with tighter schedules or more aggressive setpoints.

**Free-Ridership.** Free-Ridership with this program increased substantially from PY2. The evaluation completed interviews with eight participants of an attempted census (34). The free-ridership questions established a free ridership rate of zero for four of the projects, a rate of 0.05 for one project, and 0.44-0.55 for the other three projects. The sites that had indications of free-ridership all had equipment deficiencies and solutions known to the appropriate people in the company. The companies stated that they would have taken all of the completed actions within one to two years even if the program had not been available.

Overall, five of eight interviewed participants were already aware of essentially all performance issues identified by the RCx study, and four of eight were already aware of essentially all recommended solutions. This suggests that the program may be directing its study resources towards opportunities that are already known. Not surprisingly, these participants are the ones who would have implemented the same RCx measures without the program.

- **Recommendation.** Consider free-ridership in screening of projects. Customers who were already aware of performance issues and solutions before the RCx study would often have implemented the same RCx measures without the program. While awareness of performance issues might help the program identify eligible projects, caution should be given in screening more informed participants, as their participation could result in free-ridership issues in future years.

### Key Process Findings and Recommendations

**Program Processes.** Program staff have done a good job incorporating lessons learned from prior program years into the PY3 program design. RSPs and customers find that participation

processes are clearly explained. Some RSPs expressed frustration with certain parts of the application and review processes, including duplication of inputs throughout the process and lengthy review from the program administrator. Program timelines still present problems for participants, however this has been improving as RSPs have gained more experience with the program. That noted, overall feedback for the program was very positive.

- **Recommendation.** Re-evaluate the time requirements for each phase as most projects do not meet them and RSPs consider them too aggressive for the work required. Explore flexibility in the legislation-mandated timeline, as you have with early enrollment in PY3 and now PY4. Retro-commissioning projects typically span 1 ½ to 2 years between contract signing and measure implementation.
- **Recommendation.** Streamline the application and review process. For example, reduce duplicate information required for each phase of the project and eliminate review of documents that have already been reviewed and have not changed.

**Participant Satisfaction.** Interviewed participants provided high satisfaction ratings for the program. Overall, participants gave very high ratings to their satisfaction with all aspects of the program about which they were asked, including the level of commitment required to receive the free study, the information provided in the retro-commissioning study, the program administrator (Nexant), the Smart Ideas for Your Business Program staff, the retro-commissioning program overall, and ComEd overall. Only one interviewed participant gave a dissatisfied rating to Nexant and stated that the program administrator did not push the report through in a timely fashion.

Program participants were generally very satisfied with their RSPs and found that the RSP was able to meet their needs in terms of identifying measures. All eight interviewed participants would recommend their RSP to other firms, though one participant, contacted for impact evaluation questions, was disappointed with their RSP and the scope of the measures recommended.

Based on their experience in the program, all interviewed participants stated that they would recommend the Retro-Commissioning program to their peers inside and outside of their organization. Participants' suggestions for improving the program included offering chilled plant water optimization as a measure and to further streamline the participation process.

- **Recommendation.** Maintain close PA engagement even into the implementation phase to keep projects on track and identify any participation problems early.

**Retro-Commissioning Service Providers.** Despite their criticism of some aspects of the program, RSPs were very satisfied with the program overall in PY3 and found that it met or exceeded their expectations. RSPs were very satisfied with the support from ComEd and Nexant, but less satisfied with certain elements of the program such as the amount of

documentation required and the lengthy review process. In general, RSPs found the program's performance review process and training to be helpful, but offered some suggested improvements. Overall, RSPs found that the benefits of participating in the program outweighed the drawbacks, and their satisfaction was high.

- **Recommendations.** Try to maintain continuity of PA reviewers for each project so that settled questions at one stage do not reappear later in later phases of the program.

**Marketing and Outreach.** RSPs remain the primary promoters of the retro-commissioning program and are expected to generate leads. Based on their feedback, ComEd and Nexant provide a sufficient level of support for outreach, but RSPs feel that the development of additional case studies and project leads would be welcome.

