NAVIGANT

Energy Efficiency / Demand Response Plan: Plan Year 2 (6/1/2009-5/31/2010)

Evaluation Report: Nonresidential New Construction

Presented to

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Presented by

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Section E. Executive Summary

This document provides the results of the PY2 evaluation of the C&I New Construction program. 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 Energy Center of Wisconsin (ECW) implements the program for ComEd as a turn-key program.

The program maintains three 'tracks' for projects. The most complex is the comprehensive track where the program implementers are highly involved in the design of the building to help bring about savings from combining all components in a building 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 business track was added during PY2 and contains challenging lighting and daylighting requirements for buildings under 20,000 square foot. All savings from the 16 projects completed in PY2 were from the systems track.

E.1 Evaluation Objectives

The objectives of the evaluation are to: (1) Quantify net electric energy and peak demand impacts from the projects completed during PY2 (June 2009 to May 2010); and (2) Determine key process-related program strengths and weaknesses and provide recommendations to improve the program, where needed.

E.2 Evaluation Methods

The evaluation team used depth interviews of program implementers and participants to reach conclusions in the process analysis. Engineering desk review of all 16 participant projects was used to assess gross impacts. Net impacts were calculated using self-reported data from participants.

E.3 Key Findings

Impacts

Through the 16 projects included in the PY2 time period, the program exceeded its net energy savings goal. The net impact results for C&I New Construction program compared to goals are shown in Table E-1.

Table E- 1. Program Net Savings – C&I New Construction

Net Savings Estimates	MWh	MW
ComEd Plan Target	596	0
ComEd Reported for PY2 (ex ante)	1,098	0
Total PY2 Evaluation-Adjusted Net Savings (ex post)	803	0.174

Source: ComEd Plan Target: Commonwealth Edison Company's 2008 – 2010 Energy Efficiency / Demand Response Plan, Docket No. 07-0540, ComEd Ex. 1.0, November 15, 2007. Targeted net savings include a net-to-gross ratio of 0.8. ComEd Reported: Program Tracking Database from Implementer with a gross realization rate of 0.8 and a net-to-gross ratio of 0.85.

When comparing the tracking results (i.e., the results expected by the program from the 16 projects before any adjustments) to the verified gross impacts, the evaluation analysis reduced the gross impacts by 15%. (Table E-2) The net-to-gross ratio was 0.59 for the program (compared to the program tracking assumption of 0.85). This somewhat low value is due to three customers who represent 30% of the expected savings indicating the program had no influence on the choices made within their building.

Table E- 2. Verified Program Gross & Net Savings – C&I New Construction

	Tracking Gross Savings	Verified Gross Savings	Realization Rate	Verified Net Savings	NTGR (applied to verified gross)
MWh	1,615	1,368	85%	803	0.59
MW	0.309	0.296	96%	0.174	0.59

Impact Recommendations

We noted issues with the current system for tracking savings and recommend that:

- Project values are automatically updated in the central tracking sheet
- When minimum qualifications and specific codes are referenced in the application forms, those qualifications and codes should be the only standards used and distributed to the program implementation staff for use in project reviews

Process

Program managers have faced challenges associated with the economic downturn and the lack of large building construction (the planned cornerstone of the program). Because of this, most applications fell into the systems track, which provides incentives for lighting and HVAC systems. Early in the program, smaller buildings (under 20,000 square foot) were applying for the systems track which created added burden on the program and brought in smaller energy

savings. Therefore, program managers created a small buildings track to challenge the market and to avoid administrative burdens associated with small projects that would otherwise fill the systems track. Program managers are also focused on market transformation through the development of a community of educated and trained designers, engineers, and architects.

Participants are generally satisfied or very satisfied with the program and find it valuable, both for the available financial incentives and the information about energy efficient measures and design they learn about from ECW staff. While most were familiar enough with program processes to judge them positively, few knew about the technical assistance phase by name or were aware of training opportunities provided by the program's outreach activities.

Process Recommendations

Although participants were generally satisfied, there were a few recommendations to consider:

- There was a lack of understanding about the progress of their project once accepted into the program. This uncertainty could be ameliorated through a document clearly outlining the specific steps by name and continuous interaction with participants where these same names are brought up each time along with progress and timing as the project moves through the program steps.
- Clearly document how participants may benefit from participation in more than one of the ComEd program offerings to assure that all available measures are included in the projects.
- The program should expand the marketing of the training classes and review the content of each class to fit specific audiences.

Section 1. Introduction to the Program

1.1 Program Description

The C&I New Construction program began in the second program year (PY2) of the ComEd portfolio of demand side programs. It is designed to capture immediate and long-term energy efficiency opportunities that are available during the design and construction of new buildings, additions, and renovations in the non-residential market. The program provides incentives to improve the efficiency of building systems (e.g., lighting and/or HVAC) in new construction (system track) as well as through integrated whole building design (comprehensive track). Early in the program year, a small business track was added with incentives for buildings less than 20,000 square feet. This track attempted to move lighting/daylighting systems beyond the systems track level of efficiency. Projects were expected to come from a mix of system, small business, and comprehensive tracks.

Through market preparation activities, this program has also attempted to achieve beneficial impacts that extend beyond the life and scope of the program. Market preparation entails moving the awareness and knowledge gained by designers and architects through program participation into their standard construction practice through an integrated education and training effort. There was no assessment of these activities in PY2.

For PY2, the program has net energy savings goals of 596 MWh.

1.1.1 Implementation Strategy

Roles of the Implementation Contractor

The program is a turn-key approach provided by the Energy Center of Wisconsin (ECW). The program manager at ECW works with the ComEd program manager to implement the program following ComEd protocols and reporting requirements.

Program Timeline

The program was launched in June 2009.

Program Delivery Mechanisms and Marketing Strategy

Program implementation activities to achieve energy saving and market preparation objectives are applied through four primary offerings:

1. Targeted Education and Training, Information, and Outreach on integrated design practices and technologies and benefits were provided directly to customers through the program and to the broader market.

2. Technical Assistance Services provide capabilities that are not yet fully adopted in the market. Services included facilitation in the design process, reviewing plans and construction documents, assisting with research and product selections and analyzing energy savings.
3. Design Incentives to the design team are available to help offset the costs of developing designs that provide as-built performance that is more energy efficient than their standard practice designs.
4. Measure Incentives to owners and developers help reduce cost barriers to adopting electric energy saving measures that have not yet been accepted as standard practice for construction.

The program channeled projects through one of three participation approaches:

- ***Comprehensive Track*** offers the highest level of project assistance and financial incentives for custom design solutions. This approach allows the design team the greatest flexibility to meet energy performance goals by adopting integrated design solutions analyzed through whole-building energy simulations. This approach is chosen when project size, schedule, complexity, and interest level justify a significant investment of program resources to achieve the full benefits of integrated building design. There are no projects in PY2 within the comprehensive track.
- ***Systems Track*** is a lower-assistance participation approach that offers a limited menu of financial incentives. This track provides measure incentives to meet performance criteria for improvements in lighting power density, lighting controls, envelope and mechanical equipment. Design incentives are not offered. This approach is chosen for projects where there is limited opportunity for integrated design and for those later in the design process. All PY2 projects were in the systems track.
- ***Small Buildings Track*** offers an opportunity for buildings less than 20,000 square feet to receive incentives for lighting and daylighting. The track provides a combined measure incentive to meet performance criteria for improvements in lighting power density and the incorporation of daylighting strategies and controls. This approach is chosen for any project less than 20,000 square feet that can meet the minimum performance requirements. This track began shortly after the program launched and any site under 20,000 square feet in PY2 was accepted into the program prior to the small building track coming online. There are no small building track projects in PY2.

The primary targets of program marketing activities are design professionals such as architects and engineers as well as construction firms. Trainings, monthly presentations, and emails are the main approach to reaching this group. Secondary targets include customers and developers. This group is marketed to using newsletters and bill inserts as the main approach.

1.1.2 Measures and Incentives

Projects must comply with the requirements below to earn incentives. The incentive information comes from the ECW Operations Manual, dated September 30, 2009. As there were

only systems track projects in PY2, we only provide measure and incentive information for lighting and HVAC measures.

A Measure Incentives Agreement must be submitted to the Program for approval prior to purchase or installation of energy saving measures. Equipment invoices must be dated after June 1, 2009 to qualify for incentives.

Lighting Measures

The lighting power density (LPD) reduction incentive encourages lighting designs and equipment that provide quality lighting at lower installed wattage. The incentive for reducing lighting power density is calculated on a per square foot (sf) basis for LPD performance relative to the International Energy Conservation Code 2006 table 505.5.2.

For each 0.10 [Watt/sf] below Table 505.5.2 IECC 2006 requirements, the incentive is $0.03 per square foot.

The maximum payment is $0.15 per square foot gross lighted area or $40 per fixture, whichever is lower.

The program may assign a power rating (e.g., watts per fixture) for proposed lighting equipment that is not supported by manufacturer model numbers or specification sheets.

The program will make the final determination of affected area for incentive calculation.

Lighting power densities must be based on designs that meet applicable codes and standards and follow industry guidelines for acceptable quantity and quality of light for the space type and tasks.

HVAC Measures

The efficient HVAC equipment incentive encourages selection of energy efficient air conditioning and kitchen exhaust hood devices. The energy performance of the selected equipment must meet or exceed the requirements shown in the table below. Qualifying incentive amounts are also shown.

Table 1-1. HVAC Equipment Type Size Category Qualifying Efficiency Incentive (per ton)

Equipment Type	Size Category	Qualifying Efficiency	Incentive (per ton)
Unitary and Split Air Conditioning Systems and Air Source Heat Pumps	< 65,000 Btu/h (5.4 tons)	14 SEER	$ 15.00
		15 SEER	$ 30.00
	≥ 65,000 Btu/hr <240,000 Btu/h (5.5-20 tons)	11.5 EER / 11.9 IPLV	$ 15.00
		12 EER / 12.4 IPLV	$ 30.00
	≥ 240,000 Btu/h and <760,000 Btu/h (21-63 tons)	10.5 EER / 10.9 IPLV	$ 15.00
		10.8 EER / 12.0 IPLV	$ 30.00
		9.7 EER / 11.0 IPLV	$ 15.00
Water-Cooled Chillers	All	Level 1	$ 20.00
		Level 2	$ 40.00
Air-Cooled Chillers	All	1.04 kW/ton IPLV	$ 30.00
Room Air Conditioners	All	Level 1	$ 30.00
		Level 2	$ 50.00
PTAC/PTHP	All	EER = 13.08-(0.2556 x Capacity [Btu/h]/1000)	$ 30.00

Measure incentives are limited to $100,000 per facility per program year (June 1 to May 31).

1.2 Evaluation Questions

The evaluation sought to answer the following key researchable questions:

Impact Questions:

1. What are the gross impacts from this program?
2. What are the net impacts from this program?
3. Did the program meet its energy and demand goals? If not, why not?

Process Questions:

1. What challenges have occurred in PY2 implementation and how were they handled?
2. What are the characteristics of the customers and program "partners" (which encompass design professionals, trade allies, and construction companies) participating in the programs and is this the expected group for participation? Who should be more involved but is not, and how can the program increase their involvement?
3. Is the program outreach to customers and program partners effective in increasing awareness of the program opportunities?
    a. What is the format of the outreach?
    b. How often does the outreach occur?
    c. Are the messages within the outreach clear and actionable?

4. Are the program processes effective for smoothly providing incentives to customers and motivating the program partners to participate?
    a. What is the timing from start to finish for projects that go through this program?
    b. How quickly does the program answer customer and program partner questions?
    c. Are customers and program partners satisfied with the program processes in which they were involved?
    d. Is the application process onerous?
5. What areas could the program improve to create a more effective program for customers and/or program partners and help increase the energy and demand impacts?

Section 2. Evaluation Methods

As a part of the overall ComEd portfolio, the risk of non-performance by this program is low as the expected ex ante[1] impacts are a small percent of the portfolio energy savings (0.3%). For this reason, the evaluation activities for PY2 are somewhat limited (about 5% of the overall evaluation budget).

For the Non-Residential New Construction program assessment, the Navigant Consulting team conducted in-depth interviews with the program implementers, ComEd program manager, and participants. The gross impact analysis was based on an engineering desk review, and the net impact results were based on the self-report method.

