Commonwealth Edison Company
Energy Efficiency/Demand Response Plan
Plan Year 1 (6/1/2008-5/31/2009)
Evaluation Report:
All-Electric Efficiency Upgrade

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Submitted To:
ComEd

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Final Report

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E EXECUTIVE SUMMARY

E.1 Evaluation Objectives

The goal of this report is to present a summary of the findings and results from the evaluation of the PY1 Multifamily All-Electric Efficiency Upgrade program[1]. This program has three major elements: provide direct installation of low-cost measures such as CFLs, electric water heater tank insulation, faucet aerators and low-flow showerheads; an energy audit of common areas; and rebates for HVAC and lighting measure recommendations through the Business Custom or Prescriptive programs. The target market is the property owners and managers of all-electric multifamily residential facilities, and tenants.

The primary objectives of this evaluation are to review default energy savings assumptions for direct installed measures, to quantify gross savings impacts from review of the program tracking data for direct installed measures, and to determine key process-related program strengths and weaknesses and identify ways in which the program can be improved. The impact evaluation activities for 2009 and 2010 will address gross and net impacts.

E.2 Evaluation Methods

Table 1 provides a summary of the data collection activities conducted as part of this evaluation. As this figure shows, the primary data collection activity for this evaluation was in-depth interviews with program management and implementation staff.

Table 1. Data Collection Activities

Data Collection Type	Targeted Population	Sample Frame	Sample Design	Sample Size	Timing
Tracking Data Analysis	All tenants receiving direct installed measures	Tracking Database	-	All	Ongoing
In-depth Phone Interviews	ComEd Program Manager	Contact from ComEd	Program Manager	1	April 2009
	Program Implementer	Contacts from ComEd	Honeywell Program Manager and Energy Specialist	2	May 2009

[1] Program Year 1 (PY1) began June 1, 2008 and ended May 31, 2009.

E.3 Key Findings

The Multifamily All-Electric Efficiency Upgrade program targets the property owners and managers of all-electric multifamily residential facilities, and tenants. The goals of this program were to generate immediate electric energy savings by providing direct installation of low-cost measures such as CFLs, electric water heater tank insulation, faucet aerators and low-flow showerheads in 3,300 tenant spaces; provide an energy audit of common areas; provide rebates for HVAC and lighting measure recommendations through the Business Custom or Prescriptive programs; and provide energy efficiency educational material to all-electric multifamily facility managers.

A total of 4,119 tenant spaces received direct installation of efficiency measures as part of the program. Rebates and energy savings for recommended measures installed in common areas will be evaluated within the Business Custom or Prescriptive programs. Table 2 below provides the first-year evaluation-adjusted gross savings estimates for each direct install measure type. The impact evaluation activities for 2009 and 2010 will address gross and net impacts.

Table 2. PY1 Gross and Net Savings Estimates

Gross and Net Parameter and Savings Estimates	Multifamily All-Electric Efficiency Upgrade
CFLs directly installed through the Program	19,428
Showerheads directly installed through the Program	3,786
Aerators directly installed through the Program	7,073
Water heater wraps directly installed through the Program	4
Program Tracking System MWh	2,568
Program Tracking System Coincident MW	*Not recorded*
Total First-Year Evaluation-Adjusted Gross MWh Savings	**2,315 MWh**
Gross Realization Rate (MWh)	**90%**
Total First-Year Evaluation-Adjusted Gross Coincident MW Savings	**0.20 MW**
Net-to-Gross Ratio (1-FR) ***(ComEd Program Assumption)***[2]	80%
Total First-Year Evaluation-Adjusted Net MWh Savings	**1,852 MWh**
Total First-Year Evaluation-Adjusted Net Coincident MW Savings	**0.16 MW**

Source: Analysis of program tracking data.

[2] The PY1 evaluation did not estimate the net to gross ratio. The value of 80% is drawn from the program plan presented in ComEd's 2008-2010 Energy Efficiency and Demand Response Plan (November 15, 2007). Page D-2 of the ComEd plan provides a footnote stating the net to gross ratio of 80% is drawn from the California Energy Efficiency Policy Manual, version 2 (2003).

Key Impact Findings

The PY1 net claimed energy savings for this program were 2,045 MWh[3], resulting in a net saving realization rate of 91%. The evaluated gross realization rate was 90%, lower than the value of 95% used in program planning.[4] The reasons for this lower realization rate are:

1. The default planning assumption for showerheads of 355 kWh savings per unit used in the tracking system assumed each showerhead installed counts as a unit, even when multiple showerheads are installed in a single tenant apartment or condominium. Source assumptions for the default energy savings are based on a "unit" being the tenant residence where all showers are converted to low flow devices. There were 593 tenant units that had two showerheads installed, and 12 that had three showerheads installed. The savings for two showerhead installations per tenant unit were reduced from 710 kWh to 355 kWh, and the savings for three showerheads was reduced from 1065 kWh to 355 kWh. If low flow showerheads are not installed in all shower facilities in the tenant unit, it would be necessary to reduce the 355 kWh savings for partial installation. The tracking data did not provide necessary detail to make this adjustment for partial installation. If the program seeks to claim higher savings for units with multiple showerhead installations, it will be necessary to document a greater number of occupants per tenant unit taking more showers than assumed in the default of 355 kWh. ***The total reduction from tracking savings for this adjustment was 219 MWh.***

2. Similarly, installations of bathroom and kitchen faucet aerators counted 52 kWh saved for each aerator installed, even in tenant units with multiple installations. The default savings assumptions provide 52 kWh for converting all bathroom aerators in a tenant unit, and a separate, additional 52 kWh for converting all kitchen aerators to low flow devices. The tracking system indicated 829 tenant units with two bathroom or two kitchen aerators installed in a unit, claiming 104 kWh saved – these were reduced to 52 kWh saved. There were 19 tenant units with three bathroom aerators, and 2 units with 4 bathroom aerators installed that were reduced to 52 kWh. ***The total reduction from tracking savings for this adjustment was 45 MWh.***

3. The only other adjustment to tracking savings was to reduce a single entry of 1,264 kWh saved for the installation of 6 CFLs to 264 kWh saved. ***The total reduction from tracking savings for this adjustment was 1 MWh.***

ComEd's default savings for compact fluorescent lamps was based on the replacement of a 75 watt incandescent with an 18 watt integral CFL, at 2.34 hours per day, with a 90% in-service rate for a savings of 44 kWh per lamp. The CFL product installed by the program is rated at 20 watts, reducing savings slightly, but we estimate the in-service rate at 95%, for a savings of 44.6 kWh per lamp when replacing a 75 watt incandescent. The 90% in-service rate adjusts for both failure to install and removal after installation. As a direct installation program, we are only adjusting for later bulb removal, estimated by ComEd's PY1 Residential Lighting program evaluation at 5%. ***The total increase from tracking savings for this adjustment was 12 MWh.***

[3] Original goal for the MFEE program was 2,369 net MWh.

[4] The value of 95% is drawn from the program plan presented in ComEd's 2008-2010 Energy Efficiency and Demand Response Plan (November 15, 2007). Page D-2 of the ComEd plan provides a footnote stating the value is an assumption by ICF Consulting.

We recommend the program create a technical reference manual to document the default savings values, similar to that used by the C&I Prescriptive program to establish default savings. The technical reference can build off of the default savings review presented in Section 3, and revise the assumptions for each measure to fit local ComEd conditions and the multifamily program. This activity should be done in coordination with the evaluation team, as certain key assumptions will be examined through the impact evaluation process.

We also recommend the program tracking data receive periodic data quality reviews and clean up, and that data entry include checks for values outside of limits. Data exported for the evaluation team should also be checked for anomalies.

Key Process Findings

Although the MFEE program met its customer participation goals for PY1, there are some changes that could be made to the program processes to improve operations and ensure the program continues to meet its goals in the future. Key findings are provided below; additional findings are provided in Section 3.2 and Section 4.2.

1. Due to the varied nature of the buildings targeted for inclusion in the program, the marketing plan does not make use of more common methods such as mailers, bill stuffers and mass media. Honeywell contacts the buildings directly and then relies on owners and managers to market the program to the tenants to gain access to units. Honeywell has experience with multifamily programs in other markets and has found their current approach to be most effective. However, the program should consider targeted mailings to tenants in advance of the visit to ensure that tenants are aware of the program and its benefits.

2. The audits of the common areas are to include an introduction to the existing Custom and Prescriptive C&I programs so that building owners can participate in these programs to make the recommended changes. Because the C&I programs had already met their PY1 goals when most audits were conducted, it was not possible for owners to participate. The programs should do a better a job of coordinating activities to allow building owners the opportunity to participate in the C&I programs as well.

3. Honeywell does not regularly collect tenant contact information, thus it is difficult for ComEd to do random follow up checks and for the evaluation team to do its work. Though tenants should not be required to provide contact information, they should be encouraged to do so.

4. ComEd conducts ride alongs and places follow-up phone calls to evaluate the work of Honeywell energy specialists. The method for selecting which buildings to visit and tenants to call is not defined or documented. The results of these activities are also not documented. The program should set a system for conducting the ride alongs and placing the calls on a regular basis and tracking the results. The phone calls could be rolled into the follow up survey discussed below.

5. The survey Honeywell leaves with tenants to get feedback on the program has a 13.6% response rate and participants can choose to participate. In order to obtain feedback from a more representative sample of participants, ComEd should consider replacing or supplementing the survey left with tenants with phone calls to a random sample of participants. This effort could be combined with the follow up phone calls discussed above to get an assessment of both the energy specialists work as well as satisfaction with the installed measures.

1 INTRODUCTION TO THE PROGRAM

1.1 Program Description

ComEd's Multifamily All-Electric Efficiency Upgrade Program (MFEE) targets multifamily buildings with both electric heat and hot water and provides site visits to improve the building's energy efficiency. These site visits consist of two major elements:

- Apartment walkthrough assessment – Energy specialists conduct a walkthrough assessment of each unit in the building and provide installation of high efficiency measures where possible. Replacement measures include compact fluorescent light (CFL) bulbs, low-flow showerheads, sink aerators and water heater wraps. The staff member also provides the tenant with a write-up of the measures installed and information regarding energy efficiency.

