# Evaluation of
# 2013 Energy Efficient Products Program

**Final Report**

**Prepared for FirstEnergy Ohio Companies:**

***The Cleveland Electric Illuminating Company***

***Ohio Edison Company***

***The Toledo Edison Company***

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# 1 Executive Summary

During 2013, the Ohio Operating companies The Cleveland Electric Illuminating Company ("CEI"), Ohio Edison Company ("OE"), and The Toledo Edison Company ("TE") (collectively "Companies") continued to offer the Energy Efficient Products Program. Through this program, rebates are provided to residential customers to encourage the purchase and installation of energy efficient appliances as well as heating, ventilation and air conditioning (HVAC) services and equipment. Incentives for energy efficient lighting and consumer electronics were added to the program in 2013. In 2013, the only participating measure for consumer electronics was controlled surge protectors (smart strips). The program was administered by Honeywell, which worked with lighting manufacturers, retailers and HVAC contractors to implement the program.

Building off of a base of program partners established in past years, the Energy Efficient Products (EEP) Program continued to grow in 2013. While the number of retailers participating in the appliance program decreased slightly, the total retail applications increased by 43%. The addition of the energy efficient lighting markdown and rebate program further increased retailer participation, adding 106 retailers to the program.

Similar growth was seen in the HVAC rebate applications. While the number of HVAC contractors decreased by 6%, the overall HVAC installations and tune-ups increased by 41%. The number of HVAC installations actually increased by 152% over the 2012 program year.

Rebated products were required to meet a number of screening criteria. These criteria included being listed as an ENERGY STAR® qualified product and meeting minimum energy efficiency standards. Table 1-1 shows the quantity of rebates, by measure category for each of the companies.

*Table 1-1. Rebates by Measure Category for 2013 EE Products Program*

| ***Measure Type*** | ***CEI*** | ***OE*** | ***TE*** | ***Total*** |
|---|---|---|---|---|
| Appliances | 3,887 | 7,442 | 999 | 12,328 |
| HVAC | 1,700 | 2,228 | 658 | 4,586 |
| Consumer Electronics | 11 | 21 | 8 | 40 |
| Lighting (total bulbs/fixtures) | 674,842 | 752,290 | 247,957 | 1,675,089 |

Estimates of the gross energy savings (kWh) and peak demand reductions (kW) for the program in the three service territories are reported in Table 1-2.

*Table 1-2. Impact Evaluation Results for 2013 EE Products Program*

| ***Utility*** | ***Ex Ante Expected Gross Savings*** | | ***Ex Post Verified Gross Savings*** | | ***Realization Rates*** | |
|---|---|---|---|---|---|---|
| | ***Gross kWh*** | ***Gross kW*** | ***Gross kWh*** | ***Gross kW*** | ***kWh*** | ***kW*** |
| CEI | 29,853,282 | 3,452 | 28,156,950 | 3,453 | 94% | 100% |
| OE | 34,102,058 | 4,037 | 33,439,941 | 4,089 | 98% | 101% |
| TE | 10,883,761 | 1,254 | 10,388,210 | 1,265 | 95% | 101% |
| All Companies | 74,839,101 | 8,743 | 71,985,101 | 8,808 | 96% | 101% |

The gross kWh savings total shown in Table 1-2 give a realization rate for kWh savings of approximately 96%, as determined by the ratio of verified gross kWh savings to expected gross kWh savings. The realization rate for kW reductions was approximately 101%.

The ex ante and ex post kWh savings and realization rates for each measure category are presented in Table 1-3.

*Table 1-3. Overall Evaluation Results by Measure Type*

| ***Measure Type*** | ***Ex Ante kWh*** | ***Ex Ante kW*** | ***Ex Post kWh*** | ***Ex Post kW*** | ***kWh RR*** | ***kW RR*** |
|---|---|---|---|---|---|---|
| Appliances | 2,082,963 | 355.21 | 2,086,411 | 345.24 | 100% | 97% |
| HVAC | 1,707,481 | 533.14 | 3,334,681 | 501.37 | 195% | 94% |
| Consumer Electronics | 1,695 | 0.18 | 2,260 | 0.25 | 133% | 139% |
| Lighting | 71,046,962 | 7,854.54 | 66,561,749 | 7,961.36 | 94% | 101% |
| Total | 74,839,101 | 8,743.07 | 71,985,101 | 8,808.22 | 96% | 101% |

# 2 Introduction

In 2013, the Companies continued implementation of the Energy Efficient Products Program. The program provided rebates to residential customers to encourage the purchase and installation of ENERGY STAR® qualified products and other energy efficient appliances as well as the service or installation of HVAC equipment. Rebates for energy efficient lighting were added in 2013. The program was administered by Honeywell, who worked with lighting manufacturers, retailers, and HVAC contractors to implement the program.

Under contract with the Companies, ADM performed evaluation, measurement, and verification (EM&V) services to determine and verify the savings being realized through the Energy Efficient Products Program during 2013. The evaluation of the program included both impact and process evaluations. ADM conducted the impact evaluation, and NMR Group conducted the process evaluation (under subcontract with ADM). This document is the final report on the EM&V for the program. The choice of procedures that was used to perform the EM&V activities has been formed by the State of Ohio Energy Efficiency Technical Reference Manual ("TRM") and ADM's experience in evaluating the 2012 Program. In addition, the procedures chosen build on information collected from ongoing discussions with the Companies' staff.

# 3 Description of Program

The goal of the Energy Efficient Product Program is to help residential customers of the Companies to reduce their electricity consumption as well as their peak load demands. Towards this goal, rebates and incentives were provided during 2013 through the program to encourage residential customers to purchase and install ENERGY STAR® qualified appliances, efficient lighting, and high efficiency HVAC equipment and services.

The appliances for which the program provided rebates in 2013 included the following ENERGY STAR®-rated energy efficient measures:

- Dehumidifiers
- Refrigerators
- Freezers
- Clothes washers

The HVAC services and equipment promoted with rebates through the 2013 program included the following measures:

- Residential HVAC maintenance/tune ups
- Room air conditioners
- High efficiency central air conditioning
- High efficiency air source heat pumps
- ENERGY STAR® qualified high efficiency ground source heat pumps
- High efficiency ductless mini split air conditioning
- High efficiency ductless mini split heat pumps
- High efficiency electric water heaters
- High efficiency heat pump water heaters
- Whole House Fan

The consumer electronics portion of the program provided rebates for smart strips, but will add other measures in future years

The lighting rebate portion of the program included a wide range of compact fluorescent (CFL) and light emitting diode (LED) bulbs, including both specialty and general purpose options. In addition to the CFLs and LEDs, rebates were offered for Ceiling Fans with integral CFLs and torchiere floor lamps

The Companies contracted with Honeywell to manage the program as the Implementation Contractor.

During 2013, the Energy Efficient Products Program was implemented in partnership with 202 retailers who sold the rebated energy efficient appliances and 152 retailers who sold the energy efficient lighting products to Ohio consumers. There were 304 HVAC contractors who participated in the program during 2013. The retail and HVAC partners were distributed throughout the Companies' service territory.

# 4 Evaluation Methodology

The evaluation of the 2013 Energy Efficient Products Program consisted of both an impact evaluation and a process evaluation. The impact evaluation methodology is described in section 4.1 and the process evaluation methodology is described in section 4.2 of this chapter.

## 4.1 IMPACT EVALUATION METHODOLOGY

The impact evaluation addressed the following two research questions:

1. What are the kWh energy savings for each product or measure which qualified for a rebate?
2. What are the peak demand kW reductions for each product or measure which qualified for a rebate?

The methods used to verify a measure's qualifications for being rebated and to calculate kWh savings and kW reductions for qualifying measures rebated through the Energy Efficient Products Program are presented in sections 4.1.1 and 4.1.2 of this chapter. For each product measure identified, total kWh savings and total peak demand savings for that measure are determined as a product of the number of measures verified as qualifying for a rebate and the savings per measure.

ADM's impact analysis was based on data files provided by Honeywell and the Companies' database. These files contained data for lighting and appliance rebates, and for HVAC equipment and service rebates processed and paid during 2013. These files contained per-unit *ex ante* kWh savings and kW demand reduction values for each appliance and HVAC product, as well as data on the number of rebates. To determine the final *ex post* quantities rebated per measure ADM screened out: (a) rebates that were paid but that were not Energy Star qualified measures, and (b) duplicate work orders.

### 4.1.1 Ex-Ante Review

ADM conducted an *ex ante* review of the Program's final 2013 database. In this review, ADM carried out the necessary data cleaning and data editing steps in preparing the data for analysis, including:

- Verification of rebate status as completed
- Verification of measure rebate requirements (e.g., ENERGY STAR® qualified status and high efficiency level) for completed rebates
- Elimination of duplicate data entries

- Elimination of cases with incomplete data (e.g., no model number provided)

Measures verified as passing ADM's rebate screening process were analyzed further for energy and demand savings using the procedures described below.

The tables below table that include the ex ante values per measure:

*Table 4-1. Ex Ante Estimates of per unit Annual kWh & kW Savings for Qualified Energy Efficient Products by Type of Measure*

| Measure | kWh | kW | Source |
|---|---|---|---|
| ***Energy Efficiency Measures: Appliances*** | | | |
| Dehumidifiers (>25 to 35) | 114 | 0.030 | TRM based algorithm |
| Dehumidifiers (>35 to 45) | 213 | 0.048 | TRM |
| Dehumidifiers (>45 to 54) | 297 | 0.070 | TRM |
| Dehumidifiers (>54 to 75) | 185 | 0.040 | TRM |
| Freezers | 134 | 0.020 | TRM based algorithm |
| Refrigerators, bottom freezer | 119 | 0.021 | TRM |
| Refrigerators, side by side | 100 | 0.018 | TRM |
| Refrigerators, top freezer | 142 | 0.025 | TRM |
| Clothes Washers | 202 | 0.028 | TRM |
| ***Energy Efficiency Measures: HVAC*** | | | |
| Air Source Heat Pumps | 1,054 | 0.172 | Blended Value Based on TRM |
| Central Air Conditioning | 218 | 0.229 | Blended Value Based on TRM |
| Ductless Mini Split Air Conditioner | 49 | 0.352 | Blended Value Based on TRM |
| Ductless Mini Split Heat Pump | 224 | 0.352 | Blended Value Based on TRM |
| Electric Water Heater | 47 | 0.04 | TRM Algorithm Modified for Electric Savings |
| Ground Source Heat Pumps | 2,509 | 0.43 | Blended Value Based on TRM |
| Heat Pump Water Heater | 1,297 | 0.18 | TRM |
| HVAC Tune Ups* | 113 | 0.036 | TRM |
| Room Air Conditioners* | 24 | 0.028 | Blended Value Based on TRM |
| ***Energy Efficiency Measures: Consumer Electronics*** | | | |
| Smart strips | 56.5 | 0.006 | TRM |
| ***Energy Efficiency Measures: Lighting*** | | | |
| CFLs* | 42 | 0.005 | TRM |
| LEDs* | 42 | 0.007 | TRM |
| Torchieres | 128.9 | 0.015 | TRM |
| Ceiling Fans | 192 | 0.024 | TRM |

### 4.1.2 Analysis of Savings for Appliance Measures

A "deem and count" approach was used to analyze the energy savings and demand reductions for the following ENERGY STAR®-rated measures:

- Dehumidifiers
- Refrigerators
- Freezers
- Clothes Washers

#### 4.1.2.1 ENERGY STAR® Dehumidifiers

Annual kWh savings per unit and average peak kW savings per unit are deemed based on the unit's capacity range in pints per day. Capacity was determined for each ENERGY STAR® qualified dehumidifier based on the model listed in the Honeywell appliance database. Table 4-3 lists the deemed savings values specified in the TRM (p. 64), and updated by ADM to account for changes made to the ENERGY STAR® assumptions of use, for the purchase of an ENERGY STAR® Dehumidifiers.

*Table 4-2. Deemed Savings Values for ENERGY STAR® Dehumidifiers*

| ***Capacity Range (pints per day)*** | ***Average Annual kWh Savings per unit*** | ***Average Peak kW Savings per unit*** |
|---|---|---|
| <25 | 130 | 0.03 |
| >25 to 35 | 120 | 0.03 |
| >35 to 45 | 149 | 0.03 |
| >45 to 54 | 266 | 0.06 |
| >54 to 75 | 249 | 0.06 |
| >75 to 185 | 179 | 0.04 |

#### 4.1.2.2 ENERGY STAR® Refrigerators

Annual kWh savings and kW demand reduction are deemed based on the refrigerator door configuration, which is recorded in the Honeywell appliance database. Table 4-4 shows the deemed savings values for ENERGY STAR® qualified refrigerators specified in the TRM (p. 53) for the purchase of ENERGY STAR® Refrigerators.