There was a significant amount of data collected by the program implementer that we used for the impact assessment. This created a cost-effective evaluation process. We verified the quality of this secondary data for the first set of projects assessed prior to choosing to use this data for the entire gross impact evaluation.

Additionally, the evaluation team reviewed the operations manual in January 2010 to provide intermediate feedback to the program implementers. The original memo is included as Appendix C.

2.1 Analytical Methods

2.1.1 Impact Evaluation Methods

Data Sources

The gross impact analysis used the project files for all 16 projects. In support of this effort, ECW provided complete electronic files for each project. We were assured the project files included all available documentation for each project, including electronic scans of any paper documents, and found no reason to doubt that assurance. Files included participant applications, implementers' project verification reports, implementers' savings calculation spreadsheets, measure cut sheets, project plans and schedules, copies of email communications between the implementer and participants, and any other submitted supporting documentation. However, some project files lacked sufficient information to verify savings. Where possible during the evaluations, additional information was gathered from manufacturers' websites and catalogs, or the participant's project engineer or project lead was contacted and additional information requested.

[1] Ex ante refers to the program estimated impact found in the program tracking database.

For the net analysis, we attempted to interview one participant from each of the 16 projects that were included in the PY2 sample. We completed interviews with six individuals representing 14 of the projects. In a few cases, we followed up via email or by phone with the original respondent for clarification on information provided during the original interview.

Gross Program Savings

The purpose of the gross impact evaluation is to verify ComEd's original reported gross savings estimates for the program. The gross savings impact evaluation consisted of two aspects. The first, at program level, entailed an engineering review and evaluation of the overall program assumptions and algorithms used for calculating default measure gross savings estimates. The second portion, at measure level, focused on verification of individual project measure quantities and characteristics that are used to calculate gross savings estimates for each project.

The program level engineering review looked at the program assumptions and savings algorithms. The review included assessment of the appropriateness, accuracy and consistency of algorithms and variable assumptions that were applied program-wide for all participants. Where it was deemed appropriate during the evaluation, some program level adjustments were made to the implementer assumptions primarily to improve consistency and accuracy of program verified savings.

For example, the implementer sometimes used an algorithm for calculating energy and demand savings for HVAC units which included a single redundancy factor, however, the redundancy factor should vary depending on unit capacity. Alternatively for some projects a savings per ton table was used which used a single number for a range of unit capacities rather than the actual HVAC unit capacities and efficiencies. The implementer referenced a table of HVAC equivalent full load hours (EFLH) which was used for some projects but did not appear to be used for others. To maintain consistency and accuracy, for all projects the ex post energy and demand savings were calculated using the actual HVAC unit information and an algorithm which included a variable redundancy factor which matched HVAC unit capacity. The algorithm also utilized a table of HVAC EFLH which varied by building type and unit capacity.

Another specific change was the introduction and use of lighting energy interactive effects when determining the energy savings for lighting projects. The interaction of lighting heat output with the HVAC system is real and significant. The implementer did not include this interaction when calculating lighting energy savings. To more accurately reflect the whole building energy savings associated with lighting systems an Energy Interactive Factor was used to calculate the lighting energy savings for all projects. (This term increases the electrical savings due to the lighting project.)

At the measure level, an engineering file review was performed to verify program savings for each participant. For the C&I New Construction program, we performed a census file review

due to the limited participation rate in PY2. Onsite verification was not performed as part of the evaluation.[2] The engineering file review used the documentation available within each project file to verify the specific inputs into the savings algorithms. Where appropriate, adjustments were made to baseline and measure quantities, wattages, efficiencies, hours of use, etc, based on the information within each project file.

The adjusted program assumptions and algorithms and the verified inputs were used to calculate the final ex post gross savings estimates for each project. These ex post gross savings were used to calculate an overall program gross realization rate (RR = Ex post gross savings / ex ante savings) which is an informative metric to understand how the program performed in terms of the original assessment of savings.

Net Program Savings

The net analysis creates a ratio to account for attribution of the program activities in the gross savings results. That is, it identifies how much of the gross savings are due to program activities. Our net to gross (NTG) analysis of the program's energy impacts progressed through three stages. At the first stage, we designed an analysis approach that is based on the self-report approach for determining NTG. In this stage, we wrote an analysis plan that outlined the three main concepts used to calculate the free ridership factor and the concept of spillover; created the question battery to collect data for these concepts; and determined the plan for calculating the final NTG ratio. This analysis approach is provided in Appendix B with the main algorithms shown in Equation 1 and 2.

Equation 1

$$NTG = 1 - FR + SO$$

Where:

NTG = net-to-gross ratio

FR = free-ridership factor

SO = spillover factor

Equation 2

$$FR = \text{average of three concepts } (PFI + OPI + CF)$$

[2] We made one exception. The evaluation team performed onsite verification for one site between the draft and final version of the report to double check that our gross impact of zero for this site was correct. The onsite verification supported the original value and there was no change for this site.

Where:

PFI = Program Measures' Influence

OPI = Overall Program Influence

CF = Counter factual[3]

The second stage of NTG analysis consisted of the interviews with the main decision-makers or those individuals associated with the projects that were most able to give us insight into project design decision-making. While interviewing, one issue arose where our NTG question battery did not adequately capture decision-making.

This difficulty showed up when there were instances in which retailers had used existing, national prototypes to design stores they submitted to the program. These stores came into the program through "incentive hunters" – firms who specialize in obtaining energy efficiency rebates for their customers. Working with this type of specialty firm, retailers partially base their prototypes on their understanding of what measures are included in typical utility incentive programs throughout the nation for energy efficient commercial design. However, each prototypical project also had some small opportunity for modification which had the chance to be influenced directly by the ComEd program. Our NTG question battery assumed only a discrete, direct influence of the ComEd program on the projects completed in ComEd territory as opposed to an indirect influence of the program through the aggregate of many such utility programs influencing national, prototypical designs. As such, our respondents had difficulty answering some of these questions, as they tried to weigh overall direct or indirect influences of the ComEd program.

However, our battery did successfully bring out the issue of financial benefit from the program without much actual change on the part of the customer. At least one participant we interviewed gave inconsistent responses, which implied that they might be purposely trying to give credit to the program in the hopes of continuing to benefit from the program.

Thus, during the third stage of our NTG analysis we examined each respondent we interviewed on a case by case basis to determine whether the existing NTG algorithm was applicable or not. During this review we believed there was good reason to adjust the NTG algorithm in some cases. We achieved high inter-rater reliability[4] by building consensus at each step for why and

[3] The counterfactual measures what would have occurred in the absence of the program.

[4] Inter-rater reliability comes about through separate analysis of the same data to come to a conclusion and then achieving consensus through discussion. This technique is used to reduce the bias that can be introduced when a single person makes judgments. For this analysis two different analysts reviewed the information to determine specific changes to a net-to-gross ratio.

how each case should be adjusted if at all. Following the adjustments, we calculated a weighted NTG, based on proportional amount of savings at each project in our sample. The weighted NTG value was then applied to the few projects where we were unsuccessful in reaching participants.

2.1.2 Process Evaluation Methods

The process evaluation consisted of qualitative analysis from the in-depth interviews of the program managers and customer/market actors. Our data collection instrument followed the process plan and was created to research specific areas within the program that entailed creation of themes found in the interviewer responses. The instrument is provided in Appendix A.

Data Sources

The process questions were informed by in-depth interviews with program managers, as well as market actors (e.g., design contractors, lighting engineers, incentive hunters, etc.) and customer program participants. We completed two in-depth interviews with the ComEd and program implementation team program managers during the first half of March 2010. We completed in-depth interviews with four market actors and two customers from March to July 2010. Because some market actors participated in multiple projects, our interviews reached representatives from 14 of the 16 projects completed in PY2.

2.2 *Sampling Plan*

We used a purposive sample for all in-depth interviews. We attempted to reach the most highly engaged participants in the program as indicated by the program implementer. Where that person was unavailable, we called one of the other names available for a participant site. The data collection summary for this evaluation is as follows:

Table 2-1. Data Collection Summary

What	Who	How Many	When	Purpose
In-Depth Interview	Program Staff	2	February 2010	Process
In-Depth Interview	Program Participants	6 individuals representing 14 projects	March 2010 to July 2010	Process and Impact
Engineering Review	Data from Program Implementer	16 projects	March 2010 to July 2010	Impact

Section 3. Program Level Results

3.1 Impact Results

3.1.1 Verification and Due Diligence

The verification activities for this program were relatively modest given budget constraints. However, we did identify a few issues that should be noted. During the impact analysis and project file reviews, it was difficult to see how quality control and assurance are being handled by the implementer. It was clear that final approval was obtained prior to issuance of incentive checks. However, it was not fully clear if there was any additional quality control review of individual project information and savings estimates. Our file reviews revealed some concerns related to data quality control.

Some of the projects had an abundance of project documentation, and it appears the program reviewer did a thorough job reviewing the submitted data and adjusting the savings inputs and calculations appropriately. A few of the projects on the other hand had a distinct lack of supporting documentation and insufficient data to calculate any savings; however, incentives and savings were still approved and reported. The opposite also occurred where a couple participants had provided the necessary information and the projects should have qualified for incentives based on the documentation, but the implementer did not appear to have fully reviewed the files and rejected the measures and incentives.

An example of lack of documentation occurred for a lighting project. This project was approved for lighting incentives based on a reduction of overall lighting power density (LPD). The calculations for this project used a baseline LPD for the entire building square footage, but only added up a portion of the building installed lighting because the implementer did not realize that only some of the building lighting plans and fixture schedules were provided.[5]. The calculation greatly over estimated the savings, and in the evaluation the savings could not be verified because there was insufficient supporting documentation.[6]

An example of improper rejection occurred for an HVAC project: When asking for clarification by the implementer on one of the rejected measures, it was discovered that an incorrect table showing the baseline efficiencies for HVAC measures was being used and some measures were rejected because of it. The implementer indicated there was a mix up when reviewing the project

[5] Whole sections of the building did not have lighting plans, nor were they accounted for in the invoices.
[6] The one onsite verification performed by the team was for this site. The results of this onsite verification supported the lack of documentation for this lighting project and the original zero ex post savings for this site was maintained.

application, and the incorrect baseline and minimum qualification was entered into the calculation spreadsheet which resulted in the error.

3.1.2 Tracking System Review

In general, ComEd's C&I NC program tracking system is clear and well documented. The program does not have a central database to calculate measure savings, but instead uses a standard form spreadsheet for each project and a central spreadsheet where overall program savings are tracked.

Within each project file is the project calculation spreadsheet file which includes some default assumption tables and algorithm inputs, as well as HVAC and Lighting calculation tabs. These spreadsheets are easy to follow and provide for a clear description of how the savings are calculated for each project.

The disadvantage of spreadsheet based systems is that they are prone to errors, and this program was not immune to that problem. For example, when a project came to the program, the implementer calculated an initial project savings estimate and entered it in the program tracking spreadsheet. As projects were finalized, the updated final savings estimates were calculated within each project file, and then updated by hand in the overall program tracking spreadsheet. For two projects the final project savings estimates were calculated appropriately within the project file, but the final savings estimates were not updated in the program tracking spreadsheet.

Another source of error was that not all of the program defaults, minimum qualifications, and baseline inputs were in the standard calculation spreadsheet. These were therefore entered by hand into each project which led to some transfer errors.

In one project the implementer correctly calculated the lighting power density to be above the project maximum LPD and therefore the project did not qualify for lighting incentives. While this was correct, the higher lighting demand was incorrectly subtracted from the HVAC savings in the ex ante savings estimates for the project. The increased lighting demand should not be counted against the qualified HVAC energy savings as, while there are interactive effects, these are two different measures with distinct loads. This also proportionally reduced the participant's incentive.

Program implementers may want to carefully review their tracking system to assure that all aspects are working and that central values are automatically updated. Moving away from a spreadsheet system to a relational database can also reduce some of the types of errors the evaluation found.