- Common area assessment – Program staff also conduct an energy audit of the building's common areas to identify potential energy savings. The building manager or property owner is then given a report of recommended improvements and information regarding rebates through ComEd's Business Custom or Prescriptive programs.

The MFEE program launched in June 2008 and has just completed Program Year 1. Honeywell Utility Solutions is the implementer of the program.

1.2 Evaluation Questions

The Evaluation Plan from May 18, 2009 outlined the key researchable questions for the evaluation team. This report is structured accordingly.

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. Has the program design changed from the plan filed on November 15, 2007? If so, how, why, and was this an advantageous change?
2. Is program implementation on track and meeting goals? Has the program been implemented in a manner consistent with program design?
3. Effectiveness of program implementation, design and processes, and marketing efforts,
4. Customer (tenant and owner/manager) experience and satisfaction with the program, and
5. Market effects associated with program activities.

2 EVALUATION METHODS

This section describes the analytic methods and data collection activities implemented as part of the PY1 process and impact evaluation of the Multifamily All-Electric Efficiency Upgrade program, including the data sources used for the data collection activities.

2.1 Analytical Methods

Default Savings Review

We conducted a technical review of measures with assigned default savings values to assess the reasonableness of underlying algorithms, technology assumptions, and calculated savings values. Our findings regarding individual assumptions and algorithms may be categorized as follows:

1) ACCEPTABLE AS IS: assumption or algorithm is reasonable and appropriate for ComEd

2) REVISE OVER TIME: the assumption or algorithm is acceptable for the near term but should be improved over time through the evaluation process, market research, or program experience.

3) ERROR OR DISAGREEMENT: We believe the assumption or algorithm contains an error or we disagree on the value or approach.

The preferred data sources for assumptions are recent local primary research, EM&V, and program experience. Since those sources were generally not available in Illinois when ComEd assembled documentation and developed default savings values, we understand that some assumptions must be drawn from data sources that involve a compromise between age, rigor, or location. When assumptions are described as "needing revision", we may propose an existing alternative data source or suggest using the evaluation process, market research, or program experience to revise the assumption through a collaborative review process.

Several points in this default savings review discuss issues that EM&V *could* illuminate. This should not be construed as saying that EM&V work as defined in the current evaluation plans *will* address the issue. The current evaluation budget could not support detailed research on the full range of issues identified as potential targets for EM&V work. The EM&V deliverables within our current plans will be one of several sources of information to draw upon as default values are updated.

Following are the types of issues we considered in our reviews:

Measure definition – Provides a description of the efficient technology, the required technology performance specifications, and the applications where the technology is eligible. Potential issues include:

- Are the performance specifications complete to ensure the default savings will be achieved?
- Are the performance specifications independently rated or certified?

Measure Savings Engineering Analysis – provides the algorithms used to calculate non-coincident demand reduction, coincident demand reduction, and annual energy savings:

- Are the algorithms correct for the measure?

- Do the algorithms provide reasonable estimates for the range of applications and operating conditions of participants in the program?
- Are factors missing from the equation?

Measure Savings Assumptions – documents the wattages, efficiency ratings and operating assumptions for baseline and efficient equipment to calculate non-coincident demand reduction, coincident demand reduction, and annual energy savings. Potential issues include:

- Is the baseline equipment type and performance appropriate for the measure description?
- Are the efficiency ratings and wattages appropriate for the range of operating conditions expected of participants?
- Do the operating assumptions provide a reasonable representation for program participation?
- Are the coincident factors reasonable?
- Are the assumptions documented and are the data sources appropriate for ComEd?

Measure Savings Results – Presents the default values that are derived from the algorithms and assumptions. Potential issues include:

- Has the calculation been correctly performed to generate the default values (any math errors)?
- Is the weighting or averaging of data to derive a single default value reasonable?
- Do individual default values cover too broad of a range?
- Are the units for the savings correct and clearly presented?

Net Program Savings

The primary objective of net savings analysis is to determine a program's net effect on customers' electricity usage, accounting for free-ridership and spillover. This requires estimating what would have happened in the absence of the program. Thus, after gross program impacts have been assessed, net program impacts are derived by estimating a Net-to-Gross (NTG) ratio that quantifies the percentage of the gross program impacts that can reliably be attributed to the program. Once free-ridership and spillover have been estimated the Net-to-Gross (NTG) ratio is calculated as follows:

NTG Ratio = 1 – Free-ridership Rate + Spillover Rate

Participant free-ridership and spillover were not estimated for PY1. Free-ridership and spillover will be addressed in the PY2 and PY3 evaluation activities.

The PY1 evaluation will use ComEd's program planning assumption for NTG ratio:

NTG Ratio = 80% (ComEd Program Assumption)[5]

[5] ComEd, *Commonwealth Edison Company's 2008-2010 Energy Efficiency and Demand Response Plan*, November 15, 2007, Docket No. 07-0540 ComEd Ex. 1.0, page D-2.

2.2 PY1 Data Collection Activities

The data collected for the evaluation of the PY1 Multifamily All-Electric Efficiency Upgrade program was gathered during a number of activities including in-depth phone interviews with ComEd program staff and program implementers at Honeywell and ComEd tracking data analysis. Table 3 below provides a summary of these data collection activities including the targeted population, the sample frame, and timing in which the data collection occurred.

Table 3. Data Collection Activities

Data Collection Type	Targeted Population	Sample Frame	Sample Design	Sample Size	Timing
Tracking Data Analysis	All tenants receiving direct installed measures	Tracking Database	-	All	Ongoing
In-depth Phone Interviews	ComEd Program Manager	Contact from ComEd	Program Manager	1	April 2009
	Program Implementer	Contacts from ComEd	Honeywell Program Manager and Energy Specialist	2	May 2009

2.2.1 Data Sources

Program Tracking Data

The tracking data delivered for this evaluation was extracted from a copy of the ComEd online database uploaded to the evaluation team SharePoint site on September 17, 2009. We extracted four databases:

1. A master list of project ID's. A project is associated with a site that may contain one or more buildings under a common name or owner (59 project ID's were included in PY1).
2. A table of building audit data, one record for each recommended measure type in each building, that includes building owner or manager contact information, site address information, premise ID, heating and water heating system types, audit date, number of units, and common area audit recommendations (225 records for PY1).
3. A table of direct installation data with one record per measure type per apartment that includes apartment unit or condo address, installer and installation date, customer response, premise ID, water consuming appliance identification, work order number, measure types and quantities, and kWh savings (28,722 records for PY1).
4. A table of customer feedback survey responses, one record per response (559 records for PY1).

These extracted databases are not the official database used by the program implementer; they are databases provided for evaluation. During evaluation team analysis of the data, it was discovered that energy savings data had not transferred for 5 installation dates in March 2009. The implementer confirmed that this arose somewhere within the data conversion and uploading process, as the official tracking database included the savings data for those 5 days.

In-Depth Interviews and Program Materials

Data for this task was gathered through in-depth interviews with program and implementation staff at ComEd and Honeywell. The interviews are summarized in Table 4.

Table 4. In-Depth Interviews

Program	Person	Date Interviewed
Multifamily All-Electric Efficiency Upgrade	Sharon Madigan (ComEd)	04/21/09
Multifamily All-Electric Efficiency Upgrade	Dan Sturdevant (Honeywell)	05/07/09
Multifamily All-Electric Efficiency Upgrade	Steve Meyer (Honeywell)	05/19/09

The evaluation team also reviewed program materials, including: Honeywell's operating manual, related forms, program tracking database and the Honeywell customer survey results.

3 PROGRAM LEVEL RESULTS

This section presents the results of the impact and process evaluations of the Multifamily All-Electric Efficiency Upgrade program.

3.1 Impact Evaluation Results

3.1.1 Verification and Due Diligence

This section provides the results of the evaluation of ComEd's Verification and Due Diligence of the Multifamily All-Electric Efficiency Upgrade Program. We explored the quality assurance and verification activities currently carried out by program and implementation staff. We compared these activities to industry best practices[6] for similar residential and C&I programs to determine:

1. If any key quality assurance and verification activities that should take place are currently not being implemented.
2. If any of the current quality assurance and verification activities are biased (i.e., incorrect sampling that may inadvertently skew results, purposeful sampling that is not defendable, etc.).
3. If any of the current quality assurance and verification activities are overly time-consuming and might be simplified or dropped.

The applicable best practices are summarized in Appendix 5.2. This assessment primarily relied on in-depth interviews with program and implementation staff and documentation of current program processes, where available.

Data Collection

Data for this task was gathered through in-depth interviews with the program management and implementation staff, as shown in Table 4. Program materials, such as the operating manual and related forms, were also reviewed as part of this task.

Results

Participant Eligibility

The program targets multifamily buildings with electric heat and electric hot water. The program works from a list of 174,000 buildings coded as "all-electric." However, in practice, many of these buildings have central hot water heaters and therefore do not qualify. The Honeywell staff has found that the easiest way to identify potential participant buildings is to have staff drive around and do a spot check on buildings to see if it has a gas hook-up. If not, the staff will find the contact information of the management office and confirm the heat and hot water fuel type.

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

Assessment: Although it may be effective, this method of identifying eligible buildings requires an extra step by Honeywell to qualify buildings, compared with qualification directly if a better set of data was available. Contacting buildings by phone without spot checking the fuel type may be less costly, although likely not as effective given the quality of the data.

Another concern regarding participant eligibility is that the population of all-electric buildings may not be large enough to support the program long term goals. To compensate, the program is open to allowing buildings with a central gas heating system but with units that have individual electric hot water heaters.