*Table 4-3. Deemed Savings Values for ENERGY STAR® Refrigerators*

| ***Refrigerator Configuration*** | ***Average Annual kWh Savings per Unit*** | ***Average Peak kW Savings per Unit*** |
|---|---|---|
| Bottom Freezer | 119 | 0.021 |
| Top Freezer | 100 | 0.018 |
| Side by Side | 142 | 0.025 |

#### 4.1.2.3 ENERGY STAR® Clothes Washers

ADM verified that the rebated clothes washers were ENERGY STAR® qualified ADM used the deemed calculations for kWh and kW demand reduction cited in the TRM for ENERGY STAR® qualified clothes washers. The listed savings values for ENERGY STAR® clothes washer are 202 kWh per unit and 0.021 kW per unit.

#### 4.1.2.4 ENERGY STAR® Room Air Conditioners

ADM used a deemed energy savings value of 22 kWh per qualified ENERGY STAR® room air conditioner, per the approved VEIC replies to the Joint Utility Comments document which recommended adjusting the size of the average rebated unit from 8,500 BtuH to 10,000 BtuH. An average peak demand savings of 0.028 kW per unit was used, as specified in the TRM (p.67).

#### 4.1.2.5 Smart Strips

Energy and demand savings are deemed based on the plug size (5-plug or 7-plug) of the smart strip purchased. Table 4-5 shows the deemed savings values specified in the TRM (p. 76) for the purchase of Smart Strip.

*Table 4-4. Deemed Savings Values for Smart Strips*

| ***Plug Size*** | ***Average Annual kWh Savings per Unit*** | ***Average Coincident Peak kW Savings per Unit*** |
|---|---|---|
| 5-Plug | 56.5 | 0.0063 |
| 7-Plug | 102.8 | 0.012 |

Honeywell's appliance database uses the deemed savings values for 5-plug smart strips as the *ex ante* values. ADM similarly used the 5-plug values to determine *ex post* savings.

### 4.1.3 Analysis of Savings for HVAC Measures

The impact methods used to analyze the HVAC measures are presented in section 4.1.3 and utilize the formulas specified in the TRM to calculate energy and demand savings. Estimates of savings were calculated for the following HVAC measures that were rebated through the Energy Efficient Products Program in 2013.

- Residential HVAC Maintenance/Tune Up
- Central air conditioning (CAC)
- Air Source Heat Pump (ASHP)
- Ground Source Heat Pump (GSHP)
- Ductless Mini Split Air Conditioner
- Ductless Mini Split Heat Pump

- Electric Water Heater
- Heat Pump Water Heater
- Room Air Conditioners

For each HVAC measure, total kWh savings and total peak demand savings for that measure are determined as a product of the number of measures verified as qualifying for a rebate under the Energy Efficient Products Program and the savings per measure. The methods used to verify rebate qualifications and the per-unit kWh and peak demand savings for the HVAC measures are described in this section.

#### 4.1.3.1 Residential HVAC Maintenance/Tune Ups

ADM performed an engineering desk review of available data to determine if the savings claims for tune-ups were rational. It was determined that the savings claimed for tune-ups was reasonable and conservative.

#### 4.1.3.2 Central Air Conditioning

The TRM algorithms for estimating annual energy and demand savings from the purchase of a new central air conditioning ducted split system meeting ENERGY STAR® efficiency standards were used for calculating energy and demand savings in the 2013 evaluation. As specified in the TRM, the formula for calculating annual energy savings for a new ENERGY STAR® central air conditioning system is:

$$\text{kWh Savings} = (\text{FLHcool} * \text{BtuH} * (1/\text{SEERbase} - 1/\text{SEERee}))/1000$$

where:

FLHcool = Full load cooling hours, which depend on location

BtuH = Size of the replaced AC unit in tons (1 ton = 12,000 BtuH)

SEERbase = SEER efficiency of the baseline AC unit = 13[1]

SEERee = SEER efficiency rating of the ENERGY STAR® AC unit installed

The formula for calculating demand savings for the purchase of a central air conditioning unit meeting ENERGY STAR® standards is specified as follows in the TRM:

$$\text{kW Savings} = (\text{BtuH} * (1/\text{EERbase} - 1/\text{EERee}))/1000 * \text{CF}$$

where:

BtuH = Size of the new AC unit in tons (1 ton = 12,000 BtuH)

EERbase = EER efficiency rating of the baseline AC unit = 11[2]

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[1] The minimum Federal standard for central AC systems is currently 13 SEER

[2] Minimum Federal Standard

EERee = EER efficiency rating of the ENERGY STAR® AC unit installed

CF = Peak Coincidence Factor for a CAC measure = 0.5 (TRM specified)

Full load cooling hours were determined from the customer's zip code. The values for other variables in the equation (e.g., BtuH, SEER, and EER) were determined for a given central air conditioning system model by looking up the values for a given model number in the AHRI database.

#### 4.1.3.3 Air Source Heat Pump

The TRM algorithms for the estimating annual energy and demand savings from the purchase of a new air source heat pump were used for calculating energy and demand savings in the evaluation of the 2013 Energy Efficient Products Program. As specified in the TRM, the formula for calculating annual energy savings for a new air source heat pump meeting minimum ENERGY STAR® efficiency level standards is:

$$\text{kWh Savings}_{\text{AS Heat Pump}} = ((\text{FLHcool} * \text{BtuH} * (1/\text{SEERbase} - 1/\text{SEERee}))/1000 + (\text{FLHheat} * \text{BtuH} * (1/\text{HSPFbase} - 1/\text{HSPFee}))/1000$$

where:

FLHcool = Full load cooling hours, which depend on location

FLHheat = Full load heating hours, which depend on location

BtuH = Size of the HVAC equipment in tons (1 ton = 12,000 BtuH)

SEERbase= SEER efficiency rating of the baseline unit = 13[3]

SEERee = SEER efficiency rating of the new ASHP installed

HSPFbase = Heating Season Performance Factor for baseline unit = 7.7[4]

HSPFee = Heating Season Performance Factor for efficient unit installed

The formula for calculating demand savings for the purchase of a new air source heat pump meeting ENERGY STAR® standards is specified as follows in the TRM:

$$\text{kW Savings} = \text{BtuH} * (1/\text{EERbase} - 1/\text{EERee}))/1000 * \text{CF}$$

where:

- BtuH = Size of the new ASHP unit in tons (1 ton = 12,000 BtuH)
- EERbase = EER efficiency rating of the baseline ASHP unit = 11[5]
- EERee = EER efficiency rating of the ENERGY STAR® ASHP unit installed

[3] Minimum Federal Standard

[4] Minimum Federal Standard

[5] Minimum Federal Standard

- CF = Peak Coincidence Factor for measure (TRM specifies CF = 0.5)

Full load cooling and heating hours were determined from the customer's zip code. The values for other variables in the equation (e.g., BtuH, SEER, EER, and HSPF) were determined for a given air source heat pump model by looking up the values for a given model number in the AHRI database.

#### 4.1.3.4 Ground Source Heat Pump

The TRM algorithms for estimating annual energy and demand savings from the purchase of a new ground source heat pump were used for calculating energy and demand savings in the evaluation of the 2013 Energy Efficient Products Program. As specified in the TRM, the formula for calculating annual energy savings for a ground source heat pump meeting ENERGY STAR® efficiency level standards is:

kWh Savings GS Heat Pump = ((FLHcool * BtuH * (1/SEERbase – 1/EERee *1.02))/1000 + (FLHheat * BtuH * (1/HSPFbase – 1/COPee * 3.412 ))/1000

where:

FLHcool = Full load cooling hours, which depend on location

FLHheat = Full load heating hours, which depend on location

BtuH = Size of the HVAC equipment in tons (1 ton = 12,000 BtuH)

SEERbase= SEER efficiency rating of the baseline unit = 13[6]

EERee = EER efficiency rating of the new GSHP installed

1.02 = Constant used to estimate SEER based on efficient unit's EER

HSPFbase = Heating Season Performance Factor for baseline unit = 7.7[7]

COPee = Coefficient of Performance for efficient unit installed

3.413 = Constant to convert the COP of the unit to HSPF

The formula for calculating demand savings for the purchase of a ground source heat pump meeting ENERGY STAR® standards is specified as follows in the TRM:

kW Savings = BtuH * (1/EERbase – 1/(((EERee * 1.02) * 0.37) + 6.43))/1000 * CF

where:

BtuH = Size of the new GSHP unit in tons (1 ton = 12,000 BtuH)

EERbase = EER efficiency rating of the baseline GSHP unit = 11[8]

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[6] Minimum Federal Standard

[7] Minimum Federal Standard

[8] Minimum Federal Standard

EERee = EER efficiency rating of the ENERGY STAR® GSHP unit installed

1.02 = Constant used to estimate the unit's equivalent AC EER to enable comparisons to the baseline unit[9]

CF = Peak Coincidence Factor for measure = 0.5 (TRM specified)

Full load cooling and heating hours were determined from the customer's zip code. The values for other variables in the equation (e.g., BtuH, SEER, EER, and CF) were determined for a given ground source heat pump model by looking up the values for a given model number in the AHRI database.

### 4.1.4 Analysis of Savings for Lighting Measures

ADM analyzed data from follow-up telephone surveys to verify annual *ex post* energy savings. EDC customers from the retail channel were surveyed to determine installation rates, residential installation locations, characteristics of the light bulbs replaced, and dates of installation. This information was used to calculate annual kWh *ex post* savings in accordance with the formula specified in the TRM. As set out in the TRM,

$$\text{kWh Savings} = (\Delta\text{Watt}*1{,}000)*\text{ISR}*\text{Hours}*\text{WHFe}$$

Where:

ΔWatts = CFL watts * delta watts multiplier;

CFL watts = wattage of installed CFL, as verified

Delta watts multiplier = factor to account for baseline conditions.

- 15 watts or less = 3.25, From TRM;
- 16-20 watts = 2.45, determined by ADM's Lighting Shelving Study (see Appendix C)
- 21 watts or more = 2.06 (From TRM)
- For all Specialty bulbs = 3.25 (From TRM)

ISR = In Service Rate

- Percentage of bulbs/fixtures distributed that are actually installed, as estimated by the verification survey

Hours = Average hours of use per year;

- Based on deemed values associated with the location of installation, as estimated from the verification survey. TRM value of 1040 hours was verified by the 2013 survey effort

WHFe = Waste Heat Factor for energy

[9] Using the algorithm EERac = (SEER * 0.37) + 6.43

- To account for effects on heating/cooling from efficient lighting

Thus, to calculate ex post verified energy savings, ADM will need to determine the following five variables:

- Wattage of bulb/fixture
- Hours of Use
- Delta Watts Ratio
- Waste Heat Factor for energy (WHFe)
- In Service Rate (ISR)

Methodologies for determining these variables are described in the remainder of this section.

### Wattage of Bulb/Fixture

ADM checked bulb/fixture model numbers listed in the tracking databases maintained by Honeywell against ENERGY STAR® databases (www.energystar.gov) to verify that each bulb distributed in 2013 is: (i) ENERGY STAR® qualified and (ii) assigned the correct Watts per bulb by the implementer.

### Hours of Use (HOU)

ADM determined the quantities of CFLs installed in specific rooms and usage areas through the follow-up telephone surveys. CFL daily hours of use were estimated based on deemed values associated with installation locations provided in the 2010 Duke Energy Report of the Ohio Residential Smart Saver CFL Programs.[10] Table 4-6 presents the predicted average daily hours of use by room or usage area, according to the Duke Energy Report.

10 Final Report. Ohio Residential Smart Saver CFL Program: Results of a Process and Impact Evaluation. Prepared for Duke Energy by TecMarket Works and BuildingMetrics. June 29, 2010. (see Table 9)

*Table 4-5. Average CFL Hours of Use per Day*

| ***CFL Hours of Use by Room*** | |
|---|---|
| ***Room*** | ***Hours/Day ($HOU_i$ from Duke Energy (2010)*** |
| Kitchen | 3.42 |
| Living room | 3.85 |
| Entryway | 2.10 |
| Garage | 1.11 |
| Bedroom | 1.96 |
| Bathroom | 0.88 |
| Hallway | 3.52 |
| Basement | 2.68 |
| Dining room | 2.54 |
| Office | 9.00 |
| Den | 0.69 |
| Stairway | 0.54 |

The result of this calculation was consistent with TRM deemed value of 1040 hours.

### Delta-Watts Ratio

Delta-Watts ratios were applied using the guidelines set forth in theTRM, adjusted based on results of the customer survey and ADM's baseline lighting shelving study (see Appendix C). The Values used in this year's evaluation are as follows:

- For general purpose lighting:
  - 15 watts or less = 3.25;
  - 16-20 watts = 2.45;
  - 21 watts or more = 2.06 ;
- For all Specialty bulbs = 3.25 (From TRM)

Specialty bulbs are defined as all bulb types that are exempt from federal code changes, such as; globe, candelabra, reflector, etc.