3.1.3 Gross Program Impact Parameter Estimates

The gross impact engineering review included several adjustments to the program level algorithms and assumptions. PY2 included only Systems Track projects, which have savings for HVAC efficiency upgrades and Lighting Power Density (LPD) reductions above and beyond code. While only energy (kWh) savings are necessary for reporting, the program does track peak coincident demand (kW) savings at the request of ComEd.

Lighting Measures

For the Systems Track Lighting calculations there are only a few inputs to the ex ante savings algorithms. For lighting energy, the program uses a code minimum baseline LPD based on building occupancy type. This LPD is multiplied by the building area and by operating hours to calculate the annual energy savings. The default occupancy types are based on code and are appropriate. The area is based on participant reported data and was generally not adjusted. The annual operating hours used in the calculations were generally based on participant self-reported hours and were observed to be slightly high compared to the information found in the specific project files (which often came from a different person).

Operating hours are a difficult parameter to establish, as self-reported operating hours are often estimates before a store's final operating hours are established. Additionally, self-reported numbers typically add time for start-up and closing time, but do not reduce the estimate for holidays, lights that are turned off, burned out lamps, and other factors which would reduce the overall hours. While participant reported operating hours are often an appropriate estimate, for this program, the operating hour information was often based on data from a third party (such as the company finding incentives for the ultimate user of the building) and did not match up well with business hours.

The evaluation team chose to bring more consistency to the program savings estimates through using the business hours from the published business open hours from the company websites and, in one case, calling the customer. In nearly all cases this resulted in a reduction of originally estimated lighting operating hours. When possible, for some projects the lighting hours were further differentiated by space type when published open hours varied, such as for different operating hours for a pharmacy within a retail space. When published open hours were not available, a default lighting operating hours table was used based on the ComEd C&I Prescriptive program defaults.

The ex ante estimated lighting energy savings do not include an interaction factor to adjust for the associated cooling system energy savings when reducing the lighting power density. To account for this, the impact evaluation added an Energy Interactive Factor to all lighting projects which varies by building occupancy type which increases electric energy savings somewhat. The factors and building types that are used as part of the ComEd C&I Prescriptive

program were adopted. It is recommended that these Energy Interactive Factors be incorporated into PY3 and beyond.

The calculation algorithms and default Demand Diversity Factors were assessed to be appropriate and no changes were made.

HVAC Measures

ComEd C&I New Construction HVAC ex ante savings were estimated using predetermined program defaults for different size categories and qualifying Tiers. The defaults do not fully reflect the actual installed efficiencies, but rather a simplified estimate based on program assumptions. To improve estimates, the impact evaluation used actual installed HVAC unit capacities and AHRI efficiencies based on data from the program files. Because this information is already being recorded as part of the project incentive qualifications and calculations, it would be a simple update to include the calculations within the standard project spreadsheet template.

Evaluated ex post savings were based on the ComEd C&I Prescriptive program default savings algorithms and factors, and include Equivalent Full Load Hours (EFLH) defaults based on occupancy type and size of equipment. The savings algorithms include Coincidence Factors (CF) for calculating Peak Demand Savings, and a Redundancy Factor to account for system over-sizing.

Project specific adjustments were made for HVAC unit capacities when AHRI actual capacities were not in the ex ante calculations. Similarly several unit efficiencies were adjusted to reflect the correct AHRI Certified efficiencies.

There were two HVAC units incentivized when the units did not actually qualify for the program. Alternately, six HVAC units which were not incentivized did actually qualify for the program and should have been incentivized. These adjustments were made to the gross impact savings – that is we removed the savings from the two units that did not qualify and added in the savings from the six units that did qualify but were not incented.

On a project basis, some HVAC units had been categorized in incorrect default sizes, and adjustments to factors were made to correct the ex ante estimates.

3.1.4 Gross Program Impact Results

For PY2 there were 16 total projects for which incentives were paid out and ex ante savings reported. The breakdown by measure type included 4 Lighting measure only projects, 2 HVAC only projects, and 10 projects which included both Lighting and HVAC measures. By occupancy type, there were 10 retail/service projects, 5 grocery stores, and 1 restaurant.

Table 3-1 shows the total gross ex ante and ex post savings by project, including individual project realization rates. For the projects as a whole, the energy savings were adjusted downward for 7 projects and upward for 9 projects.

Table 3-1. Participant Gross Savings

Project Number	Project Building Type	ex Ante Savings (Total Participant Savings)		ex Post Savings (Total Participant Savings)		Realization Rate (Total Participant Savings)	
		Peak Demand Reduction (kW)	Energy Savings (kWh/yr)	Peak Demand Reduction (kW)	Energy Savings (kWh/yr)	Peak Demand Reduction RR	Energy Savings RR
1	Retail/Service	17	26,947	23	30,460	1.34	1.13
2	Grocery	25	110,495	26	127,720	1.01	1.16
3	Restaurant	7	25,840	6	23,008	0.92	0.89
4	Retail/Service	3	23,519	3	21,891	1.10	0.93
5	Retail/Service	5	6,081	5	6,260	1.04	1.03
6	Retail/Service	20	89,277	14	80,001	0.68	0.90
7	Retail/Service	66	311,052	64	297,070	0.97	0.96
8	Retail/Service	6	27,497	8	41,037	1.24	1.49
9	Retail/Service	13	63,105	12	71,212	0.96	1.13
10	Grocery	37	255,857	10	19,011	0.28	0.07
11	Grocery	12	51,892	12	62,861	1.03	1.21
12	Retail/Service	5	25,115	6	27,644	1.24	1.10
13	Grocery	40	331,204	33	276,076	0.84	0.83
14	Retail/Service	13	77,709	16	87,205	1.18	1.12
15	Retail/Service	4	20,759	6	19,212	1.51	0.93
16	Grocery	37	168,172	52	177,436	1.42	1.06
	Total	**309**	**1,614,521**	**296**	**1,368,102**	**0.96**	**0.85**

Table 3-2 shows similar information for the lighting measures only, and Table 3-3 shows the savings for HVAC measures only. For the lighting measures, Table 3-2 shows adjustments downward for 8 projects and upward for 6 projects. For HVAC measures, Table 3-3 shows adjustments downward for only 3 projects and upward for 9 projects.

Table 3-2. Participant Gross Savings for Lighting Measures Only

Project Number	Project Building Type	ex Ante Savings (Lighting Measures Only)		ex Post Savings (Lighting Measures Only)		Realization Rate (Lighting Measures Only)	
		Peak Demand Reduction (kW)	Energy Savings (kWh/yr)	Peak Demand Reduction (kW)	Energy Savings (kWh/yr)	Peak Demand Reduction RR	Energy Savings RR
1	Retail/Service	N/A	N/A	N/A	N/A	N/A	N/A
2	Grocery	12	87,028	14	107,101	1.16	1.23
3	Restaurant	3	18,699	2	15,096	0.82	0.81
4	Retail/Service	3	23,519	3	21,891	1.10	0.93
5	Retail/Service	N/A	N/A	N/A	N/A	N/A	N/A
6	Retail/Service	20	89,277	14	80,001	0.68	0.90
7	Retail/Service	48	294,241	43	270,308	0.91	0.92
8	Retail/Service	5	25,201	5	37,961	1.21	1.51
9	Retail/Service	12	62,183	12	71,212	1.00	1.15
10	Grocery	31	245,324	0	0	0	0
11	Grocery	9	49,066	10	60,081	1.04	1.22
12	Retail/Service	5	25,115	4	25,217	0.83	1.00
13	Grocery	40	331,204	33	276,076	0.84	0.83
14	Retail/Service	13	77,709	16	87,205	1.18	1.12
15	Retail/Service	3	18,954	2	12,490	0.72	0.66
16	Grocery	20	136,733	30	136,266	1.51	1.00
	Total	**223**	**1,484,253**	**188**	**1,200,903**	**0.84**	**0.81**

Table 3-3 shows the savings for HVAC measures only. For HVAC measures there were adjustments downward for only 3 projects and upward for 9 projects.

Table 3-3. Participant Gross Savings for HVAC Measures Only

Project Number	Project Building Type	ex Ante Savings (HVAC Measures Only)		ex Post Savings (HVAC Measures Only)		Realization Rate (HVAC Measures Only)	
		Peak Demand Reduction (kW)	Energy Savings (kWh/yr)	Peak Demand Reduction (kW)	Energy Savings (kWh/yr)	Peak Demand Reduction RR	Energy Savings RR
1	Retail/Service	17	28,812	23	30,460	1.34	1.06
2	Grocery	13	23,467	11	20,619	0.88	0.88
3	Restaurant	4	7,141	4	7,912	0.97	1.11
4	Retail/Service	N/A	N/A	N/A	N/A	N/A	N/A
5	Retail/Service	5	6,081	5	6,260	1.04	1.03
6	Retail/Service	N/A	N/A	N/A	N/A	N/A	N/A
7	Retail/Service	18	23,427	20	26,762	1.14	1.14
8	Retail/Service	2	2,296	2	3,076	1.33	1.34
9	Retail/Service	1	922	0	0	0	0
10	Grocery	6	10,533	10	19,011	1.84	1.80
11	Grocery	2	2,826	2	2,780	0.96	0.98
12	Retail/Service	-	-	2	2,427	N/A	N/A
13	Grocery	N/A	N/A	N/A	N/A	N/A	N/A
14	Retail/Service	N/A	N/A	N/A	N/A	N/A	N/A
15	Retail/Service	1	1,805	4	6,723	3.04	3.72
16	Grocery	17	31,439	23	41,170	1.31	1.31
	Total	**86**	**138,749**	**108**	**167,199**	**1.25**	**1.21**

The Lighting measure, HVAC measure, and Total Combined Program gross savings estimates are summarized in Table 3-4 below. The overall impact of the HVAC measures was relatively small compared to the savings achieved through the lighting measures. As shown in Tables 3-1, 3-2, and 3-3 above, the impact evaluation tracked all HVAC and Lighting measures separately, combining the individual measure savings for each projects' final ex post savings estimates. These project level ex post savings were then summed to calculate program-level ex post savings.

Within the program tracking file, only the final ex ante total project savings were recorded, not the breakdown between lighting and HVAC measures. It should be noted that for two projects, the sum of the ex ante measure level savings in the file did not match the reported total project savings in the tracking file. Therefore, the ex ante HVAC and Lighting gross savings shown in the table do not total up to the project based ex ante savings.

Table 3-4. Gross Parameter and Savings Estimates

	Ex Ante Gross kWh Savings	Ex Post Gross kWh Savings	kWh Savings Gross Realization Rate	Ex Ante Gross kW Savings	Ex Post Gross kW Savings	kW Savings Gross Realization Rate
Lighting Measures	1,484,253	1,200,903	0.81	223.04	188.41	0.84
HVAC Measures	138,749	167,199	1.21	86.16	107.91	1.25
Total*	**1,614,521**	**1,368,102**	**0.85**	**309.20**	**296.32**	**0.96**

** The ex ante total is as reported by the program in the program tracking file. The ex ante measure-level totals are summed from the project files. The total is different than the sum of the lighting and HVAC measures as there were a couple of transfer errors within the tracking file.*

3.1.5 Net Program Impact Results

Our net-to-gross interviews reached participants representing 14 projects and 76% of the gross impacts. As discussed in the methods section, we carefully reviewed the NTG responses from each of our interviewees and adjusted the NTG algorithm and ratio for 10 of the 14 projects included in our interviews. First, there were eight cases that used prototypical designs that might have been influenced by the program indirectly as one of many utility programs, but also tended to be influenced by the program directly in the areas where the designs could still be modified. As such, our questions about the degree of influence that various program components (e.g., incentives and technical advice) had on the program were directly applicable. Yet, our questions about the overall program influence were difficult for respondents to answer because they only applied indirectly. Thus, for these cases we removed the overall program influence concept and calculated the NTG only on two of the three concepts, the Program Measures Influence and the Counter Factual. By dropping the Direct Program Influence component, the NTG ratios increased to 0.8 for seven of the eight projects and to 0.58 for the eighth.

Second, there was one instance of a respondent who believes that the program is so important that the respondent was willing to give contradictory information in order to show influence of the program where none existed. When we sought clarification, the participant stated:

> *"We had everything designed and the program did not influence our decisions at all, but I had trouble saying that the program was not important at all. The bottom line is that I think the program is important, and I want it to continue."*

Thus we reduced the NTG ratio for this project to zero. There were two other projects where the responses throughout the interview indicated that the participant was a full free rider.[7] These three sites were 30% of the total expected energy savings from the 14 projects included in our interviews.