Ride Alongs

To ensure that the protocols established in the operating manual are followed, senior staff at Honeywell and ComEd periodically accompany the energy specialists during site visits. The ride along allows the program manager to see the energy specialist's interaction with tenants and the building manager as well as installation procedures. In addition to the installation of the energy-saving equipment, the energy specialist must gain access to the tenant's unit, describe the program and learn about the existing equipment and its use. Between the ride along visits and follow up phone calls (discussed below), the program attempts to touch 5-10% of participating tenants.

Assessment: Accompanying the energy specialist on the site visit is a good way to evaluate the specialist's success implementing the program. Because much of the site visit is direct interaction with the tenant, accompanying the energy specialist on the visit is the best way to gauge their success beyond the number of installations. The program may consider better defining and tracking the ride along procedures to ensure that their goal of 5-10% quality inspections is met.

Participant Survey

At the conclusion of the installation visit, the Honeywell energy specialist leaves a survey with the tenants. This survey includes questions regarding:

- Reasons for participation
- Performance of program representative (ability to identify, attitude, demonstration of applicable items)
- Awareness of building participation
- Satisfaction with visit and conservation items
- Level of information of leave behind materials

The survey also includes an open ended section for the tenant's comments. Providing surveys for participants to rate their experience and provide feedback allows Honeywell to track the performance of specific staff and the satisfaction of program participants, as well as to capture complaints left in the comments section. Follow up phone calls are made to tenants who provide low ratings of the staff, installed items or the overall program in an attempt to resolve the issue.

Assessment: Leaving surveys with participating tenants is a good way to gather feedback on the energy specialist, installed items and program. In PY1, 13.6% of participating tenants returned the survey. However, this should not be the only method of data collection. The program should continue to follow up with tenants who provide low ratings to determine the reason for the rating. Common reasons for dissatisfaction should be relayed to Honeywell and ComEd to address or improve in future site visits. To

improve the survey process, Honeywell may consider contacting a random sample of participants to meet the desired response rate.

Follow Up Phone Calls

Honeywell staff also periodically conducts follow up phone calls to learn about participants' experience in the program. These calls supplement the survey left with the tenants following the site visit. The staff will call the tenant if they provide negative marks on the survey to help resolve the issue. Additionally, follow up calls are made to a small, random sample of participating tenants. Between the follow up calls and ride along visits, the program attempts to touch 5-10% of participating tenants.

Assessment: Conducting follow up phone calls with participating tenants provides the program with insight into the participants' installation experience and use of the installed items that may not be captured in the survey. The program should establish more defined procedures in which a statistically drawn sample of tenants and building managers are interviewed using the same survey instrument.

Summary and Recommendations

Overall, the Multifamily All-Electric Efficiency Upgrade program employs multiple quality assurance and verification activities to help ensure the program meets its goals. The program works to identify eligible buildings and provides a feedback survey to participating tenants. This is supplemented with ride along visits and follow up phone calls. The program's goal is to touch 5-10% of participating tenants through the combined visits and calls.

Table 5 summarizes the quality assurance and verification activities currently carried out by the Multifamily All-Electric Efficiency Upgrade program. It also features recommended changes to current procedures, as well as suggestions regarding additional activities that ComEd and Honeywell could implement to enhance current quality assurance and verification.

Table 5. Summary of Quality Assurance Activities in Place and Recommendations

QA Activities in Place	Recommended Change
• Participant eligibility	• Improve eligibility checks if possible; consider expanding eligibility to building with gas heat
• Ride along inspections	• Better definition and tracking of ride along inspections
• Participant survey	• Following up surveys with phone calls to meet desired response rate
• Follow up phone calls	• Establish more defined procedures to contact statistically drawn sample

3.1.2 Tracking System Review

The direct installation tracking data for PY1 contained 28,722 records, one for each measure type installed or refused in each apartment contacted. Our review of the direct installation tracking data provided to the evaluation team uncovered several minor problems, including:

- 124 installed measures did not have an apartment number or premise ID (25 MWh).

- 762 installed measures showed quantity installed but no kWh. This error was not present in the official tracking system, but occurred during conversion and transfer of data to the evaluation team (150 MWh).
- 4 measures did not show an installed date or installer. The program implementer confirmed these measures were installed in a follow up visit but that the database was not updated (1 MWh).
- 97 measures had installation dates outside of the PY1 program year, including 36 installations with kWh identified (6 MWh). These installation dates were prior to May 31, 2009 (for example July 30, 1980). The context of these installations (building site, project ID) makes it clear these were data entry errors.

These minor problems did not result in evaluation adjustments to the tracking data, but could have if they had not been identified by the evaluation team. With this amount of data entry, we recommend the program tracking data receive periodic data quality reviews and clean up, and that data entry include checks for values outside of limits. Data exported for the evaluation team should also be checked for anomalies.

One evaluation adjustment to direct installation tracking savings was made to reduce a single entry of 1,264 kWh saved for the installation of 6 CFLs to 264 kWh saved.

After cleaning the data for the errors described above, we created an Excel spreadsheet of the direct installation measures to analyze the tracking savings by measure type.

The distribution of measures installed are provided in the tables below for CFLs, showerheads, and aerators. Each of the 4 water heater wraps was installed in a separate residence.

Table 6. Distribution of Installed CFLs

Quantity/residence	Program Total	Distribution
1	32	0%
2	110	1%
3	240	1%
4	1,004	5%
5	440	2%
6	17,550	90%
7	35	0%
8	8	0%
9	9	0%
Program Total	19,428	100%

Table 7. Distribution of Installed Showerheads

Quantity/residence	Program Total	Distribution
1	2,564	68%
2	1,186	31%
3	36	1%
Program Total	3,786	100%

Table 8. Distribution of Installed Kitchen or Bathroom Aerators

Quantity/residence	Program Total	Distribution
1	5,350	76%
2	1,658	23%
3	57	1%
4	8	0%
Program Total	7,073	100%

3.1.3 Gross Program Impact Parameter Estimates

We conducted a technical review of measures with assigned default savings values for direct installed measures to assess the reasonableness of underlying algorithms, technology assumptions, and calculated savings values. The default savings review covered the following measures:

- Compact Fluorescent Light Bulbs
- Low Flow Showerhead
- Handheld Showerhead
- Swivel Kitchen Aerator
- Bathroom Aerator
- Hot Water Heater Wrap

Integral CFL Bulbs

Measure Definition

Product specifications are provided in the Appendix and are acceptable. The measure definition assumes a base incandescent of 75 watts. Program documents do not address baseline qualification and how lamps of other wattages (such as 60 watt lamps) are handled during site visits.

The wattage of the installed product (20 watts) differs from the wattage used to derive default savings impacts (18 watts) for the program.

Algorithms

The gross energy and demand algorithms used for the integral CFL component of the Multifamily All-Electric Program are taken from DEER.[7] They are calculated as follows for an 18 watt CFL replacing a 75 watt incandescent:

$$\text{Gross kWh} = \frac{\text{Delta Watts (57)} * \text{HOU/day (2.34)} * \text{days/year} * \text{In-service Rate (90\%)}}{\text{1000 Wh/kWh}}$$

$$= 44 \text{ kWh}$$

$$\text{Gross Coincident kW} = \frac{\text{Delta Watts (57)} * \text{In-service Rate (90\%)} * \text{Peak Hour Load Share (0.081)}}{\text{1000 W/kW}}$$

$$= 0.00 \text{ kW}$$

The algorithm for gross kWh is acceptable, although consideration should be given to developing HVAC interaction factors. Electric savings seen by customers from the CFL installation could be reduced during the heating season in apartments with electric baseboard heating. The algorithm for coincident peak kW savings is acceptable, except that the demand savings period should match ComEd's peak definition, which we assume to be 1 pm through 6 pm Central Time, June through August.

Assumptions

ComEd's default savings from the algorithms listed above are based on the following assumptions:

- Bulb In-service rate of 90% (value assumed in DEER).
- Delta Watts – assumes a conversion between a 75 watt incandescent and an 18 watt CFL, taken from DEER and based on a 2005 CA Metering Study. The assumption that all program installed CFLs are replacing 75 watt incandescent bulbs may be incorrect.
- Hours of Use for all Integral CFL measures = 2.34 hours/day - taken from DEER and based on 2005 CA KEMA Metering Study.
- Peak Hour Load Share = 0.081 - taken from DEER and based on 2005 CA KEMA Metering Study.
- Measure Life was assumed to be 9 years for all Integral CFLs.
- Summary of default savings estimation:

[7] California Public Utilities Commission (CPUC) and the California Energy Commission (CEC), *Database for Energy Efficiency Resources (DEER)*. The data is accessible on the DEER website (http://eega.cpuc.ca.gov/deer/) through a database search tool.

Table 9. Ex Ante Default Savings

Measure	ComEd Gross Default Savings (kWh/unit)	DEER Gross Energy Savings (kWh/unit)	ComEd Gross Default Peak Savings (kW/unit)	DEER Gross Peak Savings (kW/unit)
18W CFL replacing 75W incandescent	44	44	0.00	0.004

Results

The units for compact fluorescent savings estimation is per bulb installed.

Table 10. Evaluation Adjusted Default Savings

Measure	Unit	Evaluation Adjusted ComEd Gross Default Savings (kWh/unit)	Evaluation Adjusted ComEd Gross Default Savings (peak kW/unit)
20W CFL replacing 75W incandescent	Per lamp	44.6	0.004

There are a number of areas of concern with the stated default values used for the integral CFL component of the Multifamily All-Electric Program. These areas include the estimated hours of use, the wattage of the installed and replaced bulbs, the assumed in-service rate, peak coincidence factor, and measure life assumptions.