### Waste Heat Factor for Energy (WHFe)

Installing energy efficient lighting in air-conditioned spaces saves electricity in two ways: first by reducing lighting electrical loads; and second by introducing less heat in conditioned spaces, hence incrementally decreasing space cooling loads. Space heating

and cooling impacts of energy efficient lighting are described using a ratio that is referred to in the Ohio TRM as the Waste Heat Factor for energy (WHFe). The TRM specifies a constant value of 1.07 for the WHFe. For further details, see footnotes 10 and 25 in the TRM.

**In-Service Rate (ISR)**

The TRM defines ISR as the "percentage of units rebated that get installed." ADM proposes to measure the ISR using the following methodology:

Three data elements need to be collected through the surveys which result in an ISR estimate for 2013. These elements are as follows:

**(1)** The number of Bulbs/fixtures purchased by survey respondents.

**(2)** Number of Bulbs/fixtures installed to date by the customer.

**(3)** Number of Bulbs/fixtures shelved and installed in near term: methodology from footnote 8 on page 13 of the TRM was used to determine the quantity of bulbs to bulbs/fixtures installed in the near term.

The ISR for 2013 was calculated as the sum of data elements 2 and 3 divided by data element 1.

#### 4.1.4.1 Calculation of Ex Post Peak Demand Savings

$$\Delta kW = ((\Delta Watts) /1000) * ISR * WHFd * CF$$

Where:

ΔWatts = CFL watts * delta watts multiplier:

- CFL watts = wattage of installed CFL, as verified
- Delta watts multiplier = difference in wattages between baseline and retrofit bulbs divided by wattage of the retrofit bulb

ISR = In Service Rate

- Defined as the percentage of units rebated that are actually installed

WHFd = Waste Heat Factor for Demand

- to account for cooling savings from efficient lighting

CF = Peak Demand Coincidence Factor

Values specified in the TRM will be used for WHFd and CF in calculating coincident peak demand savings, with WHFd = 1.21 and CF = 0.11.

#### 4.1.4.2 ENERGY STAR® ENERGY STAR® Torchiere Lamps

The deemed savings values specified by the TRM for torchiere floor lamps are 128.9 kWh annual savings per unit and average coincident peak savings per unit of 0.015 kW. These values were applied to determine the savings for torchieres rebated through the program.

#### 4.1.4.3 Ceiling Fans

Energy and demand savings for the purchase of efficient ceiling fans (with compact fluorescent lights) will be calculated using a deemed savings approach, as specified in the Ohio TRM. Deemed energy savings per unit is 192 kWh and demand savings is 0.024 kW.

### 4.1.5 Calculation of Lifetime kWh Savings per Measure

Lifetime kWh savings for lighting, appliance and HVAC measures were calculated by multiplying annual kWh savings for each measure by the deemed effective useful life for each measure, as specified in the TRM.

## 4.2 PROCESS EVALUATION METHODS

The process evaluation component of the study addressed the following research questions:

- How adequately were managers able to monitor the program?
- How well did Honeywell administer the program?
- What were the issues and concerns about implementing the program in 2013?
- What lessons were learned in resolving program implementation issues and concerns?
- What implementation issues remain unresolved?
- What changes can be made to the program's design or delivery to improve its effectiveness in future program years?
- How effective were the marketing efforts for the program? Which marketing methods were most effective?
- How effective were the financial incentives in generating customer interest in the program?
- How satisfied are retailers with the program?
- What changes can be made to the program's design or delivery to improve its effectiveness in future program years?

The process evaluation component was completed by NMR Group Inc, (NMR).

### 4.2.1 In-Depth Interviews

NMR conducted 39 in-depth interviews with individuals who served various roles in the program. The interviews focused on the identification of implementation issues and concerns related to the 2013 Energy Efficient Products Program.

NMR conducted interviews with program staff and the implementation contractor covering each EEP subprogram of Lighting, HVAC & Water Heating, Appliances, and Consumer Electronics.

Since the Appliance Rebate and HVAC Products subprograms have been evaluated twice in the past two years, for the 2013 evaluation NMR focused on retail partner interviews on the lighting component of the EE Products program. For the Appliance and HVAC components of the program NMR focused its efforts on learning about industry trends and developments by speaking with industry experts working with similar programs throughout North America.

#### 4.2.1.1 Appliance Rebates (7 interviews)

**Program Management and Implementation Contractors (2 total interviews)**

NMR conducted two interviews with the individuals that are responsible for the program design and implementation. The individuals that were interviewed are:

- The Companies Program Manager
- Honeywell Program Manager

Interview questions for the Program Managers and staff from the implementation contractor include, but were not limited to, the following:

- How adequately were managers able to monitor the program?
- How well did Honeywell administer the program?
- What were the issues and concerns about implementing the program in 2013?
- What lessons were learned in resolving program implementation issues and concerns?
- What implementation issues remain unresolved?
- What changes can be made to the program's design or delivery to improve its effectiveness in future program years?

**Industry Experts (5 interviews)**

In addition to program staff, NMR conducted five in-depth interviews with industry leading program designers, administrators, and implementers who work with similar appliance rebate programs throughout North America.

Interview questions will include:

- Current state of the market
- Future of the market
- Lessons learned
- Hurdles and barriers
- Strengths and weaknesses

#### 4.2.1.2 HVAC Rebates (7 interviews)

**Program Management and Implementation Contractors (2 total interviews)**

NMR conducted two interviews with the individuals that are responsible for the program design and implementation. The Companies in Ohio work with Honeywell for program implementation needs. The individuals that were interviewed are:

- The Companies Program Manager
- Honeywell Program Manager

Interview questions for the Program Managers and staff from the implementation contractor included, but were not limited to, the following:

- How adequately were managers able to monitor the program?
- How well did Honeywell administer the program?
- What were the issues and concerns about implementing the program in 2013?
- What lessons were learned in resolving program implementation issues and concerns?
- What implementation issues remain unresolved?
- What changes can be made to the program's design or delivery to improve its effectiveness in future program years?

**Industry Experts (5 interviews)**

In addition to program staff, NMR conducted five in-depth interviews with industry leading program designers, administrators, and implementers who work with similar HVAC programs throughout North America. Interview questions included:

- Current state of the market
- Future of the market
- Lessons learned
- Hurdles and barriers
- Strengths and weaknesses

#### 4.2.1.3 Lighting Rebates (25 interviews)

**Program Management and Implementation Contractors (2 total interviews)**

NMR conducted two interviews with program management and implementation staff listed as follows:

- The Companies Program Manager
- Honeywell Program Manager

Interview questions for the Program Managers and staff from the implementation contractor included, but were not limited to, the following:

- How adequately were managers able to monitor the program?
- How well did Honeywell administer the program?
- What were the issues and concerns about implementing the program in 2013?
- What lessons were learned in resolving program implementation issues and concerns?
- What implementation issues remain unresolved?
- What changes can be made to the program's design or delivery to improve its effectiveness in future program years?

**Retail Partners (23 interviews)**

NMR conducted interviews among local store managers from retailers that sell qualified lighting products through the Energy Efficient Products program in Ohio. The sample of

retail program partners and contact information (retailer names, store managers, telephone numbers, email addresses, etc.) was obtained from the Companies and or Honeywell. NMR conducted 23 interviews with participating retailers.

The selection of retailers included in the interviews was based on a review of a list of participating stores. Attempts were made to get feedback for every lighting product that is supported through the program.

The focus of the retailer interviews was to identify concerns and issues with the program processes and the adequacy of the rebates to promote customer participation in the program. The retailer interviews also measured satisfaction with the program and solicit ways in which the program might be improved.

Interview questions for local retail store managers included, but were not limited to, the following:

- How effective were the marketing efforts for the program? Which marketing methods were most effective?
- How effective were the financial incentives in generating customer interest in the program?
- How satisfied are retailers with the program?
- What changes can be made to the program's design or delivery to improve its effectiveness in future program years?

# 5 Detailed Evaluation Findings

The findings from the impact and process evaluation efforts are presented in this chapter. Findings from the impact evaluation are presented in Section 5.1 and from the process evaluation in Section 5.2.

## 5.1 IMPACT EVALUATION FINDINGS

The number of energy efficient products that were qualified to receive a rebate from the Energy Efficient Products Program in 2013 is shown in Table 5-1 for each utility service territory and for the total program.

*Table 5-1. Number of Rebates for Qualified Measures in the Energy Efficient Products Program during 2013*

| *Measure Category* | *CEI* | *OE* | *TE* | *All EDCs* |
|---|---|---|---|---|
| Appliances | 3,887 | 7,442 | 999 | 12,328 |
| HVAC | 1,700 | 2,228 | 658 | 4,586 |
| Consumer Electronics | 11 | 21 | 8 | 40 |
| Lighting | 674,842 | 752,290 | 247,957 | 1,675,089 |
| Lighting reflects total individual bulbs/fixtures distributed | | | | |

Table 5-2 shows the quantities of energy efficient products for which rebates were paid per operating company and for the total EE Products Program in 2013. Applying the methods described in Chapter 4 produced estimates of savings per unit on a measure-by-measure basis. Multiplying the quantities in Table 5-2 by the per-measure savings estimates produced the program-level estimates of kWh energy savings, which are reported in Table 5-3, and peak kW demand reductions, which are reported in Table 5-4.

*Table 5-2. Quantities of Qualified Energy Efficient Products Rebated through EE Products Program in 2013 by Type of Measure and Operating Company*

| | CEI | OE | TE | Total |
|---|---|---|---|---|
| ***Energy Efficiency Measures: Appliances*** | | | | |
| Dehumidifiers (<25) | 16 | 31 | 1 | 48 |
| Dehumidifiers (>25 to 35) | 69 | 155 | 24 | 248 |
| Dehumidifiers (>35 to 45) | 142 | 625 | 50 | 817 |
| Dehumidifiers (>45 to 54) | 398 | 543 | 87 | 1,028 |
| Dehumidifiers (>54 to 75) | 365 | 562 | 61 | 988 |
| Freezers | 71 | 170 | 26 | 267 |
| Refrigerators, bottom freezer | 750 | 1,590 | 191 | 2,531 |
| Refrigerators, side by side | 387 | 771 | 103 | 1,261 |
| Refrigerators, top freezer | 476 | 750 | 118 | 1,344 |
| Clothes Washers | 1,213 | 2,245 | 338 | 3,796 |
| **Total number of appliances rebated** | **3,887** | **7,442** | **999** | **12,328** |
| ***Energy Efficiency Measures: HVAC*** | | | | |
| Air Source Heat Pumps | 117 | 269 | 34 | 420 |
| Central Air Conditioning | 332 | 397 | 204 | 933 |
| Ductless Mini Split Air Conditioner | 4 | 2 | 2 | 8 |
| Ductless Mini Split Heat Pump | 13 | 12 | 3 | 28 |
| Electric Water Heater | 0 | 7 | 2 | 9 |
| Ground Source Heat Pumps | 65 | 197 | 49 | 311 |
| Heat Pump Water Heater | 4 | 10 | 0 | 14 |
| HVAC Tune Ups | 884 | 924 | 286 | 2,094 |
| Room Air Conditioners | 281 | 410 | 78 | 769 |
| **Total number of HVAC rebates** | **1,700** | **2,228** | **658** | **4,586** |
| ***Energy Efficiency Measures: Consumer Electronics*** | | | | |
| Smart strips | 11 | 21 | 8 | 40 |
| **Total number of Consumer Elec. rebates** | **11** | **21** | **8** | **40** |
| ***Energy Efficiency Measures: Lighting*** | | | | |
| CFLs | 637,927 | 748,833 | 237,464 | 1,624,224 |
| LEDs | 36,906 | 3,435 | 10,493 | 50,834 |
| Torchieres | 0 | 5 | 0 | 5 |
| Ceiling Fans | 9 | 17 | 0 | 26 |
| **Total number of bulbs/fixtures rebated** | **674,842** | **752,290** | **247,957** | **1,675,089** |

