

Residential Direct Load Control Program Evaluation, Measurement, and Verification Report 2014

Prepared for FirstEnergy Ohio Companies:

*Ohio Edison Company
The Cleveland Electric Illuminating Company
The Toledo Edison Company*

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1. Executive Summary

For 2014, the Ohio Operating Companies, The Cleveland Electric Illuminating Company (CE), Ohio Edison Company (OE), and The Toledo Edison Company (TE) (collectively “Companies”) offered the Residential Direct Load Control (DLC) program, also known as Easy Cool Rewards. Under contract with the Companies, ADM Associates, Inc. (ADM) performed evaluation, measurement and verification (EM&V) services to confirm the savings (kWh) and demand reduction (kW) realized through the energy efficiency programs that the Companies implemented in Ohio in 2014. This report presents and discusses results from an evaluation of the Companies’ 2014 DLC program.

This evaluation focuses on determining the achieved peak demand reduction and energy savings attributed to the DLC program in 2014. The evaluation included one-way UtilityPro Programmable Control Thermostats (PCTs). These thermostats restrict central air conditioner (CAC) runtime to a specified percentage of the runtime that would have occurred in the absence of the Load Control Event.

Program participation levels, Ex Ante, and Ex Post values are listed in the following table. Demand and energy savings calculations are detailed in Chapter 4. Demand savings represents average hourly kW reduction during Load Control Events, while energy savings represents the average hourly kWh over the duration (hours) of all Load Control Events.

Table 1-1: Program Savings Summary

Company	Participating Residential Households with DLC Device	Ex Ante Expected Savings		Ex Post Savings		kWh Realization Rate	kW Realization Rate
		kWh	kW	kWh	kW		
OE	10,361	19,878	6,626	5,227	6,722	26.3%	101.4%
CE	5,879	11,277	3,759	2,969	3,873	26.3%	103.0%
TE	1,367	2,652	875	375	843	14.1%	96.3%
Total Program	17,607	33,780	11,260	8,571	11,438	25.4%	101.6%

Ex Ante savings for energy savings and demand reductions were based on the average kW factors for each company for the previous year (i.e., for energy, the product of last year's kW results times the hours of the events). It is important to note that the summer temperatures were fairly mild and three events in 2014 were run as program test events and not during particularly hot, late afternoon periods, as in the prior year. This is the primary reason for the low realization rates for energy. Ex Post demand reductions are based on results consistent with PJM protocols and substantially consistent with prior year results.

DLC program savings have a measure life of one year, which is the program year itself; in other words, savings do not persist beyond the 2014 calendar year.

Key findings from the process evaluation of the 2014 Direct Load Control program include:

- **The established methods of communication between FirstEnergy staff and Honeywell staff continue to work well.** FirstEnergy and Honeywell staff both noted that there are no outstanding implementation issues with the 2014 Easy Cool Rewards program. Honeywell receives email communication from FirstEnergy staff to confirm that an event is to be called, and Honeywell responds with documentation that the event has been called. There is a standing bi-weekly call between FirstEnergy and Honeywell program staff to address any issues that arise. While these check-ins are not always necessary, they do happen regularly.
- **Direct mailings are the most effective method of marketing the program to potential participants.** Survey results support one interviewee's intuition that direct mail is the most effective method of advertising the Easy Cool Rewards program. Over 60 percent of respondents indicated they first learned of the Easy Cool Rewards program through either a utility bill insert (41 percent) or a utility direct mailing (22 percent).
- **Program participants expressed very high levels of satisfaction with the Companies' Easy Cool Rewards program.** Participant satisfaction with the overall experience with the program was high across operating companies, ranging from 4.4 in CE and TE territory to 4.5 in the OE service area (using a scale of 1 to 5, with 1 being very dissatisfied and 5 being very satisfied). Satisfaction with several program aspects increased from 2013 to 2014. In addition, respondents to the customer survey generally found program participation to be easy.
- **Current participants are likely to participate in the program in subsequent years.** More than 85 percent of customers indicated their likelihood of participating in the Easy Cool Rewards program in future years. Using a scale of 1 to 10, with 1 being not at all likely to participate and 10 being very likely, respondents averaged 8 or higher with 62 percent of respondents rating the likelihood at 10.