Finally, we increased one ratio by 0.23 (to 1.0) because the respondent made such a strong statement about there being no chance that the same efficient design would have been used in absence of the program. This individual stated:

> *"We would have done the prototypical design; we would have not done the more efficient design."*

Weighting the project-level NTG values by project savings produced a total program-level NTG ratio of 0.59. This NTG ratio was applied to the two projects where we were unsuccessful in reaching the applicant. When applied to the total ex post gross impacts, this NTG ratio yields the final net impacts shown in Table 3-5 below.

Table 3-5. Program Net Impacts

Metric	Ex Post Gross Impacts	NTG Ratio	Ex Post Net Impacts
kWh	1,368,102	0.59	802,540
kW	296	0.59	174

3.2 Process Evaluation Results

There are many themes to explore during a process evaluation. Our evaluation questions focused on five specific themes:

1) challenges found during this first year of implementation and how they were met;
2) characterizing the partners and customers participating in the program components;
3) effectiveness of the outreach;
4) effectiveness of the program processes in terms of providing incentives to the customers; and
5) areas of program improvement as described by the program staff and customers.

[7] One site was from an incentive hunter who indicated that the design was fully created prior to discussions with the program. This person indicated no influence by the program. The other site indicated that the design and measures would have remained exactly the same regardless of an incentive.

We first provide a synopsis of all areas to bring out the value of the program and then go through the results found for each theme. This analysis is based on the responses of eight individuals (two program staff and six participants). While a small number, it represents almost the entire number of participating projects (14 of the 16 projects) and the two staff most involved in the program. However, due to the small number, we do not provide statistics such as percentages. We bring out relevant quotes to show context in each area. Aside from the next section (which is a summary across the process evaluation), the first paragraph of Sections 3.2.2 to 3.2.6 gives the conclusion of our analysis of that section. Additional information is provided after that paragraph to show how those conclusions were reached.

3.2.1 Value of the program

Overall, the participants we interviewed were satisfied with the program and believe it is valuable. All found the incentives valuable and participation worthwhile while generally agreeing that, as one market actor stated, "it is a well-constructed program: simple and straight forward." Participants also found the program valuable in other ways. One customer believes that the program helps align the different disciplines involved in a project: construction, design, retail, energy management, and finance. The customer states: "Each group has its own idea, but the program's existence provides good focus and (project) articulation." Many participants mentioned that ECW staff were knowledgeable about energy efficient design and measures and could even give helpful information about other incentive programs. Another customer stated that the program was valuable because the recommendations could be received as "objective information from a disinterested third party" as opposed to energy efficient measure vendors, whose motives may be "suspect". In another instance, a participant stated that the program served an invaluable role in quality control and redesign:

> *[paraphrased] During the verification process a program staff (person) caught errors in the lighting power density design, and was invaluable in working with the contractor and architect to correct it and make the system more efficient than it would have otherwise been. It was a very helpful process. –Market Actor*

3.2.2 Implementation Challenges

Throughout the in-depth interviews, program managers identified six challenges that occurred during PY2. These include challenges related to the down economy; the influx of small building (i.e., less than 20,000 square feet) projects into the program; the difficulty with reaching construction design teams of retail chains; the time it takes to complete new construction projects; how code is understood in the marketplace; and working with industrial/ processing buildings. Overall, the implementation team handled these difficulties well – creating new components of the program where needed and continuing to work in difficult areas. In the next paragraphs we explore these challenges and explain how the program handled each of them.

First, the down economy kept many larger (i.e., 100,000 square feet or more) new, "ground up", construction projects from starting because the credit market was frozen and banks were not lending. This was a challenge since the program had been mainly designed in 2008-2009 to incorporate many of these larger, new construction projects through the comprehensive track. These types of projects were expected to bring in large amounts of savings per building as a result of working with the design teams for each project early on to obtain holistic integration of all components of a building. The program had planned to bring in 15 projects to obtain the net impacts for PY2 with some being these comprehensive type projects and others systems level projects. One program manager stated that "if the economy had been better we would have seen some larger projects coming through." Instead, retailers with "deep pockets" (e.g., Walgreen's, CVS, Dollar Tree, etc.) were able to take advantage of inexpensive rents in urban markets and renovate the space. These projects tended to be smaller (often less than 20,000 square feet), followed standardized design, and had faster timeframes (which decreased the time for the program to work with them). Additionally, ComEd transferred five smaller new construction projects into the New Construction program that had been in the Custom program. The implementer, Energy Center of Wisconsin (ECW), had to adjust its administrative budgets (designed for a greater number of larger, comprehensive projects) to accommodate the administrative costs associated with an unanticipated volume of smaller projects. At one point in PY2, there were 30 projects in the pipeline – double the expected total for the year. Nonetheless, the program worked with designers to incent changes in lighting and HVAC, the two systems incented through that program. As a result of the down economy, no comprehensive projects took place during PY2 (although there are several included in PY3), and all projects participated through the systems track.

However, the increase of applications seen in the system track by small, retailer projects with smaller per-project savings was the impetus for the creation of a small buildings track. While the systems track was created to allow for building with designs with little flexibility in terms of building envelopes, the higher than expected volume of small system track projects was costly on administrative resources and garnered fewer energy savings per site. The program had been designed to obtain systems level savings from buildings between 20,000 and 50,000 square foot. However, within the first two months of the program, three out of the four applicants were less than 20,000 square foot. Therefore, the program managers added a third track to accommodate buildings less than 20,000 square feet. While similar to the systems track in that there is minimal technical assistance and incentives for lighting, the small buildings track was designed differently in several key ways. First, the small building track is for projects less than 20,000 square feet. Second, the small buildings track only incents integrated lighting/daylighting designs, as opposed to the systems track which incents discrete lighting and HVAC. Third, the maximum lighting power density for the small buildings track is lower and therefore more efficient than that in the systems track; for example, for retail projects, it is close to 15% more efficient at 1.3 watts per square foot in the small buildings track versus 1.5 watts per square foot in the systems track. Fourth, because it is more difficult to reach the LPD value for the small

building track, the lighting incentives are higher at $.75/sf vs. $.03/sf in the systems track. Thus, the small buildings track incorporated high incentives, but also challenging requirements. In a way, the requirements were designed to filter out retail projects with designs that are already too set to be influenced toward efficiency by the program, while challenging the market to produce projects that incorporate efficient, integrated lighting. Since the inception of the small buildings track, no project application has been approved through it.

Most of the applications for projects from retail stores have been submitted by third party companies whose business model is designed to identify projects for their clients that can get utility incentives (e.g., "incentive hunters" such as RealWinWin accounted for 9 of the 16 projects in PY2). In most cases, these projects followed designs set by the corporate headquarters of the third party clients. However, program managers want to push the retail market toward longer term efficiency. In order to do this, the program must find a way to reach the corporate design teams at large retailers from which successful store prototypes are applied to all subsequent projects. Success would mean changes in overall design efficiency and not simply changing some systems to obtain incentives. To meet this challenge, program managers have started working with a national accounts group within ComEd to target decision makers within corporations.

New construction projects typically take an average of 18 months to complete. In order to maximize their impact, new construction programs must get involved in the early stages of design, which is challenging. Long construction lead times means comprehensive projects recruited in one year generally cannot be counted toward program goals until the next. As such, implementers must balance developing larger and more holistic new construction projects with meeting the current year's goals. In PY2, program goals were exceeded by working with many smaller, systems-track projects into the program, yet implementers also worked to recruit seven larger projects which are scheduled to be completed in PY3.

There may be an incomplete understanding of energy code in the marketplace. As one manager explained, "I've seen some projects come in for incentives that are significantly over code [i.e., are not meeting code for energy efficiency] which indicates the market doesn't understand what the code is." This means that program implementers must first correct misunderstandings of code, and educate customers before they discuss program incentives and energy efficient measures. While some extra effort has been required, program implementers have nevertheless recruited some projects that began over energy code (i.e., not efficient enough to meet code) and helped increase efficiency so that the project qualified for the program.

A final challenge program managers identified is working with industrial building projects. The program design assumed that it would typically address commercial office buildings, not industrial sites, because establishing an energy baseline can be difficult for industrial sites. For example, a program manager noted that there is no baseline under IECC 2009 for an industrial process building. The result is that the project "ends up being kind of a hybrid between new

construction and custom programs". To obtain the largest energy savings for the portfolio, program managers focus on adjusting the building envelope and lighting under new construction and processing equipment under custom. This requires increased coordination between the two programs. For PY2, however, there were no industrial building projects.

3.2.3 Customer Characteristics

In PY2, the program worked with designers, architects, and engineers, the main targets of the program. Although the program worked with market actors whose job it is to find rebates and incentives for their clients, this group of market actors was not planned to be a typical program partner. Additional market actors such as property owners were put forth as future targets with plans to use bill inserts to elicit participation among this group.

The program works with partners who are part of project design teams of commercial and industrial renovation and new construction projects. The program operations manual lists the initial building target recommendations as 'big box' retail; industrial and manufacturing warehouses; owner-occupied office space; 'small box' and specialty retail; and institutional (private). When asked about primary targets, one program manager emphasized commercial office space and the other emphasized 'mid market' commercial and industrial projects that would otherwise be built to near code, as opposed to projects that were being built to LEED standards. Table 3-6 outlines who the program is marketed to now and who is desired as future participants.

Table 3-6. Program's Groups for Partners

	Targets Within each Group	Desired, Future Participants
Primary Targets (Program Partners)	• Designers • Architects • Engineers • Design build firms • Mechanical HVAC engineers • Lighting engineers • Lighting designers • Construction firms • (lesser extent: Facilities managers)	• Sub contractors (especially for design build projects) • Retailer design teams • Commercial office space projects • Larger projects such as WMS World Wide Training Center
Secondary Targets (Customers)	• "Mid market C&I projects" • Hospitals • Schools • Developers • Commercial leased property owners and managers • Tenants and commercial real estate firms • Commercial office space projects	• Multi-property owners • Independent property owners • Non-profits

Program managers explained that, in order to establish a group of program partners, they have primarily marketed to, and worked with, the design communities, i.e., architects, designers, and engineers working on projects that might be incorporated into the systems or comprehensive tracks. These partners are the primary intended program partners. Depending on the project, program implementers have, to a lesser degree, also worked with construction firms, property management companies, and facilities managers. In the case of a new construction project, a property management company is not typically part of the operation yet; however, for a new construction project on an existing campus, the program may work with existing facilities managers. Finally, to a lesser degree than it does with program partners, the program works with commercial and industrial developers and owners of the buildings listed above, as the intended utility customers for the program.

Despite successes with establishing each group of participants, program managers identified types of participants they would like to see more involved in each group. Program managers would like to work with larger projects such as the WMS World Wide Training Center scheduled through the comprehensive track in PY3. One manager also explained that ideally the program would include more commercial office space projects but that construction trends are precluding such projects.

Another program manager described three kinds of customers that are well suited for the program. The first is multi-property owners, because reaching these customers could mean realizing a lot of savings through one decision maker. The second is independent, property owners who would be well served by the technical assistance component of the program. The program is currently working on marketing to these kinds of potential participant customers through bill inserts and newsletters. The third is non-profits who might be ethically inclined toward energy efficiency and could benefit from the program's financial incentives and technical assistance. To this end, the program has met with Energy Efficiency Alliance (EEA), as well as financial institutions that fund building for non profits, but has not received much response from non-profits. Despite program marketing efforts aimed at these kinds of customers and consistent with program design, the program continues to primarily focus on design team partners with the expectation that these market actors will influence all owners and decision makers they work for. To this end, one program manager stated that the program should expand its focus to sub contractors who work on certain kinds of projects: "*We've learned, especially on design build projects, you need to go straight to the sub if you want to get your EEMs (energy efficient measures) adopted, because nobody is working on the kind of detail that you need except for the sub*."