*Table 5-3. Ex Post Estimates of Annual kWh Savings for Qualified Energy Efficient Products by Type of Measure and Operating Company*

| | ***CEI*** | ***OE*** | ***TE*** | ***Total*** |
|---|---|---|---|---|
| ***Energy Efficiency Measures: Appliances*** | | | | |
| Dehumidifiers (<25) | 0 | 0 | 0 | 0 |
| Dehumidifiers (>25 to 35) | 8,263 | 18,563 | 2,874 | 29,700 |
| Dehumidifiers (>35 to 45) | 21,126 | 92,983 | 7,439 | 121,547 |
| Dehumidifiers (>45 to 54) | 105,708 | 144,220 | 23,107 | 273,036 |
| Dehumidifiers (>54 to 75) | 91,032 | 140,164 | 15,214 | 246,410 |
| Freezers | 9,114 | 21,823 | 3,338 | 34,275 |
| Refrigerators, bottom freezer | 89,250 | 189,210 | 22,729 | 301,189 |
| Refrigerators, side by side | 54,954 | 109,482 | 14,626 | 179,062 |
| Refrigerators, top freezer | 47,600 | 75,000 | 11,800 | 134,400 |
| Clothes Washers | 245,026 | 453,490 | 68,276 | 766,792 |
| **Total kWh Savings, Appliances** | **672,073** | **1,244,935** | **169,403** | **2,086,411** |
| ***Energy Efficiency Measures: HVAC*** | | | | |
| Air Source Heat Pumps | 128,588 | 320225.6 | 43586.89 | 492,400 |
| Central Air Conditioning | 65,881 | 81047.5 | 46335.46 | 193,264 |
| Ductless Mini Split Air Conditioner | 196 | 98 | 98 | 392 |
| Ductless Mini Split Heat Pump | 2,912 | 2688 | 672 | 6,272 |
| Electric Water Heater | 0 | 329 | 94 | 423 |
| Ground Source Heat Pumps | 524,513 | 1492164 | 352569.5 | 2,369,247 |
| Heat Pump Water Heater | 5,188 | 12970.8 | 0 | 18,159 |
| HVAC Tune Ups | 102,632 | 111684 | 23279 | 237,595 |
| Room Air Conditioners | 6,186 | 9025.888 | 1717.12 | 16,929 |
| **Total kWh Savings, HVAC** | **836,096** | **2,030,233** | **468,352** | **3,334,681** |
| ***Energy Efficiency Measures: Consumer Electronics*** | | | | |
| Smart strips | 622 | 1,187 | 452 | 2,260 |
| **Total kWh Savings, Consumer Elec.** | **622** | **1,187** | **452** | **2,260** |
| ***Energy Efficiency Measures: Lighting*** | | | | |
| CFLs | 25,204,945 | 30,039,144 | 9,340,860 | 64,584,949 |
| LEDs | 1,441,870 | 120,534 | 409,143 | 1,971,547 |
| Torchieres | 0 | 644.5 | 0 | 644.5 |
| Ceiling Fans | 1,344 | 3,264 | 0 | 4,608 |
| **Total kWh Savings, Lighting** | **26,648,159** | **30,163,587** | **9,750,003** | **66,561,749** |
| | | | | |
| **Total Program kWh Savings** | **28,156,950** | **33,439,941** | **10,388,210** | **71,985,101** |

*Table 5-4. Ex Post Estimates of Annual kW Reductions for Qualified Energy Efficient Products by Type of Measure and Operating Company*

| | CEI | OE | TE | Total |
|---|---|---|---|---|
| ***Energy Efficiency Measures: Appliances*** | | | | |
| Dehumidifiers (<25) | 0 | 0 | 0 | 0 |
| Dehumidifiers (>25 to 35) | 1.87 | 4.21 | 0.65 | 6.73 |
| Dehumidifiers (>35 to 45) | 20.64 | 31.78 | 3.45 | 55.87 |
| Dehumidifiers (>45 to 54) | 4.79 | 21.08 | 1.69 | 27.56 |
| Dehumidifiers (>54 to 75) | 23.97 | 32.70 | 5.24 | 61.90 |
| Freezers | 1.60 | 3.82 | 0.58 | 6.00 |
| Refrigerators, bottom freezer | 15.75 | 33.13 | 3.98 | 52.86 |
| Refrigerators, side by side | 9.68 | 19.17 | 2.56 | 31.41 |
| Refrigerators, top freezer | 8.57 | 13.13 | 2.07 | 23.77 |
| Clothes Washers | 25.27 | 46.77 | 7.10 | 79.14 |
| **Total kW Reductions, Appliances** | **112.14** | **205.79** | **27.32** | **345.24** |
| ***Energy Efficiency Measures: HVAC*** | | | | |
| Air Source Heat Pumps | 22.78 | 54.49 | 6.54 | 83.82 |
| Central Air Conditioning | 41.48 | 45.27 | 24.22 | 110.97 |
| Ductless Mini Split Air Conditioner | 1.41 | 0.70 | 0.70 | 2.82 |
| Ductless Mini Split Heat Pump | 4.58 | 4.22 | 1.06 | 9.86 |
| Electric Water Heater | 0.00 | 0.00 | 0.00 | 0.00 |
| Ground Source Heat Pumps | 42.40 | 123.64 | 27.19 | 193.24 |
| Heat Pump Water Heater | 0.71 | 1.77 | 0.00 | 2.48 |
| HVAC Tune Ups | 32.24 | 33.62 | 10.51 | 76.38 |
| Room Air Conditioners | 7.96 | 11.62 | 2.21 | 21.80 |
| **Total kW Reductions, HVAC** | **153.56** | **275.33** | **72.43** | **501.37** |
| ***Energy Efficiency Measures: Consumer Electronics*** | | | | |
| Smart strips | 0.07 | 0.13 | 0.05 | 0.25 |
| **Total kW Reductions, Consumer Elec.** | **0.07** | **0.13** | **0.05** | **0.25** |
| ***Energy Efficiency Measures: Lighting*** | | | | |
| CFLs | 3,014.72 | 3,592.93 | 1,117.24 | 7,724.89 |
| LEDs | 172.46 | 14.41 | 48.94 | 235.81 |
| Torchieres | 0.00 | 0.08 | 0.00 | 0.08 |
| Ceiling Fans | 0.17 | 0.41 | 0.00 | 0.58 |
| **Total kW Reductions, Lighting** | **3,187.35** | **3,607.83** | **1,166.18** | **7,961.36** |
| | | | | |
| **Total Program kW Reductions** | **3,453.12** | **4,089.08** | **1,265.98** | **8,808.22** |

## 5.2 PROCESS EVALUATION FINDINGS

For the process evaluation, NMR completed in-depth interviews regarding all aspects of the program, including: HVAC equipment, appliances, and lighting. For the HVAC and Appliances, NMR completed in-depth interviews with the Companies program staff (1 interview), Honeywell implementation contractor staff (1 interview), and industry experts with experience administering, designing, and/or implementing programs similar to the EEP Program (5 interviews with appliance experts and 5 interviews with HVAC experts).

For the Lighting Markdown and Rebate Program, NMR conducted separate in-depth interviews with program management staff (2) and participating retailers (23). The program management staff interviews were conducted with the Companies and the Honeywell (implementation contract) program managers. The representatives interviewed from participating retailers represented retail outlets that ranged from large national chain "big box" stores to smaller "mom and pop" stores.[11]

The feedback provided by program staff, industry experts, and lighting retailers are organized in the following sections by specific topic.

### 5.2.1 Program Tracking Data

The evaluation team examined program tracking data, provided by Honeywell, for the period of January through December for HVAC and Appliances, and for the period of May to December 2013 for Lighting. Conclusions pertaining to program tracking data include the following:

***Program tracking data have some minor inadequacies.*** The level of detail contained in the program tracking data was generally sufficient, although there are some opportunities for improvement. Specific issues with the program tracking data included: minor instances of duplicate participant records, inconsistent or missing HVAC contractor names, and missing retailer data for some retail rebate application records.

***HVAC and Appliance program partners decreased, but program participation increased.*** The overall number of participating partners in retail appliances decreased by 5%; however, rebate applications increased by 43%. The largest increase in appliance rebate came from clothes washers (138%). While the number of HVAC contractors participating in the program decreased by 6%, the total number of installations increased by 152% and the number of tune-ups increased by 11%.

***For lighting, a few partners continued to account for the majority of rebates.*** Program records indicate that 18 out of 106 (or 16%) of overall participating store

[11] Large residential retail stores in this review represent the national chains or *big box* stores. Smaller residential retail stores represent regional or local *mom and pop* stores, defined as a business that is privately owned and operated, with a small number of employees and relatively low volume of sales.

locations accounted for 85% of all lighting products that received rebates or markdowns through the program in 2013. Of all other retailer store locations, each accounted for 1% or less of overall program sales; in total, these locations accounted for 15% of overall program sales. Similarly, while 172 retailers participated in the appliance rebate program, three retailers accounted for 57% of rebates.

### 5.2.2 Program Background, Design and Objectives

Conclusions pertaining to program background, design and objectives include the following.

***New portfolio plan reduced the number of certified contractors.*** The program received approval for a new three-year portfolio plan in March of 2013. This plan necessitated a new contractor agreement due to the addition of ductless mini-splits, whole house fans, and water heaters to the program and some resulting alterations to program guidelines. Consequently, HVAC contractors who had participated in 2012 had to be re-enlisted to participate in the program for 2013. Program staff reported in interviews that approximately 200 of the close to 500 contractors who had signed the prior agreement failed to sign the new agreement.

***Federal efficiency standards could impact the future program savings.*** Appliance program experts interviewed for this report suggested that, as the existing market penetration of ENERGY STAR appliances increases, programs will be forced to devise more creative methods for achieving energy and demand savings. These new methods, experts say, would likely involve switching the program's focus to even higher efficiency products because federal efficiency standards for appliances are set to rise in the next few years, thereby narrowing savings potential.

***Quality of HVAC installation should be a program priority.*** The HVAC industry experts interviewed for the 2013 evaluation indicated that poor habits among contractors ought to be the program's primary area of concern, and that measure-specific incentive structures typically do not fully address this problem. More holistic programs that emphasize contractor training, require quality installation and quality maintenance certifications, encourage contractors to establish long-term service contracts with customers, and fully integrate product and service rebates into a single full-service incentive from the customer's perspective are more likely to achieve real, sustained energy and demand savings.

***Program staff is satisfied with the implementation of the lighting program.*** The Companies program staff member interviewed during the process evaluation believes that the education and awareness-building activities that the program conducts are as important as other program components, such as the rebates and markdowns, because these activities help to drive program sales. The interviewed program staff member said that the Companies define program success across three criteria:

- Retailers behavioral change towards stocking more efficient bulbs;

- Increased customer awareness of the program and how it works;
- The Companies achieving their energy savings goals.

Both the Companies and Honeywell staff believed that the strength of the program design was in the mix of competitive rebates and markdown levels offered to customers on a variety of bulb types.

### 5.2.3 Marketing, Outreach and Education Efforts

Process evaluation findings pertaining to marketing, outreach, and education efforts include the following.

***The 2013 marketing efforts were more focused.*** The Companies and Honeywell staff responsible for the program reported that the primary method used to promote program offerings in 2013 was face-to-face marketing on the part of retail partners and contractors. According to program staff, due to the lackluster results of mass media advertising, the program's focus shifted toward more targeted marketing and in-store retail marketing in 2013. The Companies and Honeywell interviewees reported that the program conducted segment marketing in 2013, targeting customers with more disposable income who were considered to be more likely to participate. Additionally, the program bolstered efforts to reach out to HVAC contractors, conducting more webinars, training sessions, and recruitment sessions in 2013.

***Marketing by contractors can be highly effective.*** HVAC industry experts interviewed for this evaluation largely agreed that the practice of marketing an HVAC program through its participating contractors is effective, noting that contractors are the face of the program to customers. Some related best practices also emerged; for instance, several experts expressed the importance of involving contractors in decisions regarding how to conduct outreach for the program. This could take the form of convening a panel of the program's most active contractors, who are often in a position to offer valuable feedback on program processes, rebate amounts, marketing, and other activities.

***Highly visible signs and retail staff training impacts lighting retail sales.*** Of the nine retailers interviewed by NMR with higher sales volume, eight report high levels of satisfaction with materials provided by program staff. Also, these retailers encourage their sales staff to promote the program.

### 5.2.4 Financial Incentives and Rebate Processing

Process evaluation findings pertaining to financial incentives and rebate processing include the following.

***Refrigerator rebate levels may need to increase in the future.*** Experts in both appliance and HVAC program design and administration noted that, in order to be effective, incentive amounts must meet, or nearly meet, the full incremental cost between standard efficiency and high efficiency products.

***Incentive levels for the lighting programs are well received.*** Over four-fifths of retailers reported that the current markdown and rebate levels for all of the lighting products were "just right" and sufficient to encourage customer participation in the program. Close to three-fifths of retailers reported that they carried the types of products that qualified for the program prior to their participation, and close to one-third of retailers said they had to expand their product lines somewhat to accommodate program needs. Both the Companies and Honeywell staff also believed that the rebate and markdown levels and technologies included in the program are sufficient as of now and that demand has been strong for most bulb types, but said they may reconsider what lighting products and SKUs are included in the program—as well as the rebate or markdown levels associated with them—as the program continues and depending on how customers continue to respond.

***The program is streamlining the application process.*** Changes to the application process in past years have continued to decrease the amount of application errors. In 2013, the program worked to reorganize the rebate form with the goal to make it easier to fill out for customers and contractors.

### 5.2.5 Technical Assistance and Guidelines

Process evaluation findings pertaining to technical assistance and guidelines include the following.