- **Customers were extremely satisfied with the service they received when calling the toll-free number.** While over half of all respondents (n=147) were aware of the toll-free number for the Easy Cool Rewards program, only 24 respondents contacted Easy Cool Rewards customer service. Customers reported very high levels of satisfaction when calling the toll-free number, with 23 of 24 respondents indicating that their questions about enrollment were sufficiently answered.

2. Introduction and Purpose of the Study

Under contract with the Companies, ADM performed evaluation, measurement and verification (EM&V) services to confirm the energy and demand savings realized by the energy efficiency programs implemented by the Companies in 2014.

The impact evaluation component of this report estimates annual gross energy savings and peak demand reduction through the following activities.

- Develop a load reduction research plan, including a measurement and sampling strategy to establish kW per unit impacts.
- Perform analysis of load data collected in 2014.
- Determine the program level kW and kWh Savings
- Determine the system wide kW savings at the Company level

The goal of the process evaluation component was to determine how effective the program is in terms of customer satisfaction, customer awareness, and stakeholder interaction. The process evaluation included the following activities.

- Conduct Implementation Staff Interviews
- Perform Program Manager Interviews
- Conduct Participant and Drop- Out Surveys
- Perform Cross-sectional analysis between participants and non-participants.
- Identify potential behavioral differences between populations.
- Provide recommendations aimed at increasing program retention.

3. Description of Program

The Companies have designed the DLC Program to reduce peak demand for electricity during the summer months. Customers who opt into the program will have a radio-controlled thermostat installed that will allow the Companies to reduce CAC compressor operation by a variable load control percentage (e.g., 50% cycling) during load control “events”. The demand control events occurred in the summer of 2014 and were initiated to reduce electric energy consumption during peak hours. This program is strictly for residential customers, and was targeted at customers with CAC units who are willing to accept reduced cooling capacities during event hours.

Honeywell is contracted with the Companies to provide DLC program services. Load Control Events are enabled through special programmable thermostats that can receive radio frequency signals and interrupt CAC unit compressor operation during load control events.

Devices are equipped with an adaptive algorithm that will reduce the runtime of the CAC compressor by 50% (or alternate percentage) of what it would have been otherwise, based on the normal operation of the unit. During a 70% cycling event for example, if a particular unit would have normally run 40 minutes during a given hour, the program will limit that unit to only 12 minutes of run time in that hour. Given that an event will likely last a number of consecutive hours, that same control limit will be applied to each hour of the event. The actual usage schedule that achieves the desired control limit will be unique for each program participant and will depend upon the physical characteristics of the home and behavioral patterns during conditions similar to the actual events.

During the 2014 Cooling Season the Companies ran the following whole-system events:

- (1) July 1st, 3 – 4 PM, 50% Cycling
- (2) September 4th, 3 – 4 PM, 50% Cycling
- (3) September 10th, 2 – 3 PM, 50% Cycling

From these event days, ADM calculated the average kW factor by Company and number of enrolled participants. The device count is based on data provided to ADM from Honeywell. Any participant who requested to be removed from the program before that date (July 25, 2014) was not included.

4. Evaluation Methodology

This chapter discusses the M&V approach for designing the sampling plan, calculating the kW impact per unit, program level kWh savings and program kW impacts.

4.1 Impact Evaluation Methodology

The impact evaluation addressed the following questions:

- Determine the kW peak demand reduction consistent with PJM protocols.
- Determine the kW reduction per event hour, for all program participants to support energy savings.
- Determine the operability rate of devices in the field through field inspections.

Demand reductions for each event hour and associated weighted temperature humidity index (WTHI) were based upon the predicted savings values listed in the “Deemed Savings Estimates for Legacy Air Conditioning and Water Heating Direct Load Control Programs in PJM Region” report dated April 3, 2007.

An operability rate of 88.6% was used in the calculations, based upon ADM’s 2013 Operability Study.

4.2 Data Collection and Conversion Procedures

ADM received the following information on each program participant:

- Full Name
- Address
- Install Date
- Account Number
- System Size (Tons)
- System Type (Conventional, Package Unit, Heat Pump, 2-Stage Unit)
- Removal Date (If Applicable)

The following table provides a comparison of participation tonnage values and unit age for the program.