3.2.4 Effectiveness of Program Outreach

Program outreach took many forms including training for program partners, monthly power point presentations to potential partners (e.g., design firms, AIA, ASHRAE) or customers (e.g., hospitals, individual firms), announcements in various organizations' (e.g., USGBC, AIA, AGC,

ASHRAE) monthly newsletters, email blasts, and networking at industry conferences. For PY2, the outreach has been mainly through the web site and referrals from energy focused organization such as ComEd or Focus on Energy. It has been sufficiently effective to bring in projects that meet the energy goals, although few participants knew about the available trainings.

When the program is described at trainings or through other outreach, the content includes how to qualify and explains the different tracks. The core message is that financial incentives are available for energy efficient modifications in design or systems upgrades. Both managers believe that the market is relatively unaware that program incentives exist, or if they do know about them, that the funds will be available:

> *"I think the main message…is there is money available to help your building be more efficient. [The program] can help you get that money, I think the market here is in general is not super sophisticated around energy. So before we can even address the barriers and myths of building an energy efficient building we have to let them know that there's money available to help them do that."*

> *"… nobody believes the money is really there until they see the check. And once that happens, they'll start bringing in the projects."*

The outreach efforts varied depending on the targeted group. Table 3-7 provides the different marketing approaches along with the desired outcomes according to the program managers.

Table 3-7. Program's Marketing Approach

	Targets Within each Group	Marketing Approach	Desired Marketing Outcomes
Primary Targets (Program Partners)	• Designers • Architects • Engineers • Design build firms • Mechanical HVAC engineers • Lighting engineers • Lighting designers • Construction firms • (lesser extent: Facilities managers)	• Five trainings/year • Monthly presentations to organizations (e.g., 'lunch and learns') (AIA, ASHRAE, design firms, etc.) • Monthly emailed newsletters • Networking at conferences on a monthly basis;	• Program awareness • Increase in energy efficient knowledge • Influence on owners and decision makers. • Program participation for the following kinds of projects: Big box retail, Warehouse, industrial and manufacturing, Owner occupied office space, "Small box" and specialty retail, Institutional (private)
Secondary Targets (Customers)	• "Mid market C&I projects" • Hospitals • Schools • Developers • Commercial leased property owners and managers • Tenants and commercial real estate firms • Commercial office space projects	• Energy at Work newsletter • Bill inserts • Targeting customers through the partners: (Email through well established organizations [e.g., USGBC, AIA, AGC, ASHRAE]; trainings; presentations)	• Customers will approach the program or their design teams to investigate submitting projects into a track

Training as Outreach

The program offers several trainings throughout the year that touch different aspects of designing a building and give an overview of how to participate in the program. Five trainings occurred in PY2 covering the following topics:

- June 2009- Lighting and Daylighting with Efficiency – 118 attendees
- September 2009 - Building Systems: Commissioning and Retro-Commissioning – 77 attendees
- November 2009 Energy Efficient Lighting – 75 attendees

- » February 2010 – Optimizing the Design of Variable Air Volume and Chilled/Hot Water plants – 67 attendees
- » April 2010 - Integrated Design Training – 58 attendees.

Program managers describe the trainings as successful. The implementer provides a short survey after each training class and one manager said that all had received scores of B or better based on attendee feedback satisfaction and attendance. One manager described the effects of the training component on project submission to the program:

> *"It seems [that members of project design teams] are going to the trainings [and] are actually implementing things that they've learned about in the training …we do have a few projects that are currently in the program that were a direct result of attending the training."*

However, none of the participants we interviewed had attended any trainings[8] and a few expressed surprise that they even existed. One market actor suggested that the program specifically increase its outreach through advertising in the Illumination Engineering Society for North America (IESNA) magazine.

Other Outreach

Designed to elicit applications, other outreach is typically aimed at members of the design community, although sometimes program implementers follow up with potential customers as well. Outreach to customers started with the "Owners and Developers Targeted Contact List", created through market research, and continues as the program learns about potential customers through program partners, or interacts with customers at various events. Program implementers present program offerings to larger groups within the design community (e.g., 80 to 100 people) as well as smaller groups (e.g. 5 to 10 people). As one program manager explained, the outreach content depends to some degree on the kind of group or firm in attendance, and what kind of project is being considered:

> *"In a lot of cases if [the presentation] is for a particular firm I'll walk them through a project… I really want to hear what their concerns are and try to address them in the presentation... It's how the program applies to their projects where things get interesting. And so if it's a design build firm I'll talk about one thing. If it's a design firm I'll talk about something entirely different. ...On a new project there might be five or ten people in the room. From that project they'll have me go back to their respective firms to give a presentation. That's happened quite a bit."*

[8] One market actor stated that another person within the design organization had attended a ComEd training but did not know about the details.

Our participant interviews revealed that there were two main ways market actors and customers learned of the program. The first is through the program's website. Some market actors, as agents focused on finding incentives for projects, stated they had known of the program prior to being hired by owners to look for incentives; others were asked by the design team to search for incentives. Second, all customers and one market actor learned about the program through referrals from energy-focused organizations. These included ComEd representatives at an energy conference and Wisconsin Focus on Energy.

3.2.5 Effectiveness of the Incentive Process

Program managers generally agreed that program processes are effective for smoothly providing incentives to customers and motivating the program partners to participate. They noted that there have been no complaints made to the program so far. The participants indicated satisfaction with the program process and that all aspects went smoothly. However, one program manager noted that program forms tend to be tedious for both customers and program partners.

Additionally, the program manager stated that customers can have an ongoing sense of anxiety throughout the project due to concerns about utility funds running out mid-project:

> *"We've promised to do these things, [but] will that money still be there when the project's complete? You know it's sometimes a long time to wait. We do our best to assure them that that's the case but I think it's always the question. A lot of folks [have] a reticence to participate because they're not sure that the program is there for the long term. You know and these programs have a history of turning on and off depending on the amount of funding available. …It takes a long time to learn how these programs work and if they're going to invest the time the designers want to make sure that they're going to be around for the long haul. They don't want to see radical changes to the program design from year to year; consistency is a key issue."*

Despite managers' concerns, our interviews with project participants revealed that overall they tended to be satisfied or very satisfied with program processes. Project representatives stated that program requirements were generally clearly explained; that the program application was straightforward and clear; and that the verification and payment processes went smoothly. One market actor described the verification process as "seamless". Another described the website as "well laid out" and "self explanatory". Finally those we interviewed generally agreed that ECW staff were responsive, and that communication with staff had been good or very good and had met their needs.

Few participants, however, knew the technical assistance phase of the program by name. This finding, combined with other remarks, suggests that participants did not always know where they were in the program's 'steps'. Although few respondents knew the technical assistance

step by name, many respondents stated that ECW had provided them with valuable technical information that they applied to the projects or would apply to future projects.

> *[paraphrased] ECW was a very valuable resource and provided me insight on more efficient HVAC roof top units I plan to use in the future. –ComEd Customer*

3.2.6 Areas for Improvement

Program managers and participants were asked about areas for improvement. Interestingly, few items mentioned overlapped between the different respondents. Managers focused on areas of possible expansion (gas program coordination and moving towards net-zero), areas they see as limiting to their ability to obtain customers (such as small incentives), and how to improve their customer-facing activities (such as training and interactive tools). Participants, on the other hand, brought out areas of uncertainty in how the program worked, leading to suggestions that indicated a lack of knowledge in the program specifics.

Manager Suggestions

Areas that could expand participation

- Coordinate with Gas Programs - One manager mentioned the possibility of coordinating with gas programs, which are in development and that are scheduled for implementation in 2012. This was echoed by one market actor who pointed out that gas-based water and space heating measures could be incorporated into future Chicago area projects.
- Create a net zero incentive - The manager would like to see a Net-Zero incentive implemented to create a 'high profile' project and drive participation. Generally, a Net-Zero Energy Building (NZEB) "produces as much energy as it uses over the course of a year,"[9] While obtaining net-zero is the goal, moving buildings towards this can be useful. The manager believes the program might need more technical assistance funding to perform this type of activity and should apply to projects that are at least 50% above code as a start.
- Work with LEED - One manager believes it might be possible for the program to work better with LEED, although acknowledges difficulty with this suggestion. The collaboration would mainly apply to comprehensive, new construction projects. According to the manager, as many as 20% of program projects in Chicago are already considering LEED certification. Working with LEED was suggested so that municipality and designer goals for LEED buildings can be more frequently realized

[9]Net-Zero Energy Commercial Building Initiative
http://www1.eere.energy.gov/buildings/commercial_initiative/zero_energy_definitions.html

through the help of program incentives and technical expertise[10]. The manager acknowledges that there are some challenging disconnects between the two programs. One is that the program begins design work with the projects early, but that in LEED, modeling occurs after construction. Another is that different baselines are used for each program; for the ComEd program IECC 2006 or 2009 is used, and for LEED, ANSI/ASHRAE/IESNA Standard 90.1 is used.

» Develop a community of program partners - Based on a manager's past experience in a mature market, the manager explained that regular meetings to talk with those active people in the design community would be useful for building a community of program partners. The community would be useful in raising awareness and recognition of the new construction program as well as others. Additionally, it would allow designers to network with each other - a component some trade allies have noted they would like to see. To this end, the manager would like to see more monthly 'lunch-and-learns' take place.[11] While the program has this type of component in place, the manager believes that through continued building of such a community, more projects would be submitted to the program.

> *"There seems to be something missing and I'm not quite sure what it is yet in terms of outreach. I think I'm still trying to figure out the market myself. I mean there's a huge, huge market in Chicago. And I just think it'll take us time to build the infrastructure here and that what I sense is missing is we just don't have a tightly bound community yet around new construction."*

Areas that limit participation

» Peak demand reduction - One program manager stated that incentives are small because they are only based on kWh savings. The manager would like to see the program expand to include peak demand reduction, which would likely involve greater incentives.

Customer-facing Areas

» Training - One program manager explained that although the commissioning and retro commissioning topics were part of the same training they really have two different audiences. Since both topics were included in the same day, some of each

[10] The evaluation team notes that municipal projects would not occur within the ComEd program, but would be part of the DCEO new construction program.

[11] Another manager explained that the label for such events is not accurate in that they never consist of lunch, but instead consist of visits to firms to present the program. They typically occur once a month and there have been 5 such presentations as of 7/1/10.

audience wanted more on each topic. In the future, the program manager recommends creating separate trainings for each topic, yet understands that in so doing a new challenge is created. Even with more information per topic, neither will likely fill a whole day. Conversely, there was so much information presented at the variable air volume design training that some attendees suggested it be split into two days.

» Interactive modeling tool for the customer and design team - One manager believes that an interactive modeling tool for the customer and design team would benefit understanding and discussion during technical assistance with the implementer. It would allow the customers and designers the ability to play with hypothetical measures and approaches and view resulting project energy saving profiles.

Participant Suggestions

Participants' suggestions for program improvement had little overlap with those made by program managers. Some participant suggestions stem from being unaware of where their project stood in the program or from perceiving that too few measures were eligible for incentives while others focused on ways to expand knowledge and learning among participants.

Suggestions for program process

» Orientation/ Project Tracker - One participant stated a desire that the program provide a more thorough in-person orientation. The participant stated that although the program sent many electronic forms and was always accessible to him by phone or email, it never gave him an in-depth program orientation, either in person or over the phone, which other programs have tended to give. As a result, the participant believed he got an incomplete picture of the program and the potential it has for other projects. The participant still does not understand how and whether other projects could be involved earlier (i.e., comprehensive track) with the program. Another participant suggested that the program create an online tracker, which participants could sign into showing them what step their application was in and what they should expect in terms of content and timing from that step. Echoing this point, another participant suggested that the program set expectations for how soon incentives would be paid following verification.

Suggestions for change in program design

» Expand Measures/Loosen Requirements - One participant generally finds all ComEd programs to be on the "forefront" of those across the U.S., both in terms of incentives offered and their willingness to consider new technologies where savings can be proven, such as LED lighting. Nonetheless, the market actor and represented clients

are "shocked" that the small building track has such rigorous lighting requirements. The participant finds that the requirements limit participation and therefore energy efficiency. Another participant believes that the 20,000 square foot demarcation for small business track projects should not be a strict categorical limitation, and that projects should be considered on the basis of their energy use or complexity as well. Restaurants, for example, are small businesses but are "huge energy users." Participants also suggested that the program expand the set of measures that are incented or loosen the requirements around when the measures are eligible for incentives. For example, one participant thought that the project should have received incentives for several measures including an energy management system, occupancy sensors, daylight harvesting, ECM motors in refrigerated cases, light sensors, and LED lighting in freezer cases. These examples brings out the desire of some participants to push the design of the program in ways not currently planned or a lack of knowledge about how to participate in the offerings of more than one program.