1. Hours of Use per day was taken from the CA Metering study and is likely to be different from HOU in ComEd territory for apartment and condo residences.
2. The savings resulting from an 18 Watt CFL replacing a 75 Watt incandescent is slightly larger than for the 20 Watt CFL model installed by the program to replace a 75 Watt incandescent. The default savings have been adjusted to reflect this difference.
3. The savings resulting from an 18 Watt CFL replacing a 75 Watt incandescent is larger than an 18 or 20 Watt CFL replacing a 60 Watt incandescent. If a significant percentage of base wattage lamps replaced are 60 watts, the default savings for the program need to be adjusted accordingly.
4. The default savings incorporates an in-service rate of 90% that adjusts for both failure to install and lamp removal after installation. In a direct installation program, the in-service rate will only need to correct for removal of installed lamps. The PY1 evaluation of ComEd's Residential Lighting program found through surveys that roughly 5% of the bulbs installed had reportedly been removed. The primary reasons given for the removal of these bulbs were that they had burned out or stopped working. Many fewer were removed due to bulb satisfaction reasons such as they took too long to start up, they were not bright enough or they did not like the color of light they produced.
5. The demand savings estimates were not included in the tracking database. A peak coincidence factor should be developed for ComEd.

6. The 2008 DEER update decreased Measure Life for Integral CFLs from 9 to 6.3 years.

Low Flow Showerhead or Handheld Showerhead

Measure Definition

Product specifications are provided in the Appendix and are acceptable. Honeywell instructs its energy specialists to inspect the base showerhead water flow rate and not to replace it if it is less than 2.5 gpm.

Algorithms

ComEd's 2008 – 2010 program plan identifies DEER as the source of default savings values for showerheads, but the kWh values do not match DEER 2005. It is unknown precisely from where the gross energy algorithm for low-flow showerheads is derived, but the methodology is similar to that used in the CL&P and UI Program Savings Documentation for 2008 Program Year. This methodology is acceptable, although some models include factors for throttling of flow and partial installation in the residence. We can reproduce the default value with the following calculation:

Gallons saved per year = (2.5 base GPM-2.0 low flow GPM)[0.5](minutes/shower)[8 minutes]*(#shower/day)[2shower/day]*(365 days/year)*

Gross kWh = gallons saved[2920 gal](shower temp-heater temp)[45 deg F] *8.3Btu/gallon*1kWh/3413Btu/(water heater efficiency)[0.9]*

The units for the low-flow showerhead gross savings estimation are per multifamily home.

The gross demand savings are equivalent to the DEER 2005 peak demand reduction per unit, which is calculated as follows.

Coincident Peak kW Savings = Avg demand savings between 12-6pm May through October.

The algorithm for coincident peak kW savings is acceptable, except that the demand savings period should match ComEd's peak definition, which we assume to be 1 pm through 6 pm Central Time, June through August.

Assumptions

The CL&P algorithms listed above are based on the following assumptions:

- Duration of showers is estimated to be 8 minutes. This value is derived from the State of Wisconsin Public Service Commission of Wisconsin Focus on Energy Evaluation ACES: Default Deemed Savings Review Final Report June 24, 2008.
- The installed low-flow showerhead is assumed to deliver 2.0 gpm, while the base is assumed to deliver 2.5 gpm, a 0.5 gpm reduction.
- The installed handheld showerhead is assumed to deliver 2.5 gpm, while the base is assumed to deliver 3.0 gpm, a 0.5 gpm reduction.
- Average household size of multifamily rental units is estimated to be 2.06 from the 2006 American Community Survey data from the US census for Wisconsin. Estimation is 1 shower per day per person.

- Assumes 55°F temperature of water entering water heater and 100°F temperature of water at point of use.
- Electric water heater has an efficiency of 0.9.
- DEER measure life was assumed to be 10 years for all low-flow shower heads.
- Summary of default savings estimation:

Table 11. Ex Ante Default Savings

Measure	ComEd Gross Default Savings (kWh/unit)	ComEd Gross Default Peak Savings (kW/unit)	DEER Gross Peak Savings (kW/unit)
Low Flow Showerheads	355	0.02	0.0153

Results

The units for all showerhead savings estimations are per multifamily residence.

Table 12. Evaluation Adjusted Default Savings

Measure	Unit	Evaluation Adjusted ComEd Gross Default Savings (kWh/unit)	Evaluation Adjusted ComEd Gross Default Savings (peak kW/unit)
Low Flow Showerheads	Per multifamily residence	355	0.015

There are a number of areas of concern with the stated default values used for the low-flow showerhead measure of the Multifamily All-Electric Program.

- The 355 kWh default savings estimate is high compared to the 69.6 kWh/unit per year DEER 2005 savings estimate for low-flow showerheads in multifamily homes, but similar to default assumptions used by Wisconsin Focus on Energy in the Apartment and Condo Efficiency Services (ACES) program (726.2 kWh for 1.5 gpm, 544.8 kWh for 1.75 gpm, and this implies 363.4 kWh for 2.0 gpm.)[8]. The actual savings value should be confirmed in the ComEd territory by further research on the algorithm input assumptions.
- The typical temperature of water entering water heater in the ComEd territory should be determined.
- The installed gpm of base and low-flow showerheads used in this program should be verified to deliver a reduction of 0.5 gpm.

[8] Public Service Commission of Wisconsin, Focus on Energy Evaluation *Semiannual Report (18-month Contract Period)* Final: April 8, 2009, Appendix B.

Swivel Kitchen Aerator & Bathroom Aerator

Measure Definition

Product specifications are provided in the Appendix and are acceptable. Program documents do not address field assessment of the base aerator water flow rate, a key factor in the savings calculation.

Algorithms

The gross energy and demand savings algorithms used for both faucet aerator measures of the Multifamily All-Electric Program are taken from DEER 2005. They are calculated as follows:

*Gross kWh = % savings by measure * baseline water heating end use unit energy consumption (UEC)*

Coincident Peak kW Savings = Avg demand savings between 12-6pm May through October.

The units for all faucet aerator savings estimations are per multifamily home.

The algorithm for gross kWh is acceptable, although ComEd may want to switch to a simple engineering model based on flow rates and water temperatures. The algorithm for coincident peak kW savings is acceptable, except that the demand savings period should match ComEd's peak definition, which we assume to be 1 pm through 6 pm Central Time, June through August.

Assumptions

The algorithms listed above are based on the following assumptions:

- The 3 percent savings allocated to faucet aerators comes from the NEOS Corporation, 1994. Technology Energy Savings Volume 1: Baseline Energy Use Characteristics, prepared for the California Conservation Inventory Group, May.
- The pre/post gallons per minute (gpm) are assumed to be 2.2 (1994 federal minimum) and 1.5 gpm, a difference of 0.7 gpm.
- The baseline end use UECs are differentiated by the three California service areas. The savings estimates used above are for the PG&E service territory (UEC = 1,896 kWh), which includes California climate zones 1,2,3,4,5,16.
- The UEC values are averaged over all households with difference appliances.
- DEER's baseline water heating system is a standard efficiency electric 40 gallon water heater with and energy factor (EF) of 0.88.
- Measure life was assumed to be 9 years for all faucet aerators.
- Summary of default savings estimation:

Table 13. Ex Ante Default Savings

Measure	DEER Percent Savings	PG&E Baseline UEC (kWh)	ComEd Gross Default Savings (kWh/unit)	DEER Gross Energy Savings (kWh/unit)	ComEd Gross Default Peak Savings (kW/unit)	DEER Gross Peak Savings (kW/unit)
Faucet Aerators	3%	1896	52	52.2	0.01	0.0115

Results

The units for all faucet aerator savings estimations are per multifamily residence.

Table 14. Evaluation Adjusted Default Savings

Measure	Unit	Evaluation Adjusted ComEd Gross Default Savings (kWh/unit)	Evaluation Adjusted ComEd Gross Default Savings (peak kW/unit)
Faucet Aerators	Per multifamily residence	52	0.012

There are a number of areas of concern with the stated default values used for the faucet aerator measures of the Multifamily All-Electric Program. These areas include the baseline UEC values and the percent savings by measure.

- The baseline end use UEC was developed over 10 years ago for the California population. The accuracy of this value should be confirmed in the ComEd service territory.
- The percent savings by measure is estimated to be the same for the bathroom faucet and the kitchen faucet. It is likely that the usage patterns between these two faucets are sufficiently different to warrant different percent savings values.
- The installed gpm of base and low-flow aerators used in this program should be verified to deliver a reduction consistent with savings estimates.
- The Wisconsin Focus on Energy program identifies substantially higher default savings for aerator measures in multifamily, and has estimated gross kWh savings for kitchen aerators at 223.1 kWh/yr and bath aerators at 127.1 kWh/yr. The default savings for PY2 should be re-visited by the program to determine whether the Wisconsin Focus on Energy assumptions are more appropriate than the California assumptions, and what if any adjustments need to be made for ComEd territory.

Hot Water Heater Wrap

Measure Definition

Specifications not provided. ComEd has dropped this measure from the program.

Algorithms

The gross energy and demand savings algorithm used for the hot water heater wrap (DHW wrap R-4) measure of the Multifamily All-Electric Program are similar to savings estimates provided by DEER 2001. DEER's algorithms are calculated as follows.

*Gross kWh = % savings by measure * baseline water heating end use unit energy consumption (UEC)*

Coincident Peak kW Savings = Avg demand savings between 12-6pm May through October.

The units for the hot water heater wrap savings estimation is per unit installed.

The algorithm for gross kWh is acceptable. The algorithm for coincident peak kW savings is acceptable, except that the demand savings period should match ComEd's peak definition, which we assume to be 1 pm through 6 pm Central Time, June through August.

Assumptions

The algorithms listed above are based on the following assumptions:

- The DEER 2001 Water Heater Blanket DHW wrap R-4 measure 10% savings value is an engineering estimate based on California Title 24 calculations. This percent savings is based on a baseline early 1990s less-insulated tank.
- The baseline end use UECs are differentiated by the three California service areas. The savings estimates used above are for the PG&E service territory, which includes California climate zones 1,2,3,4,5,16.
- DEER's baseline water heating system is a standard efficiency electric 40 gallon water heater with and energy factor (EF) of 0.88.
- Measure Life was assumed to be 20 years for all DHW R-4 wraps.
- Summary of default savings estimation:

Table 15. Ex Ante Default Savings

Measure	DEER Percent Savings	PG&E Baseline UEC (kWh)	ComEd Gross Default Savings (kWh/unit)	DEER Gross Energy Savings (kWh/unit)	ComEd Gross Default Peak Savings (kW/unit)	DEER Gross Peak Savings (kW/unit)
DHW wrap R-4	10%	1995	193	200	0.00	0.04

Results

The units for the hot water heater wrap savings estimation are per unit installed.