Table 4-1 Participation and Average Tonnage Summary

Company	Program Pop. Size	Average Tonnage (Program Pop.)	Average Age (Program Pop.)
CEI	10,361	2.79	13.5
OE	5,879	2.70	12.2
TE	1,367	2.61	13.4
Total	17,607	2.72	12.7

Weather Data

ADM compiled historical weather data from the National Oceanic and Atmospheric Administration for each Company from May 15th – Sept 30th for the following cities:

- Akron (OE)
- Cleveland (CEI)
- Toledo (TE)

PJM design conditions of 80.7 WTHI were used for peak demand reductions.

4.3 kW Factors by Company

Using the regression baseline model specified in Section 3.4, ADM calculated hourly kW factors for the following event days:

- (1) July 1st, 3 – 4 PM
- (2) September 4th, 3 – 4 PM
- (3) September 10th, 2 - 3 PM

4.4 Energy Savings

Annual energy (kWh) savings for the 2014 DLC Program can be calculated as a function of kW reductions, Total Devices, and the number and length of curtailment events. Energy savings for an individual event is calculated as:

$$kWh\ Savings = \sum_j^M \sum_i^N kW_{i,j} \times Total\ Devices_{i,j}$$

Where:

i = the event hour

j = the Company

$kW_{i,j}$ = the kW factor for Company i during hour j .

And M, N denote the total number of device populations (i.e. three, one for each EDC) and DR event hours, respectively. The quantity $kW_{i,j}$ is calculated for every event hour and every Company.

4.5 Process Evaluation Methodology

The process evaluation for the Direct Load Control program assessed the following program components to determine initial and post program implementation effectiveness:

- Program awareness;
- Participating customer characteristics;
- Customer participation experience;
- Customer satisfaction.

5. Detailed Impact Evaluation Findings

This chapter presents the findings of the impact evaluation of the 2014 DLC Program, including kW factors and kWh Savings.

Verified peak demand reductions are calculated based on PJM protocols. PJM guidelines specify design weather conditions (WTHI) of 80.7 degrees, and provide tables of approved kW per device. Resulting kW per device are 0.65 for the EDCs.

For kWh Savings, kW factors were calculated across all EDCs as detailed in Chapter 4. The kW factors are reported by event in the following table. The averages are weighted by the number of participants in each EDC.

Table 5-1 Average Event kW Factors

<i>Date</i>	<i>Time</i>	<i>Average Event Hour Temp.</i>	<i>Event Hour kW Factor</i>	<i>Average WTHI</i>
7/01/14	3-4 PM	84.5	0.39	78.43
9/04/14	3-4 PM	83.6	0.13	73.40
9/10/14	2-3 PM	75.8	0.04	71.73

5.1 kW Factors by Company

The kW factors were calculated independently by Company as detailed in Chapter 4. Each set of kW factors are reported separately in the following three tables.

Table 5-2 OE Event kW Factors

<i>Date</i>	<i>Time</i>	<i>Event Hour Temp.</i>	<i>Event Hour 1</i>	<i>WTHI</i>
7/01/14	3-4 PM	89.1	0.43	79.3
9/04/14	3-4 PM	82.9	0.10	73.1
9/10/14	2-3 PM	80.1	0.04	72.5

Table 5-3 CEI Event kW Factors

<i>Date</i>	<i>Time</i>	<i>Event Hour Temp.</i>	<i>Event Hour 1</i>	<i>WTHI</i>
7/01/14	3-4 PM	86.0	0.38	78.0
9/04/14	3-4 PM	84.0	0.15	73.7
9/10/14	2-3 PM	78.8	0.04	71.6

Table 5-4 TE Event kW Factors

Date	Time	Event Hour Temp.	Event Hour 1	WTHI
7/01/14	3-4 PM	78.3	0.10	73.2
9/04/14	3-4 PM	84.0	0.21	74.6
9/10/14	2-3 PM	68.5	0.00	66.9

In order to capture the impact of the DLC program during event hours, the kW factors for each Company were aggregated and scaled up by the total number of active DLC devices in the field (17,596) measured as of September, 2014. These results are captured in Table 5-5.

Table 5-5 Hourly Load Impact All Companies in MW

Date	Time	Average Event Hour Temp.	Event Hour 1	Average WTHI
7/01/14	3-4 PM	84.5	6.04	78.43
9/04/14	3-4 PM	83.6	1.95	73.40
9/10/14	2-3 PM	75.8	0.56	71.73

5.2 kWh Savings by Company

kWh Savings are calculated as the sum of the kW factors for each Company and event and hours multiplied by quantity of devices in the field. Total program savings for 2014 are 8.6 MWh. Results per event are listed in Table 5-6 below.