- **Recommendation.** Assist RSPs develop their *own* case studies for the Program, while maintaining a consistent message about the Retro-Commissioning Program as a whole. This might include developing a case study template with Program boiler-plate information that can be substituted in future years as the program evolves.
- **Recommendation.** Continue to monitor the number of leads generated by RSPs and the rate of conversion into completed projects. Leads that do not turn into completed projects might become an issue, if the program has to spend resources on processing a lot of ineligible leads and might lead to dissatisfaction among customers who do not qualify for the program.
- **Recommendation.** Increase engagement of ComEd account managers in program outreach. Given that retro-commissioning is not a widely known concept, program staff and RSPs find that it is most effective to introduce the program in person. Account managers would be ideally suited to inform their large customers of the program and its opportunities.

**Program Tracking Data.** In PY3 the Program Tracking Spreadsheet is overwhelmed with 34 participants. Future growth in the program cannot be adequately tracked in a spreadsheet.

- **Recommendation.** The PA should migrate to a database as a tracking platform. The tracking database should also track measure-level savings rather than only project-level data.

**Program quality control.** Continue strong communication and feedback practices among all parties:

- Sharing of technical or process issues with RSPs and participants as soon as possible, either in the initial meetings about the project or in RSP trainings. This will help lower the learning curve for newer RSPs by relaying the lessons learned from past projects.

- Rating of RSP's performance. This is a helpful tool for the program and the RSPs to evaluate service providers and ensure that they are active in the program and deliver high quality work.
- Soliciting feedback from customers about the program as well as their RSP.

### *3.11 Non Residential New Construction*

The program joined the ComEd portfolio of programs in PY2 to bring in energy savings as well as help bring about changes in knowledge of energy efficient commercial building practices. The program maintains three 'tracks' for projects. The most complex is the comprehensive track in which program implementers are highly involved in the design of the building to help bring about savings by combining all building components into a holistic, integrated and efficient design. The systems track allows for less involvement by the implementer to cost effectively garner savings from lighting and HVAC systems. The small building track contains challenging lighting and daylighting requirements for buildings under 20,000 square foot. While the PY2 program contained 16 systems projects, the PY3 program had a mix of systems (33) and comprehensive (4) track projects.

The evaluation analysis reduced the gross impacts only by relatively small amounts from ex-ante to ex-post gross. The gross energy realization rate for PY3 was 99.7% compared to 85% in PY2.

The net-to-gross ratio (NTGR) was 0.65 for the program (compared to the ex ante assumption of 0.85 and a PY2 value of 0.59) with a range of 0 to 0.87. When we break out the NTGR into the two tracks, we find that the NTGR for systems (n=11) was 0.69, and for comprehensive (n=4) it was 0.54. The comprehensive NTGR is low because representatives from two projects indicated that the program had only some influence (i.e., NTGR scores between 0.30 and 0.50) on the energy efficiency of their building. Representatives of the other two projects scored at 0.80 or higher. Even though we calculated the NTGR using all PY3 comprehensive track projects, we emphasize that it is based on only four projects. Given the relatively small number of participants (N=16 in PY2 and N=37 in PY3), two years of data can vary by this amount with no particular way to attribute reasons for the change. However, we believe that the improvements to the NTG battery in our data collection instrument helped us to hone in on the most appropriate net value for the program.

Customers are satisfied and find value from the program. Our research finds that the implementation team is running the program well although we do make a few suggested recommendations for their processes.

**Impact Recommendations.** While our gross impact analysis did not reduce the ex ante energy savings much overall, there is variation in the ex ante to ex post estimates for the sampled projects. To help reduce that variation, we make the following recommendations:

- The implementation team should take steps to ensure they update the savings listed in the tracking system to be consistent with the final version of the calculations.
- The implementation team should review the process for determining and reporting the lighting hours of operation. Specifically, additional questions could be added to the customer interview to account for differences in lighting operation and business hours, control methods, and changes in hours of operation for specific areas.
- The implementation team should be aware of and take care to ensure they do not provide incentives for redundant equipment that the customer does not expect to operate.
- Finally, if the implementation team incents technologies that are not specifically covered under IECC 2009, care must be taken to ensure that an appropriate baseline is chosen. For these cases, typically the baseline must be considered to be standard practice and a clear determination of that standard practice should be described.
- The evaluation team uses the energy interactive effects, demand interactive effects, and peak coincidence factors as documented for the ComEd prescriptive program. We recommend that the systems track measures include these factors in the ex ante estimates of savings where applicable (e.g., lighting measures).

Addressing these areas should improve the accuracy of the claimed savings and ensure that the ex ante claimed savings are consistent with the ex post calculated savings.