***Program continued to focus training efforts towards existing retail and contractor partners.*** In 2013, the program continued shifting its emphasis away from partner recruitment to spending more time training retailers and HVAC contractors by providing in-person training for both retailers and HVAC contractors and offering on-line webinars for HVAC contractors. According to program staff, efforts to train the program's base of contractors increased slightly in number during 2013; however, training efforts did not expand in the sense that new tactics, strategies, or training methods were implemented. Industry experts interviewed for this evaluation stressed that relying on retailers as trusted advocates instead of simply as a delivery mechanism is considered a best practice.

***Differentiate contractors that participate in program trainings.*** Another best practice that several HVAC expert interviewees mentioned was to differentiate contractors who partake in a given program training effort from those who do not in some way. For instance, the list of qualified contractors on the program's website could be altered to make contractors who go above and beyond stand out on the list by either placing them at the top or adding an icon next to their entries to differentiate them.

# 6 Conclusions and Recommendations

## 6.1 CONCLUSIONS

### 6.1.1 Conclusions from the Impact Evaluation

The number of qualifying products rebated in each service territory is detailed in Table 6-1

*Table 6-1. Rebates by Measure Category for 2013 EE Products Program*

| Measure Category | CEI | OE | TE | All EDCs |
|---|---|---|---|---|
| Appliances | 3,887 | 7,442 | 999 | 12,328 |
| HVAC | 1,700 | 2,228 | 658 | 4,586 |
| Consumer Electronics | 11 | 21 | 8 | 40 |
| Lighting | 674,842 | 752,290 | 247,957 | 1,675,089 |
| Lighting reflects total individual bulbs/fixtures distributed | | | | |

The overall evaluation results for estimated gross energy savings and peak demand reductions for the program in the Companies' service territories are summarized in Table 6-2.

*Table 6-2. Overall Evaluation Results for Gross kWh and kW Savings*

| Utility | Ex Ante Expected Gross Savings | | Ex Post Verified Gross Savings | | Realization Rates | |
|---|---|---|---|---|---|---|
| | Gross kWh | Gross kW | Gross kWh | Gross kW | kWh | kW |
| CEI | 29,853,282 | 3,452 | 28,156,950 | 3,453 | 94% | 100% |
| OE | 34,102,058 | 4,037 | 33,439,941 | 4,089 | 98% | 101% |
| TE | 10,883,761 | 1,254 | 10,388,210 | 1,265 | 95% | 101% |
| All Companies | 74,839,101 | 8,743 | 71,985,101 | 8,808 | 96% | 101% |

The gross kWh savings total shown in Table 6-2 give a realization rate for kWh savings of approximately 96%, as determined by the ratio of verified gross kWh savings to expected gross kWh savings. The realization rate for kW reductions was approximately 101%.

The ex ante and ex post kWh savings and realization rates for each measure category are presented in Table 6-3.

*Table 6-3. Overall Evaluation Results by Measure Type*

| *Measure Type* | *Ex Ante kWh* | *Ex Ante kW* | *Ex Post kWh* | *Ex Post kW* | *kWh RR* | *kW RR* |
|---|---|---|---|---|---|---|
| Appliances | 2,082,963 | 355.21 | 2,086,411 | 345.24 | 100% | 97% |
| HVAC | 1,707,481 | 533.14 | 3,334,681 | 501.37 | 195% | 94% |
| Consumer Electronics | 1,695 | 0.18 | 2,260 | 0.25 | 133% | 139% |
| Lighting | 71,046,962 | 7,854.54 | 66,561,749 | 7,961.36 | 94% | 101% |
| Total | 74,839,101 | 8,743.07 | 71,985,101 | 8,808.22 | 96% | 101% |

### 6.1.2 Conclusions from the Process Evaluation

Several conclusions can be drawn from the process evaluation regarding the program.

***Appliance rebate applications increased.*** Appliance rebate applications also increased in spite of a slight drop in the number of participating retailers—due mainly to a significant increase in clothes washer rebates. This indicates that the partners who are active in the program continue to take their participation seriously.

***The most effective marketing method for the program is face-to-face.*** Program staff reported that the mass media marketing conducted by the program in PY2 was not effective. As a result, face-to-face marketing of the program was emphasized in PY3. The program conducted more webinars and training sessions with contractors to ensure that they were prepared to sell the program and held in-store customer outreach events at big box retail locations. The program also employed more targeted marketing strategies—including targeting higher-income customer segments, as program staff believed that they were more likely to participate.

***Outreach to retail partners and contractors has improved.*** Program staff indicated that efforts to engage the retailers and contractors who are the face of the program have improved in PY3. For the appliance sub-program, this has primarily been a function of time; program staff report that the outreach coordinators responsible for maintaining the program's relationship with retailers have improved their understanding of how to communicate simply through practice. For the HVAC sub-program, this has been accomplished by staying engaged with contractors through webinars and training sessions.

***CFLs accounted for the majority of bulbs rebated through the program.*** The total count of all bulb types rebated or marked down through the program in its first year reached 1,675,089 bulbs/fixtures sold, with program-qualifying CFL bulbs accounting for 97% of total bulbs sold. Program-qualifying LED bulbs accounted for approximately 3% of program sales. Five ENERGY STAR torchiere floor lamps and twenty six ENERGY STAR ceiling fan/light fixtures were rebated in 2013.

## 6.2 RECOMMENDATIONS

This section provides recommendations pertaining to different aspects of the Energy Efficient Products Program.

***Convene panels of the program's most active retail and contractor partners to gather feedback.*** Pointing out that contractors in general tend to be a fairly independent-minded group, experts interviewed for this evaluation suggested that engaging with the program's contractor base regarding changes to the program, however minor, can be beneficial to the program's relationship with contractors. Convening a panel of the program's most active contractors to provide feedback in the event of a change in the program would be the simplest and most effective way to accomplish this. According to experts, this engagement can also take the form of employing tech riders to act as the program's representatives to contractors in the field. A similar panel of the program's most active retailers could lead to much the same effect; experts noted that relying on retailers as trusted advocates rather than as simply a delivery mechanism has helped other programs expand and improve their operations.

***Increase level of engagement with and training for retail partners.*** The evaluation team recommends that the program staff increase their level of engagement with retail staff during in-store visits, with a particular focus on store locations with comparatively lower program sales, to ensure that sales staff is informed of the program and to check in with sales staff about the effectiveness of marketing materials.

***Continue to monitor effectiveness of lighting product mix.*** The evaluation team recommends that program staff continue to monitor customer interest in all lighting products offered through the program to ensure an effective product mix. In particular, the program should monitor customer interest in the rebates for ENERGY STAR ceiling fan/light fixture combinations and torchiere floor lamps, which have experienced comparatively lower program sales. Adjusting the number of eligible SKUs may help to better meet customer tastes and preferences. Also, moving to an electronic rebate process, which the program is currently working to develop, may help improve the frequency with which consumers apply for the ENERGY STAR ceiling fan/light fixture combination and torchiere floor lamp rebates.

# Appendix A: Required Savings Tables

Tables showing measure-level participation counts and savings for the Energy Efficient Products Program were provided in Chapter 5. This appendix provides an additional table summarizing lifetime ex post kWh savings.

- Table A-1 reports the lifetime *Ex-Post* kWh savings by utility and measure.

*Table A-1. Lifetime Ex Post kWh Savings by Utility and Measure*

| | EUL | CEI | OE | TE | Total |
|---|---|---|---|---|---|
| ***Energy Efficiency Measures: Appliances*** | | | | | |
| Dehumidifiers (<25) | 12 | - | - | - | 0 |
| Dehumidifiers (>25 to 35) | 12 | 99,156 | 222,756 | 34,488 | 356,400 |
| Dehumidifiers (>35 to 45) | 12 | 253,512 | 1,115,796 | 89,268 | 1,458,576 |
| Dehumidifiers (>45 to 54) | 12 | 1,268,496 | 1,730,640 | 277,284 | 3,276,420 |
| Dehumidifiers (>54 to 75) | 12 | 1,092,384 | 1,681,968 | 182,568 | 2,956,920 |
| Freezers | 14 | 127,596 | 305,522 | 46,732 | 479,850 |
| Refrigerators, bottom freezer | 14 | 1,249,500 | 2,648,940 | 318,206 | 4,216,646 |
| Refrigerators, side by side | 14 | 769,356 | 1,532,748 | 204,764 | 2,506,868 |
| Refrigerators, top freezer | 14 | 666,400 | 1,050,000 | 165,200 | 1,881,600 |
| Clothes Washers | 11 | 2,695,286 | 4,988,390 | 751,036 | 8,434,712 |
| **Total Lifetime kWh Savings, Appliances** | | **8,221,686** | **15,276,760** | **2,069,546** | **25,567,992** |
| ***Energy Efficiency Measures: HVAC*** | | | | | |
| Air Source Heat Pumps | 18 | 2,314,584 | 5,764,061 | 784,564 | 8,863,209 |
| Central Air Conditioning | 18 | 1,185,858 | 1,458,855 | 834,038 | 3,478,751 |
| Ductless Mini Split Air Conditioner | 18 | 3,528 | 1,764 | 1,764 | 7,056 |
| Ductless Mini Split Heat Pump | 18 | 52,416 | 48,384 | 12,096 | 112,896 |
| Electric Water Heater | 13 | - | 4,277 | 1,222 | 5,499 |
| Ground Source Heat Pumps | 18 | 9,441,234 | 26,858,952 | 6,346,251 | 42,646,437 |
| Heat Pump Water Heater | 13 | 67,444 | 168,620 | - | 236,064 |
| HVAC Tune Ups | 5 | 513,160 | 558,420 | 116,395 | 1,187,975 |
| Room Air Conditioners | 12 | 74,232 | 108,311 | 20,605 | 203,148 |
| **Total Lifetime kWh Savings, HVAC** | | **13,652,456** | **34,971,644** | **8,116,936** | **56,741,036** |
| ***Energy Efficiency Measures: Consumer Electronics*** | | | | | |
| Smart strips | 4 | 2,488 | 4,748 | 1,808 | 9,044 |
| **Total Lifetime kWh Savings, Consumer Elec.** | | **2,488** | **4,748** | **1,808** | **9,044** |
| ***Energy Efficiency Measures: Lighting*** | | | | | |
| CFLs | Varies | 143,030,939 | 172,568,048 | 52,140,240 | 367,739,227 |
| LEDs | Varies | 10,824,985 | 1,024,269 | 3,086,389 | 14,935,643 |

| | | | | | |
|---|---|---|---|---|---|
| Torchieres | 8 | - | 5,156 | - | 5,156 |
| Ceiling Fans | 10 | 13,440 | 32,640 | - | 46,080 |
| **Total Lifetime kWh Savings, Lighting** | | **153,869,364** | **173,630,113** | **55,226,629** | **382,726,106** |
| | | | | | |
| **Grand Total of Lifetime kWh Savings** | | **175,745,994** | **223,883,265** | **65,414,919** | **465,044,178** |

# Appendix B: Survey Instruments

**2013 Energy Efficient Products Program**
**Participant Telephone Survey**

Q1. Hello, my name is [INTERVIEWER NAME], and I am calling on behalf of [NAME OF EDC], your electric utility company. May I speak with [NAME OF RESPONDENT]?

1. Yes
2. No [IF NOT AVAILABLE, ASK FOR ANOTHER ADULT FAMILIAR WITH HOUSEHOLD'S PARTICIPATION IN ENERGY EFFICIENT PRODUCTS PROGRAM]

Q2. I'm with ADM Associates, an independent research firm. We are speaking with households that participated in [NAME OF EDC]'s Energy Efficient Products Program. Through this program you may have received a rebate for the purchase of energy efficient products like an Energy Star refrigerator, dehumidifier, or clothes washer or you might have received a rebate for the tune-up of your home heating and air conditioning system. Do you recall participating in this program?

1. Yes [SKIP TO Q6]
2. No
98. Don't Know
99. Refused [THANK AND TERMINATE]

Q3. Is it possible that someone else in your household would be familiar with the products or services you received through this program?

1. Yes
2. No [THANK AND TERMINATE]
98. Don't Know [THANK AND TERMINATE]
99. Refused [THANK AND TERMINATE]

Q4. May I speak with that person?

1. Yes [RECYCLE THROUGH Q1 and Q2 WITH NEW RESPONDENT]
2. No [THANK AND TERMINATE]
98. Don't Know [THANK AND TERMINATE]
99. Refused [THANK AND TERMINATE]

Q5. Great, thank you. First I want to assure you that I'm not selling anything. We are calling program participants to verify information about the products and services received and to assess customer satisfaction with the products and services. You will receive a $10 gift card from Shell for participating in this survey. May I take a few minutes to talk with you

about the products and services you received and how satisfied you have been with those products and services? Your responses will be kept confidential.

1. Yes [PROCEED WITH INTERVIEW]
2. No [THANK TERMINATE]
99. Refused [THANK AND TERMINATE]

Q6. Would you be interested in scheduling a follow-up home visit with ADM associates as an additional step of verification of the measures installed at your home? You will receive an additional 10.00 gift card for your courtesy at the time of the appointment.