Table 5-6 kWh Savings by Event

Date	kWh CE	kWh OE	kWh TE	kWh Combined
7/01/14	1,979	3,943	121	6,044
9/04/14	781	917	254	1,953
9/10/14	208	367	0	575
Total	2,969	5,227	375	8,571

6. Detailed Process Evaluation Findings

This chapter provides the findings of the process evaluation component of this report. The process evaluation was informed by participant telephone survey data and in-depth interviews with program staff at Honeywell and the Companies.

6.1 Program management, Implementation and Oversight

The evaluation team conducted interviews with FirstEnergy and Honeywell program staff in February 2015. These interviews focused on investigating program administration processes during the 2014 program year. Both FirstEnergy and Honeywell staff described the processes as functioning smoothly. There is a clear process in place for coordinating events and a clear chain of communication.

The Easy Cool Rewards program reached its participation target in 2014 and did not have significant numbers of customers drop out.

Marketing and Program Awareness

Direct mailings are the most effective method of marketing the program to potential participants. Survey results support that direct mail is the most effective method of advertising the Easy Cool Rewards program. Over 60 percent of respondents indicated they first learned of the Easy Cool Rewards program through either a utility bill insert (41 percent) or a utility direct mailing (22 percent).

Table 6-1 How Participants Learned About Easy Cool Rewards Program

Response	CE	OE	TE	Total
Utility bill insert	48%	37%	37%	41%
Utility direct mailing	23%	23%	16%	22%
Telephone call	13%	11%	26%	13%
Word of mouth: Friend/Relative/Neighbor/Co-worker	8%	10%	5%	9%
Easy Cool Rewards email	8%	10%	5%	8%
Newspaper	0%	4%	5%	3%
Utility website	1%	3%	0%	2%
Other	1%	2%	0%	1%
Radio advertising	0%	1%	5%	1%
Total	80	115	19	214

The established methods of communication between FirstEnergy staff and Honeywell staff continue to work well. FirstEnergy and Honeywell staff both noted that

there are no outstanding implementation issues with the 2014 Easy Cool Rewards program. Honeywell receives email communication from FirstEnergy staff to confirm that an event is to be called, and Honeywell responds with documentation that the event has been called. There is a standing bi-weekly call between FirstEnergy and Honeywell program staff to address any issues that arise. While these check-ins are not always necessary, they do happen regularly.

Program participants expressed very high levels of satisfaction with the Companies' Easy Cool Rewards program. Participant satisfaction with the overall experience with the program was high across EDCs, ranging from 4.4 in CE and TE to 4.5 in OE (using a scale of 1 to 5, with 1 being very dissatisfied and 5 being very satisfied). In addition, respondents to the customer survey generally found program participation to be relatively easy.

Table 6-2 Mean Satisfaction with Specific Aspects of Easy Cool Rewards Program

Program Aspect	CE		OE		TE		Total	
	Avg	Std. Dev	Avg	Std. Dev	Avg	Std. Dev	Avg	Std. Dev
The receipt and installation of a new thermostat as compensation for participation in program	4.7	0.8	4.8	0.7	4.8	0.6	4.7	0.7
The service professional who installed the device	4.7	0.7	4.7	0.8	4.8	0.6	4.7	0.7
The enrollment process	4.6	0.8	4.7	0.8	4.6	0.8	4.6	0.8
Overall experience with program	4.5	0.9	4.6	0.9	4.4	1.0	4.5	0.9
The program information provided	4.3	1.0	4.4	1.0	4.3	1.1	4.4	1.0
Overall experience during energy reduction events	4.2	0.9	4.3	0.9	4.2	1.2	4.3	1.0

Current participants are likely to participate in the program in subsequent years. More than 85 percent of customers indicated their likelihood of participating in the Easy Cool Rewards program in future years. Detailed results are provided in Table 6-3.