» Facilitate Knowledge and Understanding through Additional Information - Other participant suggestions were focused on knowledge. One participant suggested that the program create general guidelines for various kinds of projects: for example, an energy conscious grocery store design; energy conscious office design etc. For each, the program should list five to ten typical features that might help modify an existing building and post them on the internet. One participant thought it would be helpful for the design team to see a full list of possible measures, especially for lighting retrofit design (e.g., dimming systems, high performance parking lot lighting, etc.). The participant reasoned that the more the engineers and design team know upfront about potential measures, including the cost/benefit analysis for each, the more they can start learning about energy efficient building. At some point, they might be able to do the analysis themselves.

3.2.7 Program Theory

There was no program logic model or theory created for this program by the evaluation team. The implementer had already created a model which was reviewed early in the program cycle. The memo from that review is provided in Appendix B.

3.3 Cost Effectiveness Review

This section addresses the cost effectiveness of the Nonresidential New Construction program. Cost effectiveness 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."*[12]

ComEd uses DSMore™ software for the calculation of the TRC test.[13] 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. Environmental benefits have been quantified for CO_2 reductions, using a value of $0.013875 per kWh.

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.

Table 3-8. summarizes the unique inputs used in the DSMore model to assess the TRC ratio for the Nonresidential New Construction program in PY2. Most of the unique inputs come directly from the evaluation results presented previously in this report. Measure life estimates and program costs come directly from ComEd. All other inputs to the model, such as avoided costs, come from ComEd and are the same for this program and all programs in the ComEd portfolio.

[12] Illinois Power Agency Act SB1592, pages 7-8.
[13] Demand Side Management Option Risk Evaluator (DSMore) software is developed by Integral Analytics.

Table 3-9. Inputs to DSMore Model for Nonresidential New Construction Program

Item	Value Used
Measure Life	15 years
Participants	16
Annual Gross Energy Savings	1,368 MWh
Gross Coincident Peak Savings	0.3 MW
Net-to-Gross Ratio	59%
Utility Administration and Implementation Costs	$77,506
Utility Incentive Costs	$86,425
Participant Contribution to Incremental Measure Costs	$45,000

Based on these inputs, the Illinois societal TRC for this program is 0.87 and the program does not pass the TRC test. The standard TRC calculation produced by DSMore is 0.52. This was the first full year of operation of the Nonresidential New Construction program. Administrative costs are highest in the startup year of a program. It is expected that administrative costs will moderate and participation will increase in future years. The combined effect should be increased savings at a lower cost per unit, creating a TRC that is greater than one.

Section 4. Conclusions and Recommendations

This section highlights the findings and recommendations from the evaluation of ComEd's PY2 Nonresidential New Construction Program. Below are the key conclusions and recommendations.

4.1 Conclusions

4.1.1 Program Impacts

The PY2 program exceeded their original net energy goals of 596 MWh by 35%. There were no specified demand goals.

Table 4-1. Program Net Impacts Compared to Target

Net Savings Estimates	MWh	MW
ComEd Plan Target	596	0
ComEd Reported for PY2 (ex ante)	1,098	0
Total PY2 Evaluation-Adjusted Net Savings (ex post)	803	0.174
Net Savings Realization Rate (ex post / plan target)	135%	NA

When comparing the tracking results (i.e., the results expected by the program from the 16 projects before any adjustments) to the verified gross impacts, the evaluation analysis reduced the gross impacts by 15% followed by a reduction from the NTGR. (Table 4-2)

Table 4-2. Program Gross and Net Impacts

	Tracking Gross Savings	Verified Gross Savings	Gross Impacts Realization Rate	Verified Net Savings	NTGR (applied to verified gross)	Net Impacts Realization Rate
MWh	1,615	1,368	85%	803	0.59	62%
MW	0.309	0.296	96%	0.174	0.59	70%

4.1.2 Program Processes

Program managers have been successful in meeting PY2 energy goals. They implemented the systems track to incent several retail projects in PY2 and created a stringent small buildings track to challenge the market and to avoid administrative burdens associated with small projects that would otherwise fill the systems track. Additionally, the program is now working with some comprehensive projects, from which higher amounts of savings can be realized in

PY3. Program managers are also focused on market transformation through the development of a community of educated and trained designers, engineers, and architects.

Participants are generally satisfied or very satisfied with the program and find it valuable, both for the available financial incentives and the information about energy efficient measures and design they learn about from ECW staff. While most were familiar enough with program processes to judge them positively, few knew about the technical assistance phase by name or were aware of training opportunities

4.2 Recommendations

4.2.1 Impact Recommendations

Regarding gross impacts, the implementation team may want to carefully review their program tracking database to assure that:

- Project values are automatically updated in the central tracking sheet
- When minimum qualifications and specific codes are referenced in the application forms, those qualifications and codes should be the only standards used and distributed to the program implementation staff for use in project reviews

Addressing these two areas should help assure that all projects that should be incented are and that when project changes are made, the change in energy savings are reflected in the total.[14]

4.2.2 Process Recommendations

There are few process recommendations as participants were generally satisfied. However, we do have a few recommendations to consider:

- There was a lack up understanding about the progress of their project once accepted into the program. This uncertainty could be ameliorated through a document clearly outlining the specific steps by name and continuous interaction with participants where these same names are brought up each time along with progress and timing as the project moves through the program steps.
- Clearly document how participants may benefit from participation in more than one of the ComEd program offerings to assure that all available measures are included in the projects.

[14] We note that ComEd indicated a centralized on-line database is being used as of the end of October 2010 and minimum codes and standards are specifically identified in the site verification report.

» The program should expand the marketing of the training classes and review the content of each class to fit specific audiences.

Section 5. Appendices

5.1 *Appendix A – In-Depth Interview Guide*

ComEd In-Depth Interview Guide- Smart Ideas for Your Business New Construction Decision Maker[15]

Final: 05-05-10

This depth guide will be used to assess attribution for the projects under the purview of the respondent. It will also support the process analysis. These interviews will be performed shortly after receiving information from ECW on completed projects to help reduce issues regarding memory. They will be performed by ODC analyst staff via the telephone. We will be calling the primary contact person as provided by ECW, but may expand our calls to include others within the project if it appears that others were highly involved with decisions. The numbered questions in our depth guide will definitely be asked, while non-numbers questions following are more prompts for us to make sure we cover the idea. As such, not all questions will be asked as written.

Respondent name: _____

Respondent phone number: _____

Respondent title: _____

Company name: _____

Project 1 (in sample) _____

Interviewer: _____

Date: _____

Time Start: _____

Introduction

Thank you for taking the time to talk with me today. The Opinion Dynamics evaluation team is currently conducting a study for Com Ed. There are two aims of this interview: first, we'd like to get your perspective on the Commercial New Construction Program; and second we'd

[15] Customer or program partner

like to find ways to improve the program as possible. We'd like to get your insight by asking you some questions that should not take any longer than 30 minutes.

PROCESS SECTION

Role on Program Projects

1. Could you tell me about your involvement in the New Construction program so far?
   - How many projects do you have going through the program? (Note: we may know this for PY2, but want to be sure our numbers match their expected projects.)
   - What has been your role on the project(s) that have been, or are in the program?
   - How long have you been working with the program?
   - What is the nature of the project(s)?
   - Through what track(s) has/have the project(s) you've worked on been submitted to ComEd? (Note: if we have the number correct, we will know this)
2. We know there were several people involved in the project, who was the main decision maker for choices regarding the energy efficiency of the building design?

Awareness of Program

3. How did you first hear about the program and what was your first impression of it?

   a. How have your impressions of the program changed, if at all, since you first learned about it?

Training Have you attended any training events?

- Did you attend the first one before or after you had submitted a project to the program?
- How did you hear about the event?
- Was the information you received or the event itself valuable to you?
- Did you learn anything in the training that you have incorporated into a building design? If so, was the building built to those specifications? If not, why not?

Program Processes

4. Have the program requirements been clearly explained to you?
   - How about how to participate?
   - Are there any ways you think the program can explain requirements or participation more clearly to participants in the future?

5. Do you think there are any requirements the program should adjust or change?
   - If so, which ones and how?

6. Did you fill out the program application for the project? If so, what do you think of it?
   - Was it straightforward, clear, tedious, difficult, etc.?
   - Do you have any suggestions for how to improve it?

7. How would you describe the technical assistance component of the program?
   - Was it straightforward, helpful, relevant, worthwhile, etc.?
   - Do you have any suggestions for how to improve it?
   -
8. How would you describe the verification process of the program?
   - Was it straightforward, tedious, a hassle, etc.?
   - Do you have any suggestions for how to improve it?

9. How did you find the payment process?
   - Was it timely, easy, etc.?
   - Do you have any suggestions for how to improve it?

10. Throughout your involvement with the program, was your communication with program staff what you wanted?
    - When you called or emailed staff, did they get back with you quickly?
    - Were they able to effectively communicate with you?

Benefits and Barriers

11. What are the main benefits of the program, if any?
    - What do you think others like you will find valuable about the program?
    - What will likely encourage others to participate?

12. What are the main drawbacks of the program, if any?
    - What do you think others like you will find difficult about the program?
    - What might keep them from participating?

Ways to Improve the Program

13. Can you think of any other ways to improve the program based on your experience, or the experience of others on the project?

NET-TO-GROSS (Attribution) SECTION

Free Ridership Factor (FR)

Now I'd like to ask a few questions about the design process for the energy efficient measures (i.e., HVAC and lighting) that were incented through the program. We need to

understand how both you and your clients thought about energy efficiency and what influenced you or your client to use the specific energy efficient design in this project. First, I have some questions that I would like you to answer to the best of your ability and then I will have an open question where you can make clarifications.

FR0. Would you say you worked with the program staff more around changes to design or changes to specific equipment? While we understand that design changes often mean equipment changes, we are trying to determine the extent of your interactions with the program. Simple equipment changes do not tend to have extensive changes in design (if any). [NOTE: we need to then ask the attribution questions in line with the answer to this question. If this is a design change, then ask as the first choice in the brackets. If they did equipment changes, then ask as the second choice]

FR1. When did you first learn about the Com Ed's New Construction Program? Was it BEFORE or AFTER you first began to THINK about the [current energy efficient design/efficient equipment]?

1. Before
2. After
8. Don't know

[ASK IF FR1=2, 8]

FR2. Did you learn about ComEd's Program BEFORE or AFTER you DECIDED to include the [energy efficient design/specific equipment] that the program incented?

1. Before
2. After
8. Don't know

FR3. Next, I'm going to ask you to rate the importance of the program as well as other factors that might have influenced your decision to include the [energy efficient design/specific equipment] that was incented in your project(s). Think of the degree of importance on a scale with equally spaced units from 0 to 10, where 0 means 'not at all important' and 10 means 'extremely important'. [FOR FR3a-g, RECORD 0 to 10; 96=Not Applicable; 98=Don't Know; 99=Refused]

(If needed: "How important was _____ in your DECISION to include the energy efficient measures and specific design in the project(s)?)

Q	Question	Response
FR3a	[ASK IF PARTICIPANT ATTENDED TRAINING AS STATED IN Q4] Training sponsored by the program	
FR3b	Availability of the program incentive	
FR3c	Information provided through the program's technical assistance process	
FR3d	[ASK IF PARTICPANT WORKED WITH A VENDOR OR CONTRACTOR – WE PROBABLY WILL KNOW BEFORE HAND BASED ON THE INFORMATION FROM ECW] Recommendation from a design professional or contractor that helped you with the choice of the equipment and the specific design	
FR3e	Recommendation from a ComEd/ECW staff person	
FR3f	Program information	
FR3g	Program marketing material	

FR3h. Were there any other factors we haven't discussed that were influential in your decision to [use this design/install this equipment]?