1. Yes [SCHEDULE INTERVIEW]
   Appointment Date :
   Appointment Time:
   Confirmed Address:
2. No [PROCEED WITH INTERVIEW]
99. Refused [PROCEED WITH INTERVIEW]

1. First, could you tell me how you heard about the Energy Efficient Products program? (Do not read; prompt if needed)
   1. Bill Insert
   2. Direct Mail from Utility
   3. Energy Save Ohio website
   4. Retail Store
   5. Contractor
   6. Print Ad
   7. Radio
   8. Word-of-Mouth
   97. Other (Specify)

2. Next, I would like to verify the products or services you received through the program. Our records indicate that you received a rebate for a [MEASURE TYPE/SIZE/MAKE). Is that correct? (Read item for which rebate was paid; record answer indicated by respondent)

| | Yes | No | DK | NA |
|---|---|---|---|---|
| a. HVAC Tune-up | 1 | 2 | 98 | 99 |
| b. Energy Star Refrigerator | 1 | 2 | 98 | 99 |
| c. Energy Star Dehumidifier | 1 | 2 | 98 | 99 |
| d. Energy Star Room Air Conditioner | 1 | 2 | 98 | 99 |
| e. Energy Star Clothes Washer | 1 | 2 | 98 | 99 |
| f. Hi Efficiency Central AC System | 1 | 2 | 98 | 99 |
| g. Air-to-Air Heat Pump | 1 | 2 | 98 | 99 |
| h. Geothermal Heat Pump | 1 | 2 | 98 | 99 |
| i. Smart Strip Surge Protector | 1 | 2 | 98 | 99 |

[DISPLAY Q3-Q5 IF Q2a = 1]

3. Can you tell me what kind of HVAC equipment you had tuned up? (Read options)
    1. Air Conditioner
    2. Heat Pump
    98. Don't know/ Don't recall
    99. Refused

4. Do you remember when in 2013 you had the tune-up done? What month was that?
    1. Month:
    98. Don't know/ Don't recall
    99. Refused

5. Did you notice an improvement in the cooling/heating performance of the system after the tune-up was performed?
    1. Yes
    2. No
    98. Don't know/ Don't recall
    99. Refused

[DISPLAY Q6-Q13 IF Q2b = 1]

6. What kind of refrigerator model did you purchase? (Read list)
    1. Top-freezer refrigerator model
    2. Bottom-freezer refrigerator model
    3. Side-by-Side refrigerator model
    98. Don't know (Prompt to look at the unit)
    99. Refused

7. Do you remember the month in 2013 when you purchased the refrigerator? What month was that?
    1. Month:
    98. Don't know/ Don't recall
    99. Refused

8. Was this refrigerator purchased:
    1. To replace a functioning unit
    2. To replace a broken unit
    3. Not a replacement
    98. Don't know/ Don't recall
    99. Refused

9. Did you get a quote for repair? If so, what was the cost?
    1. Yes:
    2. No
    98. Don't know/ Don't recall
    99. Refused

[DISPLAY Q10 IF Q9 = 2, 98, or 99]

10. Was there a warranty offered with the repair? If so, how long?
    1. Yes

2. No
98. Don't recall
99. Refused

11. Why didn't you repair the broken unit?
    1. Too costly
    2. Too much time involved
    3. Wanted to change style
    98. Don't know/ Don't recall
    99. Refused

[DISPLAY Q12 IF Q8 = 1]

12. What did you do with your old unit?
    1. Still have it
    2. Recycled through First Energy's recycling program
    3. Recycled through company other than first energy
    4. Took it to the dump
    5. Sold it for scrap metal
    6. Sold for parts
    7. Sold or gifted unit to an individual
    8. Sold or donated to an organization/company.
    9. Company name:
    98. Don't know
    99. Refused

13. Is your old unit:
    1. Not in use
    2. In use: (Number of months per year)

[DISPLAY Q14-Q16 IF Q2c = 1]

14. Do you remember the month in 2013 when you purchased the dehumidifier? What month was that?
    1. Month of purchase:
    98. Don't know/ Don't recall
    99. Refused

15. Can you tell me the make or manufacturer of the dehumidifier you purchased? The make or manufacturer should be listed on the unit.
    1. Manufacturer of unit:
    98. Don't know (Prompt to look at unit)
    99. Refused

16. What is the capacity of the unit?
    1. Capacity:
    98. Don't know (Prompt to look at the unit)
    99. Refused

[DISPLAY Q17-Q26 IF Q2d = 1]

17. Do you remember the month in 2013 when you purchased the air conditioner? What month was that?
    1. Month of purchase:
    98. Don't know/ Don't recall
    99. Refused

18. Can you tell me the make or manufacturer of the room air conditioner you purchased? The make or manufacturer should be listed on the unit.
    1. Manufacturer of the unit:
    98. Don't know (Prompt to look at the unit)
    99. Refused

19. What is the capacity of the unit?
    1. Capacity:
    98. Don't know (Prompt to look at the unit)
    99. Refused

20. Was this air conditioner purchased:
    1. To replace a functioning unit
    2. To replace a broken unit
    3. Not a replacement
    98. Don't know/ Don't recall
    99. Refused

[DISPLAY Q21-Q26 IF Q20 = 2]

21. Did you get a quote for repair? If so, what was the cost?
    1. Yes:
    2. No
    98. Don't know/ Don't recall
    99. Refused

22. Was there a warranty offered with the repair? If so, how long?
    1. Yes:
    2. No
    98. Don't know/ Don't recall
    99. Refused

23. Why didn't you repair the broken unit?
    1. Too costly
    2. Too much time involved
    3. Wanted a new look anyway
    98. Don't know/ Don't recall
    99. Refused

24. How many years would you estimate that the old unit could have continued to operate?
    1. Record response:
    98. Don't know/ Don't recall
    99. Refused

25. What did you do with your old unit?
    1. Still have it
    2. Recycled through First Energy's recycling program
    3. Recycled through company other than first energy
    4. Took it to the dump
    5. Sold it for scrap metal
    6. Sold for parts
    7. Sold or gifted unit to an individual
    8. Sold or donated to an organization/company.
    9. Company name:
    98. Don't know
    99. Refused

26. Is your old unit:
    1. Not in use
    2. In use (Number of months per year):

[DISPLAY Q28-Q30 IF Q2e = 1]

28. Do you remember the month in 2013 when you purchased the clothes washer? What month was that?
    1. Month product was purchased:
    98. Don't know/ Don't recall
    99. Refused

29. Can you tell me whether you have an electric or gas water heater?
    1. Gas
    2. Electric
    98. Don't know (Prompt to look at the unit)
    99. Refused

30. Can you tell me the make or manufacturer of the clothes washer you purchased? The make or manufacturer should be listed on the unit.
    1. Manufacturer of unit:
    98. Don't know (Prompt to look at the unit)
    99. Refused

[DISPLAY Q31-Q34 IF Q2f = 1]

31. Do you remember the month in 2013 when you purchased the central air conditioning system? What month was that?
    1. Month product was purchased:
    98. Don't know/ Don't recall
    99. Refused

32. Can you tell me the make or manufacturer of the central air conditioning system you purchased? The make or manufacturer should be listed on the unit.
    1. Manufacturer of unit:
    98. Don't know (Prompt to look at the unit)
    99. Refused

33. What is the capacity of the unit?
    1. Capacity:
    98. Don't know (Prompt to look at the unit)
    99. Refused

34. Was this air conditioner purchased:
    1. To replace a functioning unit
    2. To replace a broken unit
    3. Not a replacement
    98. Don't know/ Don't recall
    99. Refused

[DISPLAY Q35 and Q36 IF Q2g = 1]

35. Do you remember the month in 2013 when you purchased the air-to-air heat pump? What month was that?
    1. Month product was purchased:
    98. Don't know/ Don't recall
    99. Refused

36. Can you tell me the make or manufacturer of the air-to-air heat pump you purchased?
    1. Manufacturer of unit:
    98. Don't know (Prompt to look at the unit)
    99. Refused

[DISPLAY Q37 and Q38 IF Q2h = 1]

37. Do you remember the month in 2013 when you purchased the geothermal heat pump? What month was that?
    1. Month product was purchased:
    98. Don't know/ Don't recall
    99. Refused

38. Can you tell me the make or manufacturer of the geothermal heat pump you purchased?
    1. Manufacturer of unit:
    98. Don't know (Prompt to look at the unit)
    99. Refused

[DISPLAY Q39-Q42 IF Q2i = 1]

39. Do you remember the month in 2013 when you purchased the smart strip surge protector? What month was that?
    1. Month product was purchased:
    98. Don't know/ Don't recall
    99. Refused

40. Can you tell me the plug size of the smart strip you purchased? Was it a 5-plug or a 7-plug smart strip or some other size?
    1. 5-plug model
    2. 7-plug model
    97. Other plug size model (Specify)
    98. Don't know (Prompt to look at the unit)
    99. Refused

41. How many devices are plugged in the surge protector?

42. What types of devices are plugged into the surge protector?
    (Record verbatim response)

[REPEAT Q43-Q56 FOR EACH MEASURE/ EQUIPMENT SELECTED]
I'd like to ask you just a few more questions about your satisfaction with the [PROGRAM].

43. How satisfied were you with the rebate amount?
    1. Very satisfied
    2. Somewhat satisfied
    3. Neither satisfied nor dissatisfied
    4. Somewhat dissatisfied
    5. Very dissatisfied
    98. Don't know
    99. Refused

44. [IF CUSTOMER SUBMITTED REBATE APPLICATION] From the time you had the equipment installed/picked up and submitted the application, about how many weeks did it take to receive your rebate?

45. How satisfied were you with how long it took to receive the rebate?
    1. Very satisfied
    2. Somewhat satisfied
    3. Neither satisfied nor dissatisfied
    4. Somewhat dissatisfied
    5. Very dissatisfied

98. Don't know
99. Refused

46. In the course of participating in the [UTILITY] program, how often did you contact [UTILITY] or program staff with questions?

1. Never
2. 1 time
3. 2 or 3 times
4. 4 times or more
98. Refused
99. Don't know

47. How did you contact them? (Select all that apply)
1. Phone
2. Email or Fax
3. Letter
4. In person
98. Don't know/ Don't recall
99. Refused

48. And how satisfied were you with your communications with [UTILITY] and program staff?
1. Very satisfied
2. Somewhat satisfied
3. Neither satisfied nor dissatisfied
4. Somewhat dissatisfied
5. Very dissatisfied
98. Don't know
99. Refused

[DISPLAY Q49 IF Q48 = 4, 5]
49. Why were you dissatisfied?
1. Record verbatim response:
2. Don't know
98. Refused

50. Have you noticed any savings on your electric bill since installing your new [MEASURE_GENERIC]/removing your old [APPLIANCE]?
1. Yes
2. No
3. Not sure
98. Don't know
99. Refused

51. How satisfied are you with any savings you noticed on your electric bill since installing your new [MEASURE_GENERIC]/removing your old [APPLIANCE]?
    1. Very satisfied
    2. Somewhat satisfied
    3. Neither satisfied nor dissatisfied
    4. Somewhat dissatisfied
    5. Very dissatisfied
    6. I didn't notice any savings
    98. Don't know
    99. Refused

52. How satisfied are you with your new [MEASURE_GENERIC]?
    1. Very satisfied
    2. Somewhat satisfied
    3. Neither satisfied nor dissatisfied
    4. Somewhat dissatisfied
    5. Very dissatisfied
    98. Don't know
    99. Refused

[DISPLAY Q53 IF Q52 = 4 or 5]

53. Why aren't you satisfied?
    1. Record verbatim response:
    98. Don't know
    99. Refused

54. Finally, if you were rating your overall satisfaction with the [UTILITY] Rebate Program, would you say you were:
    1. Very satisfied
    2. Somewhat satisfied
    3. Neither satisfied nor dissatisfied
    4. Somewhat dissatisfied
    5. Very dissatisfied
    98. Don't know
    99. Refused

55. Why do you give it that rating?

56. Do you have any suggestions to improve the [PROGRAM]?
    1. Yes (Record verbatim response)
    2. No
    98. Don't know
    99. Refused

I'd like to finish up by asking you some questions about your home.