Table 6-3 Likelihood of Participating in Easy Cool Rewards Next Year

Likelihood*	CE (n=76)	OE (n=79)	TE (n=81)	Total (n=236)
1	1.1%	3.5%	9.5%	3.1%
2	2.2%	0.0%	0.0%	0.8%
3	0.0%	1.4%	0.0%	0.8%
4	0.0%	1.4%	0.0%	0.8%
5	3.2%	2.8%	0.0%	2.7%
6	1.1%	1.4%	4.8%	1.6%
7	6.5%	3.5%	4.8%	4.7%
8	9.7%	6.3%	9.5%	7.8%
9	19.4%	14.7%	4.8%	15.6%
10	57.0%	65.0%	66.7%	62.3%
Total	100.0%	100.0%	100.0%	100.0%

*1=very unlikely; 10=very likely

Customers were extremely satisfied with the service they received when calling the toll-free number. While over half of all respondents (n=147) were aware of the toll-free number for the Easy Cool Rewards program, only 24 respondents contacted Easy Cool Rewards customer service. Customers reported very high levels of satisfaction when calling the toll-free number, with 23 of 24 respondents indicating that their questions about enrollment were sufficiently answered.

Participants were uncertain about when energy reduction events occurred. When a Direct Load Control event is initiated, customers receive notification of the event by an indicator light on their thermostat. However, survey results indicated participants found it difficult to know when an energy reduction event was called, indicating the program is not overly invasive to customers. In 2014, there were no PJM emergency events called; the Companies initiated a test event pursuant to PJM protocol, and two additional events to obtain data for M&V evaluation. Nearly three-quarters of respondents (72 percent) could not recall the number of events called during summer while 4 percent of participants believed no energy reduction events occurred.

Table 6-4. Number of Energy Reduction Events Recalled Summer 2014

<i>Number of Events</i>	<i>CE (n=74)</i>	<i>OE (n=72)</i>	<i>TE (n=81)</i>	<i>Total (n=227)</i>
Don't know	48.6%	58.3%	55.6%	54.2%
0	25.7%	15.3%	13.6%	18.1%
1	4.1%	5.6%	6.2%	5.3%
2	2.7%	2.8%	6.2%	4.0%
3	4.1%	4.2%	6.2%	4.8%
4	2.7%	4.2%	4.9%	4.0%
5	2.7%	2.8%	4.9%	3.5%
6	1.4%	2.8%	0.0%	1.3%
7	1.4%	0.0%	0.0%	0.4%
10	1.4%	1.4%	0.0%	0.9%
12	1.4%	0.0%	1.2%	0.9%
20	1.4%	0.0%	0.0%	0.4%
40	1.4%	1.4%	0.0%	0.9%
100	1.4%	1.4%	1.2%	1.3%

7. Recommendations

Overall, the program appears to be functioning without major issues, a finding reiterated by a Honeywell staff member's statement that attrition rates are less than four percent. Interviewees reported that channels of communication between the Companies and Honeywell remained open and that meetings and telephone calls were productive throughout the program year. However, we provide the following recommendation for consideration.

Provide participating customers periodic reminders and updates regarding how the Companies will communicate when an energy reduction event will occur.

Understanding when and how they will receive notification that an event is occurring was the single aspect of the program that participants found most difficult to understand. Providing additional information, perhaps utilizing more frequent online communication (e.g., email and/or instant messaging services), may improve customers' understanding of events and may also enhance customers' abilities to manage their comfort during events.

8. Appendix A: Required Savings Table

DLC program savings have a measure life of one year, which is the program year itself; in other words, savings do not persist beyond the 2014 calendar year.

Table 8-1. Required Savings Table

Company	Annual Ex Post Savings		Measure Life	Lifetime Ex Post Savings	
	kWh	kW		kWh	kW
OE	5,227	6,926	1	5,227	6,722
CEI	2,969	3,946	1	2,969	3,873
TE	375	915	1	375	843
Total Program	8,571	11,787		8,571	11,438

9. Appendix B: Survey Instrument

Ohio Edison, Cleveland Electric Illuminating, and Toledo Edison Companies' Residential Direct Load Control Survey

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

1. Yes [CONTINUE]
2. No [SCHEDULE CALLBACK AND/ OR ATTEMPT TO CONVERT]

Q2. I'm with ADM, an independent research firm. We have been hired to assist [EDC] with review of their energy savings services by speaking with households that have signed up to participate in the Easy Cool Rewards (Thermostat) program. You should have received a postcard a couple of days ago explaining the purpose of this call. I'm not selling anything; I'd just like to ask you some questions about your decision to sign up for the Easy Cool Rewards (Thermostat) program offered by [EDC]. I'd like to assure you that your responses will be kept confidential and your name will not be revealed to anyone other than the evaluation team members. For quality and training purposes this call will be recorded.