Other Factors:

96. Nothing else influential

98. Don't Know

[ASK IF FR3h HAD A FACTOR]

FR3hh. Using the same zero to 10 scale, how would you rate the influence of this factor? [RECORD 0 to 10; 98=Don't Know]

Thinking about this differently, I would like you to compare the importance of the program with the importance of other factors in your decision to include the [energy efficient design/specific equipment] in the project(s).

FR4. If you were given a total of 100 points that reflect the importance in your decision to include [energy efficient design/specific equipment] in the project(s) and you had to divide those 100 points between: 1) the New Construction program and 2) other factors, how many points would you give to the importance of the New Construction program?

Points given to program: [RECORD 0 to 100; 998=Don't Know]

FR5. Using a likelihood scale from 0 to 10, where 0 is "Not at all likely" and 10 is "Extremely likely", if the New Construction Program had not been available, what is the likelihood that you would have included the same level of energy efficiency in your [design/equipment choices]? [RECORD 0 to 10; 98=Don't know]

[ASK IF FR5>0, ELSE SKIP TO SO1]

FR6. You indicated that there was a <FR5 RESPONSE> in 10 likelihood that you would have [designed/installed] the same level of efficiency if the program had not been available. Do you think the building would EVER have reached this same level of efficiency if you had not included it at this point in time?

1. Yes

2. No [SKIP TO FR7]

3. Don't Know

FR6a. Without the program, when do you think you would have installed equipment that would have led to the same level of efficiency? Would you say…

1. At the same time

2. Later

3. Never

8. (Don't know)

[ASK FR6a =2]

FR6b. How much later would you have installed this equipment? Would you say…

1. Within 6 months?

2. 6 months to 1 year later

3. 1 - 2 years later

4. 2 - 3 years later?

5. 3 - 4 years later?

6. 4 or more years later

8. (Don't know)

FR7. Do you have anything else that you would like to share with me about the influence of the program in the efficient [design/equipment choice] at this site?

SPILLOVER MODULE

Next, I would like to discuss any energy efficient equipment you might have installed that was not incented by the program. I'll ask first about the project(s) that have gone through the program and then about any outside of the program.

SO1. Since participating in the New Construction program, have you included any ADDITIONAL energy efficient measures in the project(s)?

1. Yes

2. No (GO TO SO6)

8. Don't know

[ASK IF SO1=1]

SO1a. Did these measures receive incentives through any utility or government program?

1. Yes

2. No

8. Don't know

[ASK SO3 – SO5 IF SO1a=2, ELSE SKIP TO SO6]

SO3. I need to understand more about the other energy efficient measures you learned about through the program and implemented without a rebate.

- How many other energy efficient measures did you implement?

- What were the measures you implemented without a rebate?

SO3a. Let's talk about <most likely to have kWh savings> measure.

a. Why are you not expecting an incentive for this measure?

b. Why did you not install this measure through the New Construction Program?

c. If applicable, please describe the SIZE and TYPE of this measure.

d. If applicable, please describe the EFFICIENCY of this measure.

e. If applicable, please describe the QUANTITY of this measure.

SO3b. Was this measure specifically recommended by the New Construction staff?

1. Yes
2. No
8. Don't know

SO3c. Did you learn about it through any program event such as training?

1. Yes
2. No
8. Don't know

SO4. How significant was your experience in the New Construction Program in your decision to include <measure>, using a scale of 0 to 10, where 0 is not at all significant and 10 is extremely significant? [SCALE 0-10; 98=Don't Know]

SO5. If you had not participated in the New Construction Program, how likely is it that your organization would still have included this measure, using a 0 to 10, scale where 0 means you definitely WOULD NOT have included this measure and 10 means you definitely WOULD have included this measure? [SCALE 0-10; 98=Don't Know]

[REPEAT SO3 – SO5 AS NECESSARY FOR THREE MEASURES]

SO2. Now I want to ask you about any other projects that have not gone through the program. Since participating in the New Construction program, have you included any energy efficient measures that you learned about from the program in any other projects?

1. Yes
2. No (GO TO CLOSING)
8. Don't know (GO TO CLOSING)

[ASK IF SO2=1]

SO2a. Did these measures receive incentives through any utility or government program?

1. Yes
2. No
8. Don't know

[ASK IF SO2a=2]

SO2b. Was it for a project in ComEd service territory?

1. Yes
2. No
8. Don't know

[ASK SO6 – SO8 IF SO2b=1, ELSE SKIP TO CLOSING SECTION]

SO6. Now, please tell me about the energy efficient measures you included in projects that did not go through the program, but that were in ComEd service territory.

- What were they?

- How many projects were these in?

SO6a. Let's talk about <most likely to have kWh savings> measure.

a. Why are you not expecting an incentive for this measure?
b. Why did you not install this measure through the New Construction Program?
c. If applicable, please describe the SIZE and TYPE of this measure.
d. If applicable, please describe the EFFICIENCY of this measure.
e. If applicable, please describe the QUANTITY of this measure.

SO6b. Was this measure specifically recommended by the New Construction staff?

1. Yes
2. No
8. Don't know

S06c. Did you learn about it through any program event such as training?

1. Yes
2. No
8. Don't know

S07. How significant was your experience in the New Construction Program in your decision to include _____, using a scale of 0 to 10, where 0 is not at all significant and 10 is extremely significant? [SCALE 0-10; 98=Don't Know]

S08. If you had not participated in the New Construction Program, how likely is it that your organization would still have included this measure, using a 0 to 10, scale where 0 means you definitely WOULD NOT have included this measure and 10 means you definitely WOULD have included this measure? [SCALE 0-10; 98=Don't Know]

[REPEAT S06 – S08 AS NECESSARY FOR THREE MEASURES]

CLOSING SECTION

14. Is there anything else that you would like to let us know based on the topics we covered today, including any ways to improve the program if possible or how the program has affected your use of energy efficient measures or design in projects?

Thank you very much for participating in our study. We appreciate your time and feedback.

End Time: _____

5.2 *Appendix B – Net-to-Gross Analysis Plan*

Questions for net analysis in the in-depth interview guide were based on the analytical plan outlined here. This self-report approach for determining a net-to-gross (NTG) ratio is used to calculate net program savings. It is similar to the approach used in other ComEd program analyses:

$NTG = 1 - FR + SO$

Where:

NTG = the net-to-gross ratio

FR = the free-ridership factor

SO = spillover factor

Once developed, the net-to-gross factors are applied to the gross savings estimates to produce net savings estimates according to the following algorithm:

$$Net\ Program\ Savings = Gross\ Program\ Savings \times NTG_{program}$$

Questions to be Used for Net Analysis

This table indicated the purpose of each of the questions from the interview guide in Appendix A

Table 5-1. Instrument Question Number and Purpose

Question Number	Purpose
FR1-2	Determine whether decision-maker learned of program before or after thinking about or deciding to include energy efficient measures.
FR3a-3g, (FR3hh)	Determine importance of various program measures in decision to include program-qualifying energy efficient measures.
(FR3h)	Capture any other factor that was important in decision to include program-qualifying energy efficient measures.
FR4	Determine overall importance of program in decision to include energy efficient measures.
FR5	Determine the likelihood the decision-maker would have included the same energy efficient measures in the absence of the program.

Question Number	Purpose
FR6-6b	In the absence of the program, determining a timeframe that the measures would have been included anyway, if at all.
S01-S04	Capture any other energy efficient measures that were included in the project(s) that were the (partial) effect of the program
S05-So8	Capture any energy efficient measures included in other projects that did not go through the program but were in ComEd service territory, that were the (partial) effect of the program.

Determining NTG

A NTG ratio was developed per decision-maker interviewed and then assigned to each of their projects included in ComEd service territory.

Determining the FR

The FR is comprised of three main concepts: program measures influence (PFI), overall program influence (OPI) and the counter-factual (CF) (i.e., what the decision-maker would have done in the absence of the program). The FR is the average of these three concepts subtracted from 1, because the survey items frame free-ridership in reverse.

FR = 1-[(PFI + OPI+CF) /3 /10]

Where:

PFI = Program Measures' Influence

OPI = Overall Program Influence

CF = Counter factual

Program Measures Influence (PFI)

Since the Program is made up of many components (e.g., financial incentives, technical assistance, training, etc.), any of which may be influential in a decision-maker's decision to include Program-qualifying levels, we take the highest rating any of these variables receive as the maximum level of program measures influence.

PFI = [max (#FR3a, # FR3b, # FR3c, # FR3d, # FR3e, # FR3f (if this "other" influence is connected to the program)]

Where:

#FR3a = a number from 0 to 10, where 0 means 'Not at all Important' and 10 means 'Very Important' as to how important the trainings were in the decision to include energy efficient measures.

#FR3b = a number from 0 to 10, where 0 means 'Not at all Important' and 10 means 'Very Important' as to how important the financial incentives were in the decision to include energy efficient measures.

#FR3c = a number from 0 to 10, where 0 means 'Not at all Important' and 10 means 'Very Important' as to how important the technical assistance was in the decision to include energy efficient measures.

#FR3d = a number from 0 to 10, where 0 means 'Not at all Important' and 10 means 'Very Important' as to how important recommendations from equipment vendors or contractors were in the decision to include energy efficient measures.

#FR3e = a number from 0 to 10, where 0 means 'Not at all Important' and 10 means 'Very Important' as to how important recommendations from Com Ed/ECW staff were in the decision to include energy efficient measures.

#FR3f = a number from 0 to 10, where 0 means 'Not at all Important' and 10 means 'Very Important' as to how important program information was in the decision to include energy efficient measures.

 # FR3h = a number from 0 to 10, where 0 means 'Not at all Important' and 10 means 'Very Important' as to how another program-related factor was in the decision to include energy efficient measures.

Overall Program Influence (OPI)

For the Program to have primary influence on the decision-maker, the decision-maker must have been aware of the Program before the decision was made to include energy efficient measures in new construction or gut rehab projects. However, the Program could still have had an important secondary level of influence on a decision-maker, even if the decision-maker had decided to include energy efficient measures before becoming aware of the Program. For example, the decision-maker's initial decision and resolve may have been later strengthened by the Program. We ask the respondent to distinguish between thinking about measures and deciding on them. If the respondent states that they learned about the program after (#FR1) they first began thinking about including measures, we follow up to see whether they learned about the program before or after they decided on including the measures (#FR2). To distinguish these primary and secondary levels of influence we multiply a tenth of the OPI (#FR4) by 1 (#FR1 or

#FR2='before') or by ½ (#FR2='after'). We take a tenth of the OPI in order to stay proportionately consistent with the PFI and CF, from which we create an average later.

*OPI = (#FR1 or #FR2) * #FR4/10*

Where:

#FR1 or #FR2 = Timing: decision made before (1) or after the program (.5)

#FR4 = If you were given a TOTAL of 100 points that reflect the importance in your decision to include energy efficient measures in the project(s) and you had to divide those 100 points between: 1) the New Construction program and 2) other factors, how many points would you give to the importance of the New Construction program?

Counter-Factual (CF)

The CF reflects the decision-maker's hypothetical decision-making in the absence of the program. To measure this concept, we ask about the likelihood that the decision-maker would have installed the same measures in the absence of the program (#FR5), using a scale from 0 ("not all likely") to 10 ("extremely likely"). Lower ratings reflect greater program influence and vice-versa. Also, we ask the decision-maker when the equipment would have been installed. The sooner the decision-maker would have installed the equipment, the more likely that the respondent is a free-rider. If the respondent would have installed the equipment within 6 months anyway, this indicates a full free rider in which case the CF score would be the likelihood score subtracted from ten. Subtracting from ten reverses the scale and keeps the CF consistent with the other terms (i.e., the PFI and the OPI). The later a decision-maker states he would have installed the equipment, the less of a free-rider he is. Outside of four years, the decision maker is not considered a free-rider at all. In order to create equal intervals to cover the time greater than six months but less than 4 years (42 months), we convert the midpoint in the answer choices to the number of months. For example, "6 months to 1 year later" becomes 9 months, "1 – 2 years later" becomes 18 months", etc. The ratio of the number of months past 6 months to 42 months is subtracted from and multiplied by the likelihood.