Table 16. Evaluation Adjusted Default Savings

Measure	Unit	Evaluation Adjusted ComEd Gross Default Savings (kWh/unit)	Evaluation Adjusted ComEd Gross Default Savings (peak kW/unit)
DHW wrap R-4	Per unit installed	193	0.040

- DEER 2005 excluded this measure as "Hot water tank wraps are only appropriate for older, less insulated tanks and not for the newer, more efficient models that have been mandated since the early 1990s. Most older water tanks have already been replaced with the newer, post 1990 tanks."
- ComEd has dropped this measure from the program.

3.1.4 Gross Program Impact Results

Based on the tracking data review and gross impact parameter estimates described in the previous sections, we were able to estimate the gross program impacts resulting from the PY1 Multifamily All-Electric Efficiency Upgrade program. The results are provided in Table 17 below.

Table 17. PY1 Gross Parameter and Savings Estimates

Gross Parameter and Savings Estimates	Multifamily All-Electric Efficiency Upgrade
CFLs directly installed through the Program	19,428
Showerheads directly installed through the Program	3,786
Aerators directly installed through the Program	7,073
Water heater wraps directly installed through the Program	4
Program Tracking System MWh	2,568
Program Tracking System Coincident MW	*Not Recorded*
Total First-Year Evaluation-Adjusted Gross MWh Savings	**2,315 MWh**
Gross Realization Rate (MWh)	**90%**
Total First-Year Evaluation-Adjusted Gross Coincident MW Savings	**0.20 MW**

The gross realization rate was found to be 90%, lower than the value of 95% used in program planning.[9] The reasons for this lower realization rate are:

1. The default planning assumption for showerheads of 355 kWh savings per unit used in the tracking system assumed each showerhead installed counts as a unit, even when multiple showerheads are installed in a single tenant apartment or condominium. Source assumptions for the default energy savings are based on a "unit" being the tenant residence where all showers are converted to low flow devices. There were 593 tenant units that had two showerheads installed, and 12 that had three showerheads installed. The savings for two showerhead installations per tenant unit were reduced from 710 kWh to 355 kWh, and the savings for three showerheads was reduced from 1065 kWh to 355 kWh. If low flow showerheads are not installed in all shower facilities in the tenant unit, it would be necessary to reduce the 355 kWh savings for partial installation. The tracking data did not provide necessary detail to make this adjustment for partial installation. If the program seeks to claim higher savings for units with multiple showerhead installations, it will be necessary to document a greater number of occupants per tenant unit taking more showers than assumed in the default of 355 kWh. ***The total reduction from tracking savings for this adjustment was 219 MWh.***

2. Similarly, installations of bathroom and kitchen faucet aerators counted 52 kWh saved for each aerator installed, even in tenant units with multiple installations. The default savings assumptions provide 52 kWh for converting all bathroom aerators in a tenant unit, and a separate, additional 52 kWh for converting all kitchen aerators to low flow devices. The tracking system indicated 829 tenant units with two bathroom or two kitchen aerators installed, claiming 104 kWh saved – these were reduced to 52 kWh saved. There were 19 tenant units with three bathroom aerators, and 2 units with 4 bathroom aerators installed that were reduced to 52 kWh. ***The total reduction from tracking savings for this adjustment was 45 MWh.***

3. The only other reduction to tracking savings was to reduce a single entry of 1,264 kWh saved for the installation of 6 CFLs to 264 kWh saved. ***The total reduction from tracking savings for this adjustment was 1 MWh.***

ComEd's default savings for compact fluorescent lamps was based on the replacement of a 75 watt incandescent with an 18 watt integral CFL, at 2.34 hours per day, with a 90% in-service rate for a savings of 44 kWh per lamp. The CFL product installed by the program is rated at 20 watts, reducing savings slightly, but we estimate the in-service rate at 95%, for a savings of 44.6 kWh per lamp when replacing a 75 watt incandescent. The 90% in-service rate adjusts for both failure to install and removal after installation. As a direct installation program, we are only adjusting for later bulb removal, estimated by ComEd's PY1 Residential Lighting program evaluation at 5%. ***The total increase from tracking savings for this adjustment was 12 MWh.***

Table 18 provides a summary of tracking system savings and evaluation adjusted gross savings by measure type.

[9] The value of 95% is drawn from the program plan presented in ComEd's 2008-2010 Energy Efficiency and Demand Response Plan (November 15, 2007). Page D-2 of the ComEd plan provides a footnote stating the value is an assumption by ICF Consulting.

Table 18. PY1 Evaluation Adjustments to Tracking Savings by Measure Type

Measure Type	Tracking System		Gross Impact Review Results			
	Installed	kWh	Installed	kWh	kW	Gross RR
CFLs	19,428	855,832	19,428	866,489	78	101%
Showerheads	3,786	1,344,030	3,786	1,124,995	48	84%
Faucet Aerators	7,073	367,796	7,073	322,400	74	88%
Hot Water Heater Wrap	4	772	4	772	0	100%
All Measures		2,568,430		2,314,656	200	90%

3.1.5 Net Program Impact Parameter Estimates

Once gross program impacts have been estimated, net program impacts are calculated by multiplying the gross impact estimate by the Program Net-to-Gross (NTG) ratio. As mentioned above, estimation of the NTG ratio for the PY1 Multifamily All-Electric Efficiency Upgrade program was not included in the evaluation. For PY1, net impacts are based on ComEd's program assumption that the NTG ratio equals 80%. The PY1 NTG ratio is calculated as:

NTG Ratio = 1 – Free-ridership + Spillover

NTG Ratio = 80% (ComEd Program Assumption,[10] not evaluated for PY1)

3.1.6 Net Program Impact Results

Table 19 below provides the program-level evaluation-adjusted net impact results for the PY1 Multifamily All-Electric Efficiency Upgrade program. As this figure shows, the ex post program-level first-year net energy saving estimate resulting from this evaluation is 1,852 MWh and the net coincident demand savings estimate is 0.16 MW.

Table 19. Net Parameter and Savings Estimates

Net Parameter and Savings Estimates	Multifamily All-Electric Efficiency Upgrade
Total First-Year Evaluation-Adjusted Gross MWh Savings	**2,315 MWh**
Total First-Year Evaluation-Adjusted Gross Coincident MW Savings	**0.20 MW**
Net-to-Gross Ratio (1-FR) ***(ComEd Program Assumption)***[11]	80%
Total First-Year Net MWh Savings	**1,852 MWh**
Total First-Year Net Coincident MW Savings	**0.16 MW**

[10] ComEd's 2008-2010 Energy Efficiency and Demand Response Plan, (November 15, 2007).

[11] ComEd's 2008-2010 Energy Efficiency and Demand Response Plan, (November 15, 2007).

The PY1 net claimed energy savings for this program were 2,045 MWh,[12] resulting in a net saving realization rate of 91%.

Table 20 below provides a comparison of ComEd's Program Goals and Reported savings estimates to the Evaluation-Adjusted savings estimates.

Table 20. Comparison of Program Goals and Reported Savings versus Evaluation Adjusted Savings Estimates

Net Parameter and Savings Estimates	Multifamily All-Electric Efficiency Upgrade		
	Energy (MWh)	Demand (MW)	% of Program-Reported Savings Achieved
Gross Program Savings Goals	**3,117**	**0.26**	
Net Program Savings Goals	**2,369**	**0.20**	
Gross Program-Reported Savings	2,568	NA	
Net Program-Reported Savings	2,045	NA	
Gross Evaluation-Adjusted Savings	**2,315**	**0.20**	**90%**
Net Evaluation-Adjusted Savings	**1,852**	**0.16**	**91%**

3.2 Process Evaluation Results

The process evaluation of the Multifamily All-Electric Efficiency Upgrade program focuses on several aspects of the program implementation process: whether the program is meeting its participation goals, effectiveness of program marketing efforts, and customer satisfaction with the program. Data sources include a review of program materials and program data base, in-depth interviews with program staff and implementers (n=3), and analysis of a participant survey administered by ComEd.

3.2.1 Program Theory

This section contains the program theory, logic model, and performance indicators of the Multifamily All-Electric Efficiency Upgrade program. When we created this model, we did so using discussions with program management and implementers as well as program documentation. The purpose of program theory and logic models is to be used:

- As a communication tool by
  - allowing the implementer to show reasoning to other stakeholders
  - bringing common understanding between implementer and evaluator
- As an evaluation tool to

[12] Original goal for the MFEE program was 2,369 net MWh.

- Focus evaluation resources
- Clearly show what evaluation will do and expected answers from evaluation
- Provide a way to plan for future work effort

The theory is explicated through text that describes why the intervention is expected to bring about change. It may reference other theories of behavioral change (e.g., theory of planned behavior, normative theory) or be based on interviews with the program managers. Our goal for this task is to 1) clearly write up the theory behind the program intervention and 2) determine if the theory is plausible. The entire evaluation will test different parts of the model that indicate whether the theory is working or not.

A logic model (LM) is a graphic presentation of the intervention – what occurs and clear steps as to what change the activities undertaken by the intervention are expected to bring about in the targeted population. Logic models can be impact or implementation oriented. An impact model is sparse in terms of how the programs works, but clearly shows the outputs of the program and what they are aimed at affecting. Outcomes are changes that could occur regardless of the program and should be written as such. The implementation model is how the program works and typically resembles a process flow chart. The attached model is an impact model.