**Process Findings.** Similar to last year, program managers faced challenges associated with the economic downturn and the lack of large building construction (the planned cornerstone of the program). Additionally, the program managers indicated difficulty with reaching projects early in the design process; difficulties arising from the program having three separate tracks; and incentive levels. Overall, the implementation team continued to handle these difficulties well, mainly through refining program focus and taking timely, appropriate steps to support the program.

The program had been working steadily with customers of comprehensive projects and PY3 saw the fruits of their labor as the first set of comprehensive projects came through. The program plans to transition to an all-comprehensive track approach over the next few years. Program managers agreed that the increased stringency of IECC 2012 would likely make the systems track obsolete. Additionally, the program was designed to take an early design /comprehensive approach to projects. For example, the program is staffed with building

engineers whose expertise is better leveraged over larger projects, maximizing energy savings while minimizing administrative costs otherwise associated with a greater number of smaller projects. By adopting a single comprehensive track approach, the program may be able to streamline its administrative and marketing activities

The program is currently well poised to transition toward this type of program in several ways. The program managers are focusing on transitioning and are preparing for it. For example, they are refining marketing and outreach to stress the benefits of participating in the program earlier in the project design process. Additionally, the program's network with designers is growing through the training component and through prior participation. As one program manager stated, "We've developed (traction) in the market through the relationships we're developing with the design community." Further, the program targets the design community in many ways including cold-calling because as one program manager explained, "designers are doing ten to fifteen projects a year." Having a designer network supports the comprehensive track of the program by increasing the likelihood that designers will channel projects into the program early in the project design cycle.

No different from last year, the participants we interviewed were very satisfied with the program. They continue to believe it is a valuable program, for the available financial incentives and for the information about energy efficient measures and design they learn about from ECW staff. As one market actor stated, "(Working with the program) was fairly easy, the whole process; and I thought it was very beneficial." Many participants mentioned that ECW staff were extremely helpful throughout the participation process and were knowledgeable about energy efficient design. Participants also found the program valuable in other ways. For example, one customer stated that the program was valuable because the incentives helped "melt internal company resistance" to using energy efficient measures.

**Process Recommendations.** Given the successful implementation of the program during PY3, we make only a few process recommendations:

**Training.** Findings from the participant interviews suggest that many participants are aware of the training sessions through email, indicating that this is one good outreach method. But given that there were several other participants who were not aware of the trainings, this also suggests that the program needs to continue to raise awareness of this program component.

- Consider using the ECW email signature lines to announce upcoming training sessions. Nearly all participants we interviewed held very favorable opinions of ECW staff and their communication. Given the amount of email correspondence that takes place during program participation especially during technical assistance, the program could alert relevant market actors to the trainings exactly when they are most involved with the program.



- Fine tune the message. In email announcements of the training sessions consider using the subject line or the beginning of the message to acknowledge the recipient's time constraints, and then follow up with statements, perhaps using attendee quotes, that capture the relevance and long term value of the program. For example, "We know you think you are too busy to step away from your projects for even a day, but consider coming to a training past attendees have called... that will maximize savings on your future projects."

**Comprehensive Track.** The program appears well-poised to transition to an all comprehensive track program over the next few years. However, interviews with market actor participants suggest that there is still disbelief and reluctance among some customers about the value of the program. To the program's credit, it is working on developing case studies of comprehensive projects that could be useful to show customers. We make two recommendations to maximize the potential of these materials:

- Test the case studies with ComEd C&I customers. For example, the program could use focus groups to see how one page case studies targeted at different types of C&I customers are perceived and whether they are compelling.
- When satisfied that the case study materials are effective, the program should make market actors aware of these materials so that they can use the ComEd materials with reluctant customers.

## Appendix A. ComEd PY3 Program Evaluation Reports

The program-specific reports will be attached as separate appendices. Multi-family Joint Program information is contained in the All-electric Efficiency Upgrade Report; and Single Family Joint Program information can be found in the All-Electric Single Family Home energy Performance Tune-up Report.

- A. Cost Effectiveness
- B. Residential ENERGY STAR Lighting
- C. Appliance Recycling
- D. Multifamily Residential All-Electric Efficiency Upgrade
- E. All-Electric Single Family Home Energy Performance Tune-Up
- G. Central Air Conditioning Efficiency Services
- F. Home Energy Report
- K. Central Air Conditioning Cycling
- H. Business Prescriptive
- H. Business Custom
- I. C&I Retro-Commissioning
- J. Non Residential New Construction