The Easy Cool Rewards (Thermostat) program helps [EDC] to save energy during peak demand periods. As a part of this program, your central air conditioning system is remotely controlled by [EDC] by increasing the temperature setting to reduce energy usage when [EDC] predicts that electricity demand will be high. Do you recall enrolling for this program?

1. Yes [SKIP TO Q5]
2. No

Q3. Is there someone else in the household who may be familiar with the program?

1. Yes [ASK TO SPEAK TO THEM AND RECYCLE TO Q1]
2. No [THANK AND TERMINATE]

[DISPLAY Q4 IF Q3 = 1]

Q4. May I speak to that person?

1. Yes [RECYCLE TO Q2]
2. No [THANK AND TERMINATE]

Q5. Are you an employee of [EDC] or FirstEnergy?

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

1. How did you FIRST learn about Easy Cool Rewards (Thermostat) program offered by [EDC]? (Do not read list; Record response)
 1. Utility bill insert
 2. Utility direct mailing
 3. Telephone call from [EDC] telemarketer
 4. Utility website
 5. Radio advertising
 6. Newspaper
 7. Door hanger
 8. Word of mouth: Friend/ Relative/ Neighbor/ Co-worker
 9. Other event: Home and Garden show/ Earth day
 10. Easy Cool Rewards email
 97. Other (Specify)
 98. Don't know
 99. Refused
2. How would you prefer to receive information from [EDC] about programs like this in the future? (Do not read; select all that apply)
 1. Utility direct mailing such as a letter or postcard
 2. Telephone call from [EDC]
 3. Program website
 4. Email from [EDC]
 97. Other (Specify)
 98. Don't know
 99. Refused
3. For what reason or reasons did you decide to participate in the Easy Cool Rewards (Thermostat) program? (Do not read; Select all that apply)
 1. Concerned about saving energy in my home
 2. The opportunity to participate in an energy savings program
 3. Concerned about protecting the environment
 4. The program was recommended to me by [EDC]
 5. Reduce need for building new power plants
 6. Help [EDC] avoid power shortages (or brownouts or buying power at high prices)
 7. To get a new thermostat
 8. Not home when the AC is cycled
 97. Other (Specify)
 98. Don't know
 99. Refused

[DISPLAY Q5 IF > 1 SELECTED FOR Q4]

4. Of all the things that interested you about the program (Read list), what was the most compelling reason you decided to enroll in the program?

1. Record verbatim response:

98. Don't know

99. Refused

5. Did you have concerns about participating in the Easy Cool Rewards (Thermostat) program?

1. Yes

2. No

98. Don't know

99. Refused

[DISPLAY Q6 IF Q5 = 1]

6. What concerns did you have? (Do not read; Select all that apply)

1. Concerned about being uncomfortable during energy reduction events

2. Concerned about the load control device damaging my air conditioning equipment

3. Concerned about the utility being able to shut off my AC

97. Other (Specify)

98. Don't know

99. Refused

[DISPLAY Q7-Q13 FOR DROPOUTS ONLY]

7. On a scale of 1 to 10, where 1 is very difficult and 10 is very easy, how easy or difficult did you find it to...(Read list; Record 1-10; 6 = Not applicable, 98 = Don't know, 99 = Refused)

a. Understand the program requirements

b. Sign up to participate in the program

c. Schedule an appointment to have the Easy Cool Rewards device installed

d. Interact with the program staff

e. Understand how to operate the new thermostat

[DISPLAY Q8 IF Q7a-Q7e = 1, 2, 3, or 4]