57. Which of the following best describes your home? (Read list: Options 1-7)
    1. Single-family home, detached construction
    2. Single-family home, factory manufactured/modular
    3. Mobile home
    4. Row house
    5. Two or Three family attached residence
    6. Apartment with 4+ families
    7. Condominium
    97. Other (Specify)
    98. Don't Know
    99. Refused

58. Do you own or rent this residence?
    1. Own
    2. Rent
    98. Don't Know
    99. Refused

59. Approximately when was your home built? (Do not read the list)
    1. Before 1960
    2. 1960-1969
    3. 1970-1979
    4. 1980-1989
    5. 1990-1999
    6. 2000-2005
    7. 2006 or Later
    98. Don't know
    99. Refused

60. How many square feet is the above-ground living space?
    1. Square Feet:
    98. Don't know
    99. Refused

[DISPLAY Q61 IF Q60 = 98 or 99]
61. Would you estimate the above-ground living space is about:
    1. Less than 1,000 square feet
    2. 1000-2000 square feet

3. 2000-3000 square feet
4. 3000-4000 square feet
5. 4000-5000 square feet
6. Greater than 5000 square feet
98. Don't know
99. Refused

62. How many square feet of below-ground living space is heated or air conditioned?
    1. Square Feet:
    2. Does not apply
    98. Don't know
    99. Refused

[DISPLAY Q63 IF Q62 = 98 or 99]
63. Would you estimate the below-ground living space is about:
    1. Less than 1,000 square feet
    2. 1000-2000 square feet
    3. 2000-3000 square feet
    4. 3000-4000 square feet
    5. 4000-5000 square feet
    6. Greater than 5000 square feet
    98. Don't know
    99. Refused

That's all the questions I have. Thank you for your time.
You will receive your gift card within the next 30 days. Do you have any questions?
OK. Good bye.

## The Companies Lighting RDD SURVEY 2013

Q1. [EDC] has a program distributing discounted Compact Fluorescent Lights (CFLs) and Light Emitting Diode (LEDs) light bulbs at many local retailers. Have you installed energy efficient CFLs from this program in 2013?

1. Yes
2. No [THANK AND TERMINATE]

98. Don't know [THANK AND TERMINATE

Q2. By participating in this brief telephone survey about energy efficient light bulbs, you will receive a $10 gift card. May I talk with you now about the CFLs and LEDs you purchased? This will only take about ten minutes.

1. Yes
2. No [THANK AND TERMINATE]

99. Refused [THANK AND TERMINATE]

[DISPLAY Q1 IF Q2 = 1]

1. Did you purchase CFL, LED lights or both?
    1. CFL
    2. LED
    3. Both

    98. Don't know

If respondent is unsure if they bought CFL vs. LED lights, explain that CFLs are the bulbs that look twisted as shown in the photo. [IMAGE]

2. How did you acquire these light bulbs? (Do not read responses.)
    1. Purchased at a retailer

    97. Other (Specify)

3. Which store did you purchase your light bulbs from? (Do not read list.)
    1. Costco
    2. Sam's Club
    3. Walmart
    4. Lowes
    5. Hartville Hardware
    6. Home Depot

    97. Other (Specify)

4. How many CFLs did you purchase/receive through the [EDC] program?*
    1. Number of CFL's:

    98. Don't know

    99. Refused [THANK AND TERMINATE]

[DISPLAY Q5 IF Q4 = 98]

5. Do you think it might have been one CFL, a 2-pack of CFLs, 3-4 CFLs, 5-6 CFLs, or more than six CFLs?
    1. 1 CFL
    2. 2 CFLs
    3. 3-4 CFLs
    4. 5-6 CFLs
    5. More than 6 CFL's
    98. Don't know [THANK AND TERMINATE]
    99. Refused [THANK AND TERMINATE]

[DISPLAY Q6 IF Q5 = 1, 2, 3, 4, or 5]

6. Of the CFLs you purchased/received, how many have you installed so far?
    1. Number of CFL's installed to date
    2. Don't know
    99. Refused [THANK AND TERMINATE]

[DISPLAY Q7 IF Q6 = 1 or 2]

7. Thinking about where the new CFLs were installed, how many were installed in each room? How many replaced incandescent lights? What was the wattage of the incandescent lights? How many replaced other CFLs? How many were installed in a new fixture?

| | Number of CFLs? | Number replacing incandescent? | Incandescent wattage? | Number replacing other CFLs? | Number in a new fixture? |
|---|---|---|---|---|---|
| Bedrooms | () | () | () | () | () |
| Bathrooms | () | () | () | () | () |
| Living Room | () | () | () | () | () |
| Kitchen | () | () | () | () | () |
| Entry Way | () | () | () | () | () |
| Dining Room | () | () | () | () | () |
| Garage | () | () | () | () | () |
| Basement | () | () | () | () | () |
| Den | () | () | () | () | () |
| Stairway | () | () | () | () | () |
| Office | () | () | () | () | () |
| Hallway | () | () | () | () | () |
| Other Room/Location | () | () | () | () | () |

| | | | | | |
|---|---|---|---|---|---|
| Store for later installation | () | () | () | () | () |
| Don't know | () | () | () | () | () |
| Refused | () | () | () | () | () |

8. Were the incandescent bulbs that you replaced with CFLs still operating when you removed them or were they burned out?
    1. Still operating
    2. Burned out
    3. Both: Some were still operating and some were burned out
    98. Don't know
    99. Refused

9. Before you received the CFLs from [EDC] about how many CFLs did you have installed in your home?
    1. None
    2. 1-5
    3. 6-10
    4. More than 10
    98. Don't know
    99. Refused

10. Does your home presently contain more CFLs or more incandescent bulbs?
    1. More CFLs
    2. More incandescent
    3. About the same
    98. Don't know
    99. Refused

11. Would you purchase CFLs in the future?
    1. Yes
    2. No
    98. Don't know
    99. Refused

12. How satisfied are you with your new CFLs?
    1. Very satisfied
    2. Somewhat satisfied
    3. Neither satisfied nor dissatisfied
    4. Somewhat dissatisfied
    5. Dissatisfied
    98. Don't know

[DIPSLAY Q13 IF Q12 = 4 or 5]

13. Why aren't you satisfied with your new CFLs? (Record response verbatim)

14. Have you noticed any savings on your electric bill since you installed the CFLs?
    1. Yes, my electric bill has decreased
    2. No, there does not seem to be a change in my electric bill
    3. Not sure or too soon to tell
    98. Don't know
    99. Refused

15. How many LED bulbs did you purchase/receive through the [EDC] program?
    1. Number of LED bulbs
    98. Don't know
    99. Refused

16. Do you think it might have been one LED bulb, a 2-pack of LEDs, 3-4 LEDs, 5-6 LEDs, or more than six LEDs?
    1. 1 LED
    2. 2 LEDs
    3. 3-4 LEDs
    4. 5-6 LEDs
    5. More than 6 LEDs
    98. Don't know
    99. Refused

[DISPLAY Q17 IF Q15 = 1]

17. Of the LED bulbs you purchased/received, how many have you installed so far?
    1. Number of LED bulbs installed to date:
    98. Don't know
    99. Refused

18. Thinking about where the new LED bulbs were installed, how many were installed in each room? How many replaced incandescent light bulbs? What was the wattage of the incandescent bulbs? How many replaced other LED bulbs? How many were installed in a new light fixture?

| | Number of LEDs? | Number replacing incandescent? | Incandescent wattage? | Number replacing other LEDs? | Number in a new fixture? |
|---|---|---|---|---|---|
| Bedrooms | () | () | () | () | () |
| Bathrooms | () | () | () | () | () |
| Living Room | () | () | () | () | () |
| Kitchen | () | () | () | () | () |
| Entry Way | () | () | () | () | () |
| Dining Room | () | () | () | () | () |
| Garage | () | () | () | () | () |

| | | | | | |
|---|---|---|---|---|---|
| Basement | () | () | () | () | () |
| Den | () | () | () | () | () |
| Stairway | () | () | () | () | () |
| Office | () | () | () | () | () |
| Hallway | () | () | () | () | () |
| Other Room/Location | () | () | () | () | () |
| Store for later installation | () | () | () | () | () |
| Don't know | () | () | () | () | () |
| Refused | () | () | () | () | () |

19. Were the incandescent bulbs that you replaced with LED bulbs still operating when you removed them or were they burned out?
    1. Still operating
    2. Burned out
    3. Both: Some were still operating and some were burned out
    98. Don't know
    99. Refused

20. Before you received the LEDs from [EDC], about how many LED bulbs did you have installed in your residence?
    1. None
    2. 1-5
    3. 6-10
    4. More than 10
    98. Don't know
    99. Refused

21. Does your residence presently contain more LED bulbs or more incandescent bulbs?
    1. More LEDs
    2. More incandescent
    3. About the same
    98. Don't know
    99. Refused

22. Would you purchase LED bulbs in the future?
    1. Yes
    2. No
    98. Don't know
    99. Refused

23. How satisfied are you with your new LED bulbs?
    1. Very satisfied
    2. Somewhat satisfied
    3. Neither satisfied nor dissatisfied

4. Somewhat dissatisfied
5. Dissatisfied
98. Don't know

[DISPLAY Q24 and Q25 IF Q23 = 4 or 5]

24. Why aren't you satisfied with your new LED bulbs? (Record response verbatim)

25. Have you noticed any savings on your electric bill since you installed the LED bulbs?
1. Yes, my electric bill has decreased
2. No, there does not seem to be a change in my electric bill
3. Not sure or too soon to tell
98. Don't know
99. Refused

I would now like to ask you some questions about your experience with the [EDC] Lighting Program.

26. How did you hear about the [EDC] Lighting Program?
1. Newspaper ad
2. Radio ad
3. TV ad
4. Retail store ad
5. First Energy call center
6. When I signed up for electricity service
7. Word of mouth
97. Other (Specify)
98. Don't know
99. Refused

27. Overall, how satisfied are you with the [EDC] Lighting Program?
1. Very satisfied
2. Somewhat satisfied
3. Neither satisfied nor dissatisfied
4. Somewhat dissatisfied
5. Dissatisfied
98. Don't know

[DISPLAY Q28 IF Q27 = 4 or 5]

28. Why do you give it that rating? (Record response verbatim)

29. Do you have any suggestions to improve this program?
1. Yes
2. No
98. Don't know
99. Refused

[DISPLAY Q30 IF Q29 = 1]|

30. What suggestions do you have for this program? (Record response verbatim)

I'd like to finish up by asking you some questions about your residence.

31. Which of the following best describes your residence? (Read list)
    1. Single-family home, detached construction
    2. Single-family home, factory manufactured/modular
    3. Mobile home
    4. Row house
    5. Two or three family attached residence
    6. Apartment with 4+ families
    7. Condominium
    97. Other (Specify)
    98. Don't know
    99. Refused

32. Do you own or rent this residence?
    1. Own
    2. Rent
    98. Don't know
    99. Refused

33. Approximately when was your residence built? (Do not read responses)
    1. Before 1960
    2. 1960-1969
    3. 1990-1979
    4. 1980-1989
    5. 1990-1999
    6. 2000-2005
    7. 2006 or Later
    98. Don't know
    99. Refused

34. How many square feet is the above-ground living space?
    1. Square feet:
    98. Don't know
    99. Refused

[DISPLAY Q35 IF Q34 = 98]

35. Would you estimate the above-ground living space is about:
    1. Less than 1,000 square feet
    2. 1000-2000 square feet
    3. 2000-3000 square feet
    4. 3000-4000 square feet
    5. 4000-5000 square feet

6. Greater than 5000 square feet
98. Don't know
99. Refused

36. How many square feet of below-ground living space is heated or air conditioned?
1. Square feet:
2. Does not apply
98. Don't know
99. Refused

[DISPLAY Q37 IF Q36 = 98]
37. Would you estimate the below-ground heated or air conditioned living space is about:
1. Less than 1,000 square feet
2. 1000-2000 square feet
3. 2000-3000 square feet
4. 3000-4000 square feet
5. 4000-5000 square feet
6. Greater than 5000 square feet
98. Don't know
99. Refused

38. What is your name?

39. In order to send your gift card, I need an address.
Street:
Street 2:
City:
State:
Postal code:

40. Is this address the same address where the light bulbs were installed?
1. Yes
2. No
98. Don't know

[DISPLAY Q41 IF Q40 = 2]
41. What is the zip code where the light bulbs were installed?

That's all the questions I have for you. The gift card should take 3 to 4 weeks to process. Thank you again for your time.

# Appendix C: Energy Independence and Security Act Ohio Lighting Stocking Survey

## PURPOSE OF STOCKING SURVEY

To calculate energy savings for a compact fluorescent lamp (CFL) installed in Ohio as the result of The Cleveland Electric Illuminating Company ("CEI"), Ohio Edison Company ("OE"), and The Toledo Edison Company ("TE") (collectively "Companies") conservation programs, the Ohio Technical Reference Manual (TRM) provides an algorithm which utilizes a factor known as the delta-watts multiplier. The delta-watts multiplier is the ratio of CFL wattage reduction (i.e., wattage of baseline bulb minus CFL wattage) to the CFL wattage.

The Ohio TRM specifies that the baseline bulb is an incandescent bulb that provides equivalent lumens, except for general purpose lighting that requires compliance with efficiency standards set forth by the Energy Independence and Security Act of 2007 (EISA). For EISA regulated general purpose lighting, the TRM assumes that the baseline bulb is an EISA compliant halogen or other high efficiency incandescent bulb.