We use numbered links with arrows between each box in the logic model. These numbers allow us to:

- Clearly discuss different areas of the model
- Describe why moving from one box to the other brings about the description in the later box
- Set up hypotheses for testing of specific numbered links
- Explicate what we will and will not be testing within the evaluation

Creation of the logic model

While there are several different "looks" to logic models, for our purposes with ComEd, we are using a multi-level Visio document that has a generic statement about resources in the header, activities in the first row, outputs of those activities in the second row, and outcomes in the third (proximal) and fourth (distal) rows. External factors are shown on the bottom of the diagram. The logic model for the MFEE program is provided in Figure 1 below.

Based on past experience, we are using proximal (influence) and distal (influence) outcomes rather than the typically used short term and long term outcomes. We have found that the issue of timing of when an outcome may occur can get in the way of creating the best model. There can be distal outcomes (i.e., things that happen that are not directly under the "touch" of the program) that occur relatively quickly in time. As well, there can be proximal outcomes (i.e., outcomes that happen that are under the direct influence of the program) that can take a long time. For example, the Home Performance with Energy Star program attempts to directly influence how contractors look at and work with residential homes so that a "house-as-a-system" becomes the normal mindset. However, this can take quite a long time and has many outside factors that come into play. Conversely, a rebate program may influence customers to purchase certain high efficiency equipment that cause retailers to increase the stock of that particular equipment. The program typically does not directly work with the retailer, so the outcome is distal to the program influence, but may occur relatively quickly.

When we created the boxes in the logic model, we used the following "road-map".

Activities – these are discrete activities that roll up to a single "box" that is shown in the model. It separates out activities that may be performed by different groups. Marketing typically has its own box. Each activity has an output. We used program documentation (implementation plans) and/or discussion with program managers to determine activities.

Outputs – As indicated before, these are items that can be counted or seen. It may be the marketing collateral of a marketing campaign, the audits performed by a program, or the number of completed applications. All outputs do not need to lead to an outcome, but if they don't, we have given a reason why they are included in the model. We used the same sources as for activities to determine outputs.

Proximal Outcomes – these are changes that occur in the targeted population that the program directly "touches". Multiple proximal outcomes may lead to one or more distal outcomes.

Distal Outcomes – these are changes that are implicitly occurring when the proximal outcome occurs. For example, an EE program may use marketing to bring about Awareness, Knowledge, or Attitudes as a proximal outcome which leads to the distal outcomes of: intent to take actions, which leads to actual installation of EE equipment, which leads to energy impacts.

External Factors – these are known areas that can affect the outcomes shown, but are outside of the program's influence. Typically, these are big areas such as the economy, environmental regulations, codes / standards for energy efficiency, weather, etc. Sometimes these arose from our discussions with the program managers, but often they were thought about and included based on our knowledge.

Expanding the Impact Model

Once the impact model was drafted, a table that describes the links, the potential performance indicators that could be used to test the link, the potential success criteria that would indicate the link was successful, and potential data sources of the link was created. This is provided in Table 21 for the MFEE program.

When thinking about how to write each of the performance indicators, we asked ourselves "What would I look at to judge whether the link description actions are occurring" and wrote the answer as the performance indicator.

For example, if the link description was:

- Customers become more aware and knowledgeable about new technologies in portfolio through the marketing materials or rebates.

Then the performance indicator was:

- Awareness and knowledge of new technologies in portfolio by customers.

And the success criteria was:

- Increase in both awareness and knowledge of new technologies that came through program by customers.

Success criteria were created by us and are thought to be reasonable.

Figure 1. Preliminary Logic Model

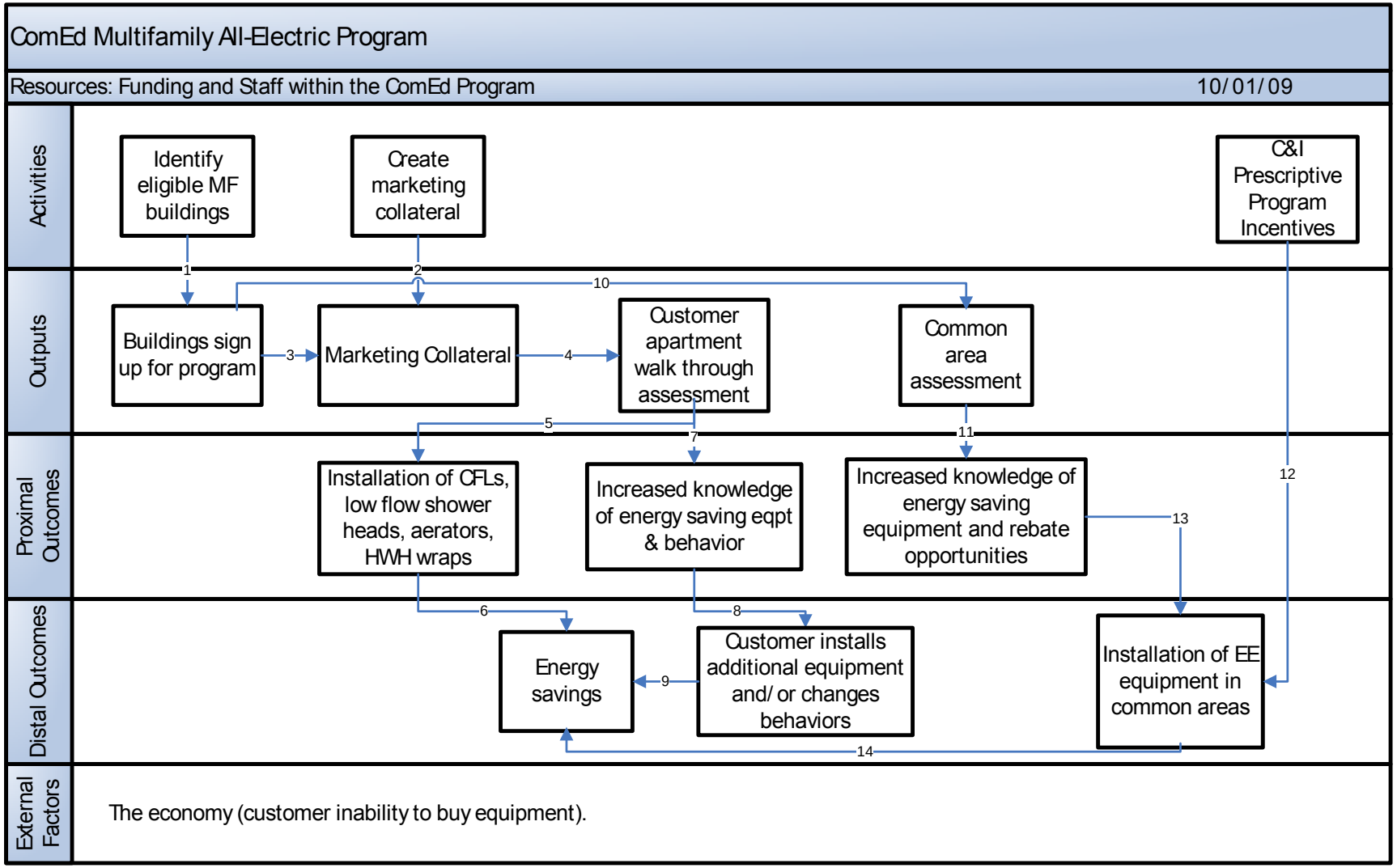

Table 21. Performance Indicators Table

Link	Description of Link	Potential Performance Indicator	Potential Success Criteria for Performance Indicator	Evaluator Data Collection Activities Associated with Link
1	With the help of ComEd, Honeywell identifies eligible MF buildings, explains the benefits of the program to the owner/manager, and convinces them to sign up for the program	1. Number of tenant units receiving direct installation in enrolled buildings	1. Meet or exceed planned participation of tenant units (PY1 goal 3,300 units)	Review of program tracking database
2	Honeywell prepares flyers and posters to advertise the site visit at the building	1. Marketing material is effective	1. Marketing materials are written clearly and in such a way that information is easy to understand.	Review of marketing materials
3	After signing up for the program, the landlord/building manager and ComEd advertise the program and site visit in the building with flyers and posters	1. Posters given out 2. Flyers distributed to tenants	1. 100% of buildings have posters 2. 100% of tenants in buildings receive a flyer explaining the program	Interviews with program implementers, building managers, and tenants
4	Tenants see the program's advertising in the building and make themselves and their apartments available for the walkthrough assessment	1. Awareness of site visit 2. Tenant participation rates	1. 75% of participating tenants were aware of program in advance of the visit 2. 75% of building tenants agree to participate	Participant survey and program tracking data
5	Honeywell representative installs equipment (CFLs, low flow showerheads, aerators and water heater wraps).	1. Number of measures installed 2. Measure frequency per unit	1. Meet or exceed original estimates of: 3.94 CFLs per unit 0.69 showerheads per unit 1.58 aerators per unit 0.1 water heater wrap per unit	Review of program tracking database
6	Tenants use less energy because of the equipment installation	1. kWh savings	1. Program meets its kWh goals	Impact analysis
7	At the walkthrough assessment, the Honeywell representative educates tenants about energy savings and provides a hard copy of installation results.	1. Participant awareness of measures installed and savings 2. Participants keep measures in place 3. Participants aware of additional actions they could take to save energy	1. 100% of tenants aware of savings and receive results 2. 100% of measures still in place 3 months after installation 3. 90% of tenants report learning of additional actions they could take to save energy	Participant survey results
8	The tenant's increased knowledge of energy saving equipment and behavior results in additional equipment installation and changed behavior	1. Number of additional energy saving pieces of equipment installed 2. Changes in behavior	1. 25% report installation of equipment 2. 75% report changes in behavior	Participant survey
9	Tenants' installation of energy saving equipment and changed behavior contribute to overall energy savings in the ComEd service territory	1. Estimated energy savings	1. kWh saved beyond program goals	Participant survey and impact analysis

Link	Description of Link	Potential Performance Indicator	Potential Success Criteria for Performance Indicator	Evaluator Data Collection Activities Associated with Link
10	As a result of signing up for the program, Honeywell schedules and conducts an assessment of the building's common areas and provides the building manager with energy efficiency recommendations	1. Number of common area assessments	1. 100% of buildings have common area assessment done	Review of program tracking database
11	The building manager learns more about energy saving equipment through the report and recommendations. The manager also learns about possible C&I programs.	1. Building managers' knowledge of energy savings equipment and behavior 2. Building managers' knowledge of additional rebate programs	1. 100% of building managers are aware of actions they could take to save energy 2. 100% of building managers are aware of additional ComEd rebate programs	Building manager survey
12	ComEd offers C&I prescriptive incentives to MF building managers	1. Building Referrals to C&I program from MFEE	1. 75% of MFEE buildings participate in C&I programs	Review of C&I and MFEE databases and building manager survey
13	The building manager makes energy saving changes based on information learned in assessment	1. Number of buildings making energy saving changes to common areas	1. 75% of buildings have changes made to common areas	Building manager survey
14	Installation of energy efficient equipment in common areas of MF buildings contributes to overall energy savings in the ComEd service territory	1. kWh savings	1. Program meets its kWh goals (2,369,000 kWh net for PY1)	Impact analysis

3.2.2 Participant Eligibility and Recruitment

The program targets multifamily buildings with electric heat and electric hot water. The program works from a list of 174,000 accounts[13] coded as "all-electric." However, in practice, many of these buildings have central hot water heaters and therefore do not qualify. The Honeywell staff has found that the easiest way to identify potential participant buildings is to have staff drive around and do a spot check on buildings to see if it has a gas hook-up. If not, the staff will find the contact information of the management office and confirm the heat and hot water fuel type.