For those who state there is a "0" in 10 chance that they would have installed the same equipment in the absence of the program OR for those who state they would have installed the equipment within 6 months:

CF= 10 – #FR5

For all others:

CF= 10 – [#FR5 X [1-[(#FR6a - 6)/42]]

Where:

#FR5= Using a likelihood scale from 0 to 10, where 0 is "Not at all likely" and 10 is "Extremely likely", if the New Construction Program had not been available, what is the likelihood that you would have included the same energy efficient equipment?

#FR6a= FR6a. How much later would you have installed this equipment? Would you say…

1. *Within 6 months?*
2. *6 months to 1 year later*
3. *1 - 2 years later*
4. *2 - 3 years later?*
5. *3 - 4 years later?*
6. *4 or more years later*

Combining PFI, OPI, and CF to Yield the FR

As stated above, the FR is the average of the PFI, OPI, and CF. However, the concepts are measures on scales of ten, and therefore to convert to an index score, we must divide by 10. Additionally, the PFI and OPI are framed positively and opposite of free-ridership (i.e, the higher the concept, the lower the free-ridership); and the CF has been framed to stay consistent with the first two concepts. Thus, we must adjust the FR by subtracting it from 1 in order to match the conventional equation. A low FR reflects high program influence and a high FR reflects low program influence.

FR = 1-[(PFI + OPI + CF) /3/ 10]

Determining the SO

There are two ways the program may have produced spillover (SO), which we seek to capture in questions #S01 through #SO8. First, we ask about any energy-efficient equipment that was installed in the New Construction project(s) because of what respondents learned about through the program, but for which they did not receive any program incentives or tax credits (#S01-SO4). Second, we ask about energy-efficient equipment that was installed on other projects within ComEd territory because of what respondents learned about through the program, but for which they did not receive any program incentives or tax credits (#S05-SO8).

Questions #SO2, #SO2ac, #SO2ad, #SO2ae, #SO6, #SO6ac, #SO6ad, and #SO6ae collect information on the specific equipment to be used for calculating savings. Questions #SO2a,b and SO6a,b ask why program-qualifying energy efficient equipment were not submitted to the Program and will be used to help determine, on a decision-maker by decision-maker basis, whether the program deserves some credit for those energy efficient measures. For example, a decision-maker who included program qualifying energy efficient measures but cites a cumbersome program application process would be included in the SO, but a decision-maker who states that pre-existing company policy dictates energy efficient equipment meeting program-qualifying levels would not. Questions #S03 and SO7 ask for the degree of program importance in the decision to install the energy efficient equipment; similarly, questions #S04 and SO8 ask for the likelihood that the organization would have installed the equipment in the absence of the program. These scores are subtracted from 10 to reverse the scale and make their direction consistent with #SO3 and #SO7. The SO is calculated:

SO:

If #SO2a,b and #SO6a,b all provide rationale against spillover, then SO=0

If #SO2a,b provides rationale for spillover, then S0 = [energy savings from #SO2 series] X [(#SO3+ (10-#SO4))/2/10]

If #SO6a,b provides rationale for spillover, then S0 = [energy savings from #SO6 series] X [(#SO7+ (10-#SO8))/2/10]

Where:

 # SO2a,b and #SO6a,b provides rationale judged as evidence for or against spillover.

energy savings = energy savings above baseline collected through questions #SO2, #SO2ac, #SO2ad, #SO2ae, #SO6, #SO6ac, #SO6ad, and #SO6ae.

#SO3 and #SO7= a number from 0 to 10, where 0 means 'Not at all Important' and 10 means 'Very Important' as to how important the program was in the decision to include energy efficient equipment in projects not submitted to the New Construction program.

#S4 and #SO8= a number from 0 to 10, where 0 means the organization definitely WOULD NOT have included this measure and 10 means it definitely WOULD have included this measure, in the absence of the New Construction program.

There was no spillover within PY2 projects.

5.3 Appendix C – Review of Operations Manual Memo

To: ComEd New Construction Program Manager and Implementers

From: EM&V Team and Mary Sutter – Opinion Dynamics Corporation

Date: January 21, 2010

Re: Review of the New Construction Operations Manual

At the request of the ComEd New Construction Program implementers (Energy Center of Wisconsin, ECW), the evaluation team reviewed the program operations manual (Version 1.2, September 30, 2009). Based upon this review, we provide feedback to ComEd and ECW regarding the design of the program as described in the manual.

Overall, we found that the operations manual is well crafted with sufficient detail to understand how the program is designed to work. We also identified several areas where additional clarification would be useful for the next version of the manual.

Positive Components of the Manual

As an evaluator, the desire of the implementation team to coordinate with us on certain tasks and use evaluation as a way to enhance the program is commendable.

The level of data collected by the ECW works well for our evaluation. For example, the dates in the tracking system will enable the team to provide a start to finish timeline that describes the program. The use of a program logic model to think through the activities and outcomes of the program is also positive, although we have two suggestions for the model.

At present, there are references to the Wisconsin code and components in the model that do not appear to be part of this current program (e.g., increase in the use of renewables). As such, we suggest that it be updated to reflect the ComEd program. The model is currently set up vertically and horizontally with multiple boxes. There are no links between the specific activities/outputs and effects. Links are used to indicate which activities are expected to bring about specific outcomes (effects). Without these links, it is not clear how the activities and effects are related and makes it difficult to test specific hypotheses.

It isn't clear what software was used to create the model. Our evaluation team has used Visio (a Microsoft product) to create program logic models as well as Inspiration, both of which have the capability to create connections between the boxes and number those links. Visio is relatively expensive and we did not find Inspiration to be as flexible as Visio. If you choose to update your model to include links and do not have Visio, we recently learned about an inexpensive software program ($39.95 for a single license) called DoView (www.doview.com) that is specifically designed for the creation of outcome models. It allows you to create levels of information that link together the activities and outcomes (although can only print out a single view at a time) as well as specifying research questions by areas within the model and including pictures. You can download a free trial and see if it works for you.

The process questions outlined on page 32 are good ones. We might add a few others during the data collection process, but one possibility is to have these current surveys sent to us as a neutral third party. When the customer knows that the information is going back to the implementer and that the feedback is not anonymous, they may not provide as frank of a review as they would otherwise. This is not something that we feel strongly about implementing, but it is one idea that is easy to set up. We can discuss this further if desired by ComEd and ECW.

The process flow charts provided are clear and helpful. They allow for a good understanding of how information flows through the program (i.e., complaint process) and how certain choices occur (i.e., project acceptance guidelines). Additionally, the beginning lists of contacts are good to see. One thing that would be helpful with the contacts, however, is if each name could be categorized by ECW to map to whether they are an architect or a mechanical engineer, etc. While we could create a categorization after the fact based on the names of companies, having it clearly indicated as to the type of market actor would reduce categorization errors and improve our ability to accurately target research.

The evaluation of training sessions is most likely not going to be an area of focus for our evaluation in PY2. However, the survey included in the manual is a good one and one that ECW indicated they have used for several years. If the survey continues to provide useful feedback to ECW for the continued improvement of the trainings, then we make no suggested changes at this time. However, if ECW is potentially looking to change the structure of the survey, they could look into a satisfaction survey with a quadrant analysis. This type of analysis can differentiate the components of the training that lead to overall satisfaction. It can also show the drivers for satisfaction, non-factors, expected factors, and areas of opportunity. This approach is one that we learned about during a conference and seems to have promise, but since we have not performed this analysis ourselves, we only bring it up as a possibility if ECW is looking for a slightly different way to analyze their trainings. We can provide more details if desired.

Areas for Clarification

Targeted Market Actors

The largest area where we need clarification is on how the targeted market actors are viewed. When we have a clear understanding of exactly who makes up a specific targeted group, it facilitates our ability to determine exactly who we may be talking with during the assessment and how to focus data collection instruments. Within the manual, market actors are discussed in a number of ways and it is unclear how much of a role they play in the program. For example, on page 22, the plan specifically indicated that trade allies, while important, are not a focus of the program. In contrast, there are multiple instances when trade allies are indeed focused upon as stated on page 27 where trade allies are part of the three pronged approach to program enrollment; on page 30 where they are included as part of the communication strategies for market transformation; and again on page 49 where they are seen as a key component in keeping the program pipeline filled. Outlining the role and relative importance of market actors to the program is a step we believe is important.

The role of manufacturers in the program isn't clear. What is the specific intervention and what is the desired outcome from that effort? While the logic model states that one outcome is that manufacturers "focus on how their products are high performance", the few times that these market actors are mentioned (outreach and training) does not appear to make this a plausible outcome from the small intervention. We suggest that this is dropped from the discussion in the manual unless a more compelling case is made that the program includes sufficient activities to plausibly affect manufacturers.

Similar naming of specific market actors throughout the manual would be beneficial in helping ensure that we have the correct groups. For example, the targeted market actors in the design and construction community (p. 22) include architects, mechanical and electrical engineers, lighting designers, design-build firms, and construction firms. However, outreach to the design and construction community is labeled as Architects, Engineering and Consulting (p 35). In this area the manual seems to include architects, engineers and designers, but not construction firms. We recommend clarifying whether construction firms are included here, as well as whether or not they should be included in any research done by the evaluation team related to outreach.

The training component of the program also seems to target groups that are not described in the manual as a specific focus of the program. For example dealers, wholesalers, and distributors are included as a target market (p. 45) as are facility and operational managers and maintenance staff (p. 46). The inclusion of training on retro-commissioning seems a bit outside the scope of a new construction program (although the commissioning component is definitely targeted). There are plausible secondary reasons for including different market actors in the training sessions, but as described, they seem to detract from the focus on the program's main

intervention. A clarification of why these groups are included in program training efforts would be useful.

The recommended clarifications presented above could just be semantics and could possibly be cleared up through a table that shows the market actors by the type of "touches" planned by the program (i.e., outreach, training, possible participant, organization used to reach market actor, etc). If the naming convention used here is carried over to the list of contacts, it would be very clear who should be called for what purpose.

Miscellaneous Areas

There are several other areas of the manual where we have substantive questions:

- How should the evaluation team use the information from the program to decide when a project is included in a specific program year? For example, we have assessed new construction programs where the date that the funding was encumbered marks the project year in which a project is considered. Alternatively, we have looked at projects that use the date of incentive payment to specify the program year. It is probably cleaner to include projects based on incentive payment, but there can be reasons for doing it the other way. We are open to either approach.
- There are several outcomes listed on page 31. They look to be appropriate outcomes, but several need additional language to fully explain exactly what would be assessed. For example, one of the outcomes is "Increased awareness of the association between high performance design and non-energy benefits." Further clarification around whose awareness is being increased would allow a more targeted assessment. We can discuss these over the phone if that would be useful.
- The differentiation for the small building track, which is described within the manual, still isn't exactly clear to us. For example, the reasoning behind the inclusion of lighting seems based only on applications received. Why are HVAC systems not included here as well? The table on page 68 indicates that projects with less than 20,000 sf are included here, but it appears to be only for new construction while the discussion on page 85 indicates it applies to retrofit situations as well. Also, why is there no technical assistance available for small buildings? It seems that this group may be the most in need of help, but if this is a matter of budget and the potential savings anticipated from small buildings is judged too small to warrant more resources then the approach makes sense.

There following are some minor areas that we also feel need attention:

- Please check the cross-references in the manual; they do not always reference the correct section, particularly those references sections in Section 10.
- Clarity around what the case studies in PY3 will be used for would be helpful. These have been created in PY2 – will they be updated in PY3? Added to?
- Update the manual to take out references to kitchen hoods and room air conditioners in the HVAC section or add information around their efficiency and incentives (p. 77 and 78).
- Update the algorithms on page 79 to include the correct units (i.e., kWh/sf or $/sf)
- Would a steam absorption chiller instead of electric be considered fuel switching? If so, then I suggest removing it from the table on p. 94.
- Double check the outputs shown on page 95. The Summary of Results table has the dollars flipped from that shown in the Incentive and Annual Energy Savings table.
- The applications indicate several possible contacts. Is this information being kept electronically such that it can be tied directly to a project?

We hope that this review is helpful for ComEd and ECW. We are happy to discuss any of our comments further in a future meeting.