The purpose of this stocking survey is to determine the post-EISA availability of 100W and 75W general purpose incandescent bulbs in the Companies' service territories during the 2013 program year, and to employ this data to develop a specific recommendation for the delta-watts multiplier that should be used in the Companies' calculations of *ex ante* estimated energy savings for CFLs that received incentives during 2013.

## BACKGROUND INFORMATION

EISA created new energy efficiency standards for general purpose lighting. The new standards are applicable to any incandescent lamp that is intended for general service applications, has a medium screw base, has a lumen range of 310 to 2,600 lumens, and is capable of being operated in a voltage range of 110 to 130 volts. Average lumens by wattage for general purpose lamps are:

- 40 watts = 450 lumens
- 60 watts = 800 lumens
- 75 watts = 1,100 lumens
- 100 watts = 1,600 lumens

The EISA standards are provided in the following table.

| GENERAL SERVICE INCANDESCENT LAMPS | | | |
|---|---|---|---|
| Rated Lumen Ranges | Maximum Wattage | Minimum Lifetime | Effective Date |
| 1490 – 2600 | 72 | 1,000 hrs | 1/1/2012 |
| 1050 – 1489 | 53 | 1,000 hrs | 1/1/2013 |
| 750 – 1049 | 43 | 1,000 hrs | 1/1/2014 |
| 310 – 749 | 29 | 1,000 hrs | 1/1/2014 |

EISA standards became effective January 1, 2012 for the 100W incandescent bulb and January 1, 2013 for the 75W incandescent bulb. EISA standards also extend to 60W and 40W lamps in 2014.

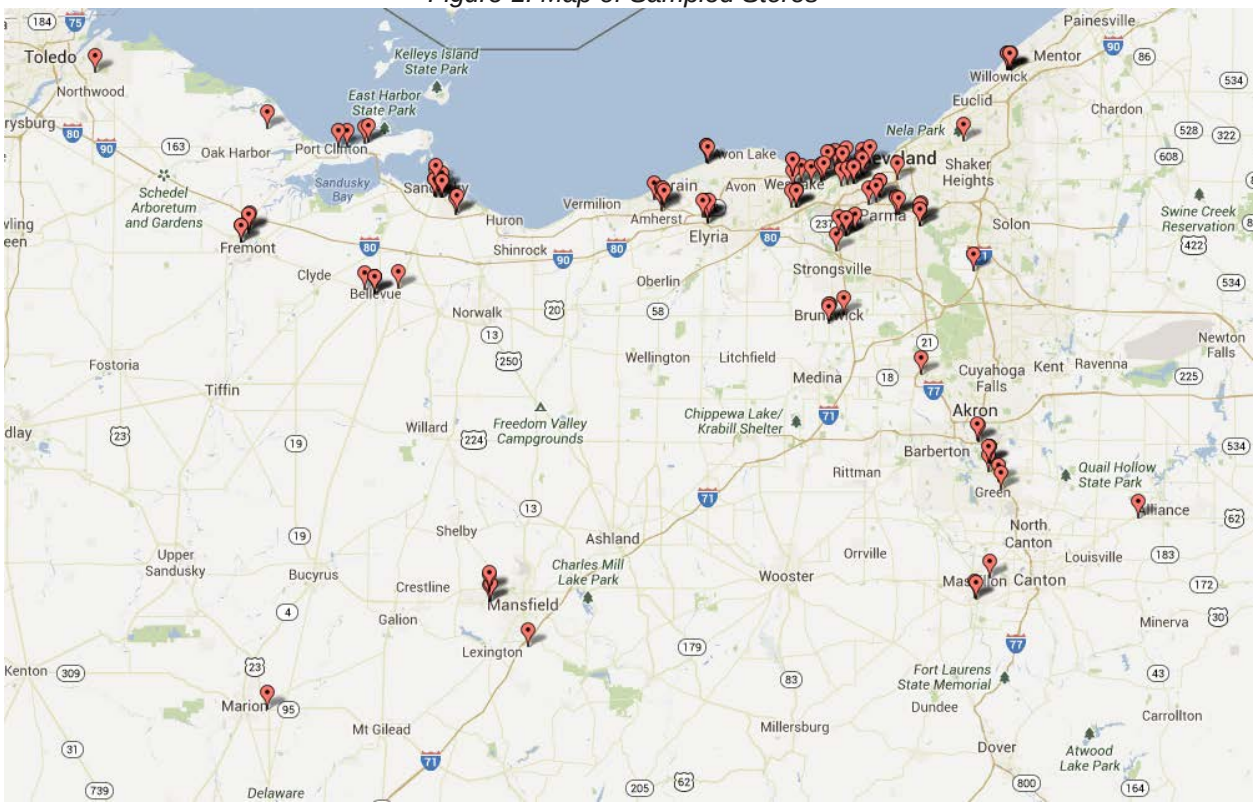
EISA standards apply to the production of general purpose incandescent bulbs. EISA does not necessarily cause the distribution of non-compliant incandescent bulbs to cease. In fact, as we describe in the remainder of this memo, 100W and 75W general purpose incandescent bulbs can still be found in Ohio retail outlets at the end of the 2013 calendar year. Therefore, to enable ADM to determine the actual

baseline wattage for the 100W and 75W equivalent CFLs currently being distributed through the Companies programs, we conducted this study to assess availability of non-compliant incandescent lamps in retail stores throughout the Companies' service territory.

## DATA COLLECTION AND ANALYSIS APPROACH

To determine availability of non-compliant incandescent lamps, ADM sampled a total of 120 retail stores throughout the Companies' service territory during the period of July 2013 through November 2013. The map below shows the sampled stores.

*Figure 1: Map of Sampled Stores*




During in-store visits ADM documented the following data: brand name or trade name of each 100W and 75W incandescent lamp that was available to be purchased; quantity of 100W and 75W incandescent packages and units per brand.

After collecting the data described above, ADM performed quantitative and qualitative analyses to determine the following criteria.

- Percent of retail outlets at which 100W and 75W incandescent lamps can be purchased.
- Delta watts multiplier to be used for *ex ante* estimated savings calculations for the 2013 program year.

## RESULTS

Many stores still have the non-compliant bulbs available to be purchased by the Companies' customers. However, 100W incandescent bulbs were less available than 75W incandescent bulbs. Only 21 of 120 stores (18%) had 100W bulbs in stock, while 50 of 120 stores (42%) had 75W bulbs in stock. The following table details the stores visited and stores that still had bulbs at the time of the survey.

*Table 1: Breakdown of Surveyed Stores*

| Retail Chain | Stores Visited | 75W Incandescent Bulbs | | 100W Incandescent Bulbs | |
|---|---|---|---|---|---|
| | | Count of stores with 75W bulbs | Percent of stores with 75W bulbs | Count of stores with 100W bulbs | Percent of stores with 100W bulbs |
| Ace Hardware | 7 | 5 | 71% | 2 | 29% |
| Apples Grocery | 1 | 0 | 0% | 0 | 0% |
| Bassett's Hardware | 2 | 0 | 0% | 0 | 0% |
| Big Lots | 3 | 0 | 0% | 0 | 0% |
| Cardinal Grocery | 1 | 1 | 100% | 0 | 0% |
| CVS | 5 | 4 | 80% | 0 | 0% |
| Discount Drug Mart | 1 | 1 | 100% | 0 | 0% |
| Dollar General | 8 | 7 | 88% | 0 | 0% |
| Dollar Tree | 2 | 0 | 0% | 0 | 0% |
| Drug Mart | 6 | 5 | 83% | 0 | 0% |
| Family Dollar | 4 | 0 | 0% | 0 | 0% |
| Giant Eagle | 9 | 3 | 33% | 0 | 0% |
| Good Cents Grocery | 1 | 0 | 0% | 0 | 0% |
| Heinen’s | 1 | 0 | 0% | 0 | 0% |
| Home Depot | 8 | 0 | 0% | 2 | 25% |
| Kmart | 3 | 0 | 0% | 0 | 0% |
| Kroger | 2 | 0 | 0% | 0 | 0% |
| Lakewood Hardware | 1 | 1 | 100% | 0 | 0% |
| Lowe's | 12 | 6 | 50% | 6 | 50% |
| Marcs | 10 | 10 | 100% | 10 | 100% |
| Rite Aid | 6 | 2 | 33% | 0 | 0% |
| Sam's | 1 | 0 | 0% | 0 | 0% |
| Save A lot | 1 | 1 | 100% | 0 | 0% |
| Target | 3 | 0 | 0% | 0 | 0% |
| True Value Hardware | 1 | 1 | 100% | 1 | 100% |
| Walgreens | 9 | 1 | 11% | 0 | 0% |
| Walmart | 12 | 2 | 17% | 0 | 0% |
| **Total** | **120** | **50** | **42%** | **21** | **18%** |

## DELTA-WATTS MULTIPLIER FOR EX ANTE ESTIMATED SAVINGS FOR PROGRAM YEAR 2013

ADM employed the following formula to determine the recommended delta-watts multiplier for ex ante estimated savings**:**

*Delta-watts multiplier = (Wbaseline - Wefficient ) / Wefficient*

Note that the Ohio TRM specifies a delta-watts multiplier of 3.25 for pre-EISA and 2.00 for post-EISA for 75W equivalent bulbs. When 75W bulbs are completely phased out as a consequence of EISA, the baseline for CFL’s in the 16-20 watt range will be the 53W halogen.

The actual baseline for 75W equivalent CFLs in 2013 can be determined simply by weighting the 75W and 53W values by the respective fractions of stores that represent each of those two possible baseline values. In other words, given that 50 of 120 stores offer 75W bulbs, the 75W value receives a weight of 50 ÷ 120; whereas given that 70 of 120 stores do not offer 75W bulbs, the default baseline value of 53W receives a weight of 70 ÷ 120. Therefore the sum of (75W x 50 / 120 stores visited) and (53W x 70 / 120 stores visited) is 62.17W. The resulting delta-watts multiplier is calculated as follows:

***Ex ante delta-watts multiplier75W equiv. CFLs, 2013 = (62.17 - 18) / 18 = 2.45***

*Where 62.17 is the average baseline wattage for calculating ex ante estimated savings and 18 is the average wattage of CFLs that can provide equivalent lumen output relative to 75W incandescent lamps.*

Note that this 2.45 delta-watts multiplier for calculating *ex ante* estimated savings for 75W equivalent CFLs for program year 2013 is comparable to the 2.23 delta-watts multiplier used to calculate *ex post* verified savings for 100W equivalent CFLs during the evaluation of the 2012 Residential Lighting program. The 2012 calculation is shown here:

***Ex post delta-watts multiplier*** $_{\textit{100W equiv. CFLs, 2012}}$ ***= (74.27 - 23) / 23 = 2.23***

*Where 74.27 is the average baseline wattage for calculating ex post estimated savings and 23 is the average wattage of CFLs that can provide equivalent lumen output relative to 100W incandescent lamps.*

As one would expect for the aforementioned delta-watts multipliers, their values are between the TRM specified values for pre-EISA (3.25) and post-EISA (2.06 for 100W equivalent CFLs; 2.00 for 75W equivalent CFLs).

## CONCLUSIONS

At the end of calendar year 2013, 75W and 100W incandescent bulbs continue to be available in the Companies' Ohio service area. Ohio consumers can easily find 75W incandescent bulbs – of the 120 retail outlets we sampled, 75W incandescent bulbs were available at 50, including select locations of big box retail chains Lowes and Walmart. Ohio consumers cannot as easily find 100W incandescent bulbs – of the 120 retail outlets we sampled, 100W incandescent bulbs were available at 21, the majority of which (16 sites) are Lowes or Marcs locations. In other words, Ohio consumers who do not frequently shop at Lowes or Marcs chains will have difficulty finding 100W incandescent bulbs.

ADM cannot predict the future date at which non-compliant incandescent bulbs will be completely unavailable in Ohio. However, our shelving studies across 2012 and 2013 provide a clear indication that incandescent bulbs are widely available for approximately one year past the EISA implementation date. For example, the EISA implementation date was 1/1/2012 for 100W incandescent bulbs, but those bulbs were generally available for all of 2012 – and can still be found in Ohio if an Ohio consumer is determined to locate and purchase them. Similarly, the EISA implementation date was 1/1/2013 for 75W incandescent bulbs, but those bulbs were generally available for all of 2013, given that it would not require significant effort for an Ohio consumer to locate and purchase them.

Therefore ADM recommends the following delta-watts multipliers for the Companies' ex ante estimated savings for "time of sale" CFLs:

- 2.06 for 100W equivalent bulbs, the post-EISA TRM specified value; this value is recommended due to the relatively limited availability of 100W incandescent bulbs during the 2013 calendar year
- 2.45 for 75W equivalent bulbs, as described in the previous section of this memo

The M&V survey for the 2013 program year will capture data regarding what bulbs customers were using before they purchased new efficient lighting products. That 2013 survey data will be used to determine the delta-watts multiplier which ADM will use to calculate ex post verified energy savings for program year 2013.