3.2.3 Changes to Program

The MFEE program has not changed substantially since its filing in November 15, 2007. However, changes are likely in the future. The main change will likely be to the definition of an eligible building. The program staff has found that their assumption that buildings with electric heat would also likely have electric hot water is not correct, as many buildings and/or units have natural gas space heating and electric water heaters or electric heat and gas hot water. As a result the population of eligible buildings is smaller than originally expected. To compensate, the program is open to allowing buildings with a central gas heating system but with units that have individual electric hot water heaters.

3.2.4 Implementation Contractor

ComEd contracted Honeywell Utility Solutions to implement the Multifamily All-Electric Efficiency Upgrade Program. The firm has implemented similar programs in other states and has drawn upon that experience to create the operating procedures.

Several staff members are tied to the program. Honeywell utilizes a regional manager, a program manager, account/customer service representative and energy specialists in the field. The program has created an operating manual for its staff describing the program and proper procedures for interacting with customers and installing equipment.

3.2.5 Goals and Progress to Date

As shown in Table 22, the MFEE program has met most of its PY1 goals in terms of measures installed. The program exceeded its goals by a substantial margin for CFLs, showerheads and aerators. The only measure that did not meet its installation goals is the water heater wrap. This is primarily because of the absence of individual electric water heaters in the buildings visited and concerns relating to voiding of warranties.

[13] This is the number of multifamily electric space heating accounts. The actual number of buildings is smaller because most multifamily buildings individually meter each unit.

Table 22. Number of Measures Installed in PY1

Measure	Annual Goal	PY1 Total	% of Goal
CFL	13,000	19,428	149%
Low-flow showerhead	2,275	3,786	166%
Faucet aerator	5,200	7,073	136%
Water heater wrap	325	4	1%

Source: Program tracking data

According to the program tracking database, 59 unique buildings[14] have had measures installed through the program. Of these, 41 have had common area audits. The total number of units that had at least one installed measure is 4,119.[15] This outnumbers the original annual estimate of 3,330 units. The actual number of units might be slightly less, due to some errors in the database. For example, one unit had listed an install date of 2007, four units listed an install date of 2000 and two units listed an install date of 1980. These are likely data entry errors and are few enough to not change the overall results.

While the program has performed very well relative to its PY1 goals, it may not have such success in future years. Given the finite number of all-electric multifamily buildings in the service territory, the program staff believes it may be more difficult to find new participants in the future. Given this, the annual program goals may not be met for each year but may average out to meet expectations.

The MFEE program is meeting most of its goals to date and Honeywell appears to be a good fit as an implementing contractor. To stave off the inevitable decline in site visits due to a finite market size, the program should continue to expand beyond all-electric buildings.

3.2.6 Marketing and Promotion Strategy

The marketing and promotion of the MFEE program is shared between Honeywell and ComEd. Any marketing materials must be approved by ComEd to ensure a positive image of the utility and consistency among all ComEd programs.

The MFEE program targets only a small subset of buildings in the service territory. Because of this, the program does not invest in an extensive marketing campaign. Instead, Honeywell identifies and targets specific buildings that qualify. The team identifies eligible buildings by using a combination of a list from ComEd and site verifications as described in the Participant Eligibility and Recruitment section above. The staff then contacts these buildings over the phone and with follow-up faxes that describe the program. The building supervisors/landlords are often skeptical of the program and can require multiple contacts and personal attention to be convinced to participate.

[14] Unique buildings are confirmed by Project ID and Site Address fields.

[15] Unique units are based on Premise ID. The number of work orders, which mostly match up to Premise ID, is slightly higher at 4726. The higher number is likely due to some units having multiple visits and more than one work order.

Honeywell also promotes the program to tenants. This is done through posters in the common area and flyers alerting tenants of the date of the unit walk through assessments. The program has considered marketing directly to tenants through bill stuffers or similar materials, but has not done this because tenants are not the decision makers for the building.

Tenant participation varies greatly depending on the engagement of the building manager. The most engaged building managers will help to post flyers around the building, offer adequate notice of the site visit and provide maintenance personnel to accompany Honeywell during the site visit to add validity of the program to tenants. The lesser engaged managers will only provide access to the buildings for the agreed amount of time and will provide no support, resulting in the Honeywell staff knocking on doors. As expected, the participation rate of tenants in buildings with more cooperative building managers is much higher.

Some buildings with 24-hour security centers do not allow unannounced tenant visits. Instead, the building tries to set up appointments for the individual visits. The program has found this method to be very ineffective and avoids it if possible.

Honeywell typically performs the walk through assessments Tuesday through Saturday and can perform about 40 assessments per day. As expected, the team finds that more tenants are home on Saturdays than other days. Although not standard practice, Honeywell may revisit some buildings where they find few residents at home in an attempt to meet with more tenants. These revisits appear to be decided on a case by case basis.

Other than targeting other qualifying buildings with the same ownership as a participating building, the MFEE program has only a limited ability to leverage the marketing and promotion work from building to building. Because most building owners and supervisors are relatively isolated and do not communicate with others, the program cannot utilize word-of-mouth as a means of promotion because there are few opportunities.

3.2.7 Participant Experience and Satisfaction

The evaluation for PY1 does not include a survey of program participants, which limits our ability to comment on participant satisfaction with the program. Honeywell's energy specialists do leave behind a survey for participants to fill out that asks participants to rate their satisfaction with various aspects of the program on a five point scale. Overall, the survey results show the tenants to be very satisfied with the program. The vast majority of participants rated their satisfaction as five on a scale of one to five, with one meaning very dissatisfied and five meaning very satisfied. As shown in Table 23, the mean ratings are all above 4.7. According to these ratings, participants were most satisfied with the attitude of the representative and the overall visit and least satisfied with the report, although a mean of 4.73 out of 5 is still highly satisfied. Notably, the fewest participants rated their satisfaction with the report indicates that some may not have read it.

Overall, only 559 surveys were completed and returned out of a possible 4,119 units equaling a 13.6% response rate. Although these figures indicate very high satisfaction with the program, there is a chance that less satisfied participants simply did not complete the survey. The evaluation team plans to conduct a phone survey of participants in the next program year to further address participant experience and satisfaction.

Table 23. Customer Satisfaction with Elements of MFEE Program[16]

	Mean Rating (1=very dissatisfied, 5=very satisfied)
Attitude of representative (n=550)	4.91
Overall satisfaction of the visit (n=550)	4.90
Ability to identify program representative (n=544)	4.86
Advanced notification of building participation (n=545)	4.83
The survey demonstrated the applicable items (n=548)	4.82
Overall satisfaction of the conservation items (n=547)	4.80
The leave behind report is informative (n=509)	4.73

The survey also asked participants why they participated in the program. Most selected cited multiple reasons for participation. Of those who selected just one reason, 57% said that it was required by the landlord, 24% said that it was to save energy and 20% said it was to save money.

Future evaluation work will also explore building owners' and supervisors' satisfaction with the program and reasons for participating.

3.2.8 Market Effects

The MFEE program has installed low cost energy saving equipment in thousands of units in the ComEd territory. Both tenants and landlords are typically less likely to install energy saving devices in multifamily units than single family homes because of the disconnect between the electricity purchaser (tenant) and the long term owner/user of the equipment (building owner). The MFEE program helps bridge this gap.

The program also provides education to the building owner and then tenant about energy efficiency to create other savings through increased knowledge of available equipment and rebates as well as behavior changes.

3.3 Cost-Effectiveness Analysis

This section addresses the cost effectiveness of the Multifamily All-Electric Efficiency Upgrade 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*

[16] Results from ComEd/Honeywell customer survey

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."[17]

ComEd uses DSMore™ software for the calculation of the TRC test.[18] The DSMore model accepts information on program parameters, such as number of participants, gross savings, free ridership and program costs, and calculates a TRC which fits the requirements of the Illinois legislation.

One important feature of the DSMore model is that it performs a probabilistic estimation of future avoided energy costs. It looks at the historical relationship between weather, electric use and prices in the MISO 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 24 summarizes the unique inputs used in the DSMore model to assess the TRC ratio for the MFEE program in PY1. 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.

[17] Illinois Power Agency Act SB1592, pages 7-8.

[18] Demand Side Management Option Risk Evaluator (DSMore) software is developed by Integral Analytics.

Table 24. Inputs to DSMore Model for Multifamily All-Electric Efficiency Upgrade

Item	Value Used
Measure Life - CFL	9 years
Measure Life - Showerhead	10 years
Measure Life - Aerator	9 years
Measure Life – DHW Wrap	20 years
Participants - CFL	19,428
Participants - Showerhead	3,786
Participants - Aerator	7,073
Participants – DHW Wrap	4
Annual Gross Energy Savings	2,315 MWh
Gross Coincident Peak Savings	0.2 MW
Net-to-Gross Ratio	80%
Utility Administration Costs	$149,900
Utility Implementation Costs	$222,475
Utility Other Costs	$19,421
Utility Incentive Costs	$411,494
Participant Contribution to Incremental Measure Costs	$0

Based on these inputs, the TRC for this program is 1.89 and the program passes the TRC test.

At this time, additional benefits related to reduction of greenhouse gas emissions have not been quantified in the calculation of the TRC. These additional benefits would increase the given TRC benefit/cost ratio.

4 CONCLUSIONS AND RECOMMENDATIONS

This section highlights the findings and recommendations from the evaluation of the Multifamily All-Electric Efficiency Upgrade program implemented by Honeywell on behalf of ComEd. The primary objectives of this evaluation were to quantify the gross and net energy impacts resulting from the direct installation of low cost measures in multifamily residences and to assess program theory, marketing, and delivery. Below are the key conclusions and recommendations.

4.1 Conclusions

The Multifamily All-Electric Efficiency Upgrade evaluation team analyzed default savings assumptions and tracking system data for all direct install measures, conducted in-depth interviews of the ComEd program manager and Honeywell implementers, and analyzed program documents. The following conclusions were drawn from these activities.

4.1.1 Program Marketing and Operations

Although the MFEE program met its customer participation goals for PY1, there are some changes that could be made to the program processes to improve operations and ensure the program continues to meet its goals in the future. These changes are addressed in the Recommendations section below.

4.1.2 Adjusted Gross Program Savings

There were two different types of evaluation adjustments made to the program tracking savings.

1. The program incurred virtually all of its reduction to gross savings from the inappropriate use of planning assumptions for default savings values during implementation (264 MWh out of 265 MWh of reductions through evaluation). The default savings values used for reporting program impacts were drawn directly from ComEd's 2008 – 2010 Energy Efficiency and Demand Response Plan of November 15, 2007. While the values are acceptable for planning programs and portfolios, the planning numbers should not be used without review and possible revision for implementation because:

    - The kWh values are built up from multiple assumptions, some of which may not be obvious, documented, or appropriate for ComEd's multifamily program.
    - They are derived from older sources, most often DEER 2005 which draws upon even older sources (some 15 years old). Technologies and baselines can change significantly in that period.
    - The values drawn from DEER are based on California conditions and markets that may not reflect ComEd service territory.

2. The only other evaluation adjustment to tracking savings was to reduce a single entry of 1,264 kWh saved for the installation of 6 CFLs to 264 kWh saved. Our review of the tracking data provided to the evaluation team identified a number of other minor problems, including:

    - 124 installed measures did not have an apartment number or premise ID (25 MWh).

- 762 installed measures showed quantity installed but no kWh. This error was not present in the official tracking system, but occurred during conversion and transfer of data to the evaluation team (150 MWh).
- 4 measures did not show an installed date or installer. The program implementer confirmed these measures were installed in a follow up visit but that the database was not updated (1 MWh).
- 97 measures had installation dates outside of the PY1 program year, including 36 installations with kWh identified (6 MWh). These installation dates were prior to May 31, 2009 (for example July 30, 1980). The context of these installations (building site, project ID) makes it clear these were data entry errors.

These minor problems did not result in evaluation adjustments to the tracking data, but could have if they had not been identified by the evaluation team.

4.1.3 Net Program Savings

Net-to-Gross Ratio

The ex ante estimate of the NTG ratio is 80%. The evaluation did not estimate a NTG ratio for PY1.

4.2 Recommendations

Impact Recommendations

The Multifamily All-Electric Efficiency Upgrade program evaluation adjusted gross and net savings fell slightly short of goal in PY1. The following recommendations could help improve performance in the future:

1. Develop a Technical Reference Manual to document default savings values in coordination with the evaluation team.

We recommend the program create a technical reference manual to document the default savings values, similar to that used by the C&I Prescriptive program to establish default savings. The technical reference can build off of the default savings review presented in Section 3, and revise the assumptions for each measure to fit local ComEd conditions and the multifamily program. This activity should be done in coordination with the evaluation team, as certain key assumptions can be examined through the impact evaluation process.

As part of developing the technical reference manual, the program should examine the incorporation of energy interactive effects in PY2.

2. Increase the number of CFLs installed per residence if it can be done cost-effectively

The program has a stated maximum of 6 CFLs installed per residence, and tracking data indicated that 90% of the CFLs installed went in as groups of 6 per residence. This suggests that 6 lamps per residence may not be capturing all cost effective applications. Consider increasing the maximum number of 20 watt CFLs per residence, and consider adding an additional CFL wattage if it can be installed cost-effectively on incandescent lamps greater than or less than 75 watts.

3. Develop and implement procedures for spot checking water flow rates

If a common type of baseline showerhead or aerator is installed within a building, it would be valuable feedback to spot check flow rates pre- and post-retrofit to confirm energy savings. There are simple, inexpensive kits for quickly checking gallons per minute. If baseline water flow rates are lower than assumed, the Program may need to specify products with lower flow rates.

4. Improve procedures for quality control and quality assurance of program tracking data

We recommend the program tracking data receive periodic data quality reviews and clean up, and that data entry include checks for values outside of limits. Data exported for the evaluation team should also be checked for anomalies.

Process Recommendations

Although the MFEE program met its customer participation goals for PY1, there are some changes that could be made to the program processes to improve operations and ensure the program continues to meet its goals in the future.

1. Targeted mailings to tenants in advance of visit.

Due to the varied nature of the buildings targeted for inclusion in the program, the marketing plan does not make use of more common methods such as mailers, bill stuffers and mass media. Honeywell contacts the buildings directly and then relies on owners and managers to market the program to the tenants to gain access to units. Honeywell has experience with multifamily programs in other markets and has found their current approach to be most effective. However, the program should consider targeted mailings to tenants in advance of the visit to ensure that tenants are aware of the program and its benefits.

2. Schedule more visits on weekends and early evenings.

Unit assessments currently take place on weekdays and weekends. The program should consider scheduling most of the unit assessments on Saturdays and early evenings to increase the likelihood that tenants are at home and will be able to participate.

3. Better coordination between MFEE and Custom and Prescriptive C&I Program

The audits of the common areas are to include an introduction to the existing Custom and Prescriptive C&I programs so that building owners can participate in these programs to make the recommended changes. Because the C&I programs had already met their PY1 goals when most audits were conducted, it was not possible for owners to participate. The programs should do a better a job of coordinating activities to allow building owners the opportunity to participate in the C&I programs as well.

4. Improved tracking of building and tenant participation rates.

The program does a good job of tracking the installations in buildings and units that agree to participate, but they do not track participation rates. The program should track all buildings contacted to be a part of the program and indicate which ones participate and which ones do not. Likewise, all units in a participating building should be tracked along with whether or not they agree to participate. This would allow ComEd and the evaluators to better assess the success of the marketing campaign and any missed opportunities for savings.

5. Collect tenant contact information at time of installation.

Honeywell does not regularly collect tenant contact information, thus it is difficult for ComEd to do random follow up checks and for the evaluation team to do its work. Though tenants should not be required to provide contact information, they should be encouraged to do so.

6. Place calls to potential buildings to confirm fuel types used before the drive by.

Honeywell identifies eligible buildings by looking for gas hook-ups at potential buildings. Although this method may be effective, it is not efficient. Contacting buildings by phone without spot checking the fuel type may be less costly but will need to be weighed against its efficacy.

7. Better defined procedures and documentation for ride alongs and follow up phone calls.

ComEd conducts ride alongs and places follow-up phone calls to evaluate the work of Honeywell energy specialists. The method for selecting which buildings to visit and tenants to call is not defined or documented. The results of these activities are also not documented. The program should set a system for conducting the ride alongs and placing the calls on a regular basis and tracking the results. The phone calls could be rolled into the follow up survey discussed below.

8. Contact a random sample of participating tenants for a follow up survey

The survey Honeywell leaves with tenants to get feedback on the program has a13.6% response rate and participants can choose to participate. In order to obtain feedback from a more representative sample of participants, ComEd should consider replacing or supplementing the survey left with tenants with phone calls to a random sample of participants. This effort could be combined with the follow up phone calls discussed above to get an assessment of both the energy specialists work as well as satisfaction with the installed measures.

5 APPENDICES

5.1 Data Collection Instruments

The data collection instruments used in this evaluation consisted of in-depth interview guides for the ComEd program manager and Honeywell management and implementers.

5.2 Quality Control and Verification Best Practices

1. Assure quality of installed equipment through independent testing procedures such as PEARL for lighting.

   - The program currently does not promote any independent testing or quality assurance.

2. Address customer satisfaction with installed item quality through evaluation activities.

   - During the site visit, the energy specialist leaves a survey with the tenant to rate their satisfaction with the visit, equipment and program. However, it is up to the tenant to return the survey. Honeywell also conducts some follow-up calls, but these are not conducted in a systematic fashion.

3. Conduct follow-up telephone calls to provide accurate estimate/verification of number of measures installed.

   - Other than the occasional ride-alongs by management, there is no on-site verification that appropriate measures were installed. Furthermore, there is no systematic follow-up to assess whether tenants leave all the measures in place or whether they remove some. This could be assessed by the participant survey and the follow-up calls, but return of the survey depends on the tenant and the follow-up calls are not conducted in a systematic manner that would allow the results to be extrapolated to other participants.

4. Pre-screen installers who have been trained for and are committed to high-quality installation.

5.3 Product Specifications for Direct Installed Measures

Honeywell provided product specification literature for the following measures:

Specs for CFL.pdf

Compact Fluorescent Light Bulbs

Specs for Shower Heads.doc

Low Flow and Handheld Showerheads

Specs for faucet aerator.pdf

Swivel Kitchen and Bathroom Aerators