8. What could the program have done differently to make it easier for you to [INSERT A-E WORDING]?

1. Record verbatim response:

98. Don't know

99. Refused

9. I understand that your household decided to participate and dropped out of the program. Can you tell me why that is? (Do not read; Prompt if needed)
1. The temperature increase was/ would be uncomfortable
 2. Didn't want [EDC] to control my energy use
 3. Didn't understand how the program worked
 4. Did not understand the energy reduction events
 5. Didn't understand what the program was trying to accomplish
 6. Afraid it might damage my central air conditioner
 7. Didn't like the time periods when the energy reduction events would happen
 8. Didn't like the number of days a year when energy reduction events would occur
 9. Health reasons
 10. Problems with Easy Cool Rewards device installation (Specify)
 97. Other (Specify)
 98. Don't know
 99. Refused
10. What could the program have done differently to encourage you to remain in the program? (Do not read; Prompt if needed)
1. Nothing they could have done
 2. Better explained the program
 3. Increase the amount of the incentive/payment for participating (Specify Amount)
 4. Shorter event days
 5. Reduced the amount by which the temperature was increased
 97. Other (Specify)
 98. Don't know
 99. Refused
- [DISPLAY Q11 IF Q8 > 1 RESPONSE]
11. Of all the reasons you mentioned for deciding not to participate in the program, which reason was the most important?
1. Record verbatim response:
 98. Don't know
 99. Refused
12. Now I would like to understand how your experience with Easy Cool Rewards (Thermostat) program has affected your satisfaction with [EDC] as your utility. Did it...(Read list)
1. Greatly improve your satisfaction
 2. Somewhat improve your satisfaction
 3. Make no difference in your satisfaction
 4. Somewhat decrease your satisfaction
 5. Greatly decrease your satisfaction

13. Will you please tell me why you responded [RESPONSE FROM Q12]?

- 1. Record verbatim response
- 98. Don't know
- 99. Refused

[DISPLAY Q14-Q22 FOR ENROLLED PARTICIPANTS ONLY]

14. Next, I would like to ask you some questions about your enrollment in the program.

Thinking about the information you have received about participating in the program, on a scale of 1 to 10, where 1 is very difficult and 10 is very easy, how difficult or easy did you find it to...(Read list; Record 1-10; 6 = Not applicable, 98 = Don't know, 99 = Refused)

- a. Understand the program requirements
- b. Sign up to participate in the program
- c. Schedule an appointment to have the Easy Cool Rewards device installed
- d. Understand when and how you will be notified of an energy reduction event
- e. Understand what you can do to reduce your electricity use when energy reduction events are occurring
- f. Interact with the [EDC] staff during enrollment

[DISPLAY Q15 IF Q14a-14f = 1, 2, 3, or 4]

15. What could the program have done differently to make it easier for you to [INSERT A-F WORDING]?

- 1. Record verbatim response:
- 98. Don't know
- 99. Refused

16. Have you called the Easy Cool Rewards (Thermostat) toll free number with any questions about enrollment?

- 1. Yes
- 2. No
- 98. Don't know
- 99. Refused

[DISPLAY Q17 IF Q16 = 1]

17. Were your questions sufficiently answered?

- 1. Yes
- 2. No (Record verbatim response: What was not answered?)
- 98. Don't know
- 99. Refused

[DISPLAY Q18 IF Q16 = 2, 98, or 99]

18. Were you aware that there is a toll free number you can call with questions about the program?

- 1. Yes
- 2. No
- 98. Don't know
- 99. Refused

19. Did you have any initial questions about the participating in the program?

- 1. Yes
- 2. No
- 98. Don't know
- 99. Refused

[DISPLAY Q20 IF Q19 = 1]

20. What questions or concerns did you have? (Do not read ; Prompt if needed)

- 1. Didn't know how to reduce my energy consumption during energy reduction events
- 2. Didn't understand how the program worked
- 3. Didn't like the potential time periods when the energy reduction events would happen
- 4. Problems with installation of Easy Cool Rewards device (Specify)
- 97. Other (Specify)
- 98. Don't know
- 99. Refused

21. Can you tell me in your own words your understanding of what occurs during an energy reduction event? (Record verbatim response)

22. What information did you find helpful? (Do not read; Select all that apply)

- 1. Information about savings periods/events
- 2. Information about rebate
- 3. Information about how to save and/or reduce energy usage during savings periods
- 4. Information about how savings period/event notifications will be sent
- 5. Information about what to do when notification is received
- 6. Information about penalties
- 7. Information about how savings are calculated
- 8. Information about how savings will be communicated
- 9. Information about what number to call if there are questions
- 10. Information about how to opt out of events
- 97. Other (Specify)
- 98. Don't know
- 99. Refused

Next I would like to ask you some questions about your experience during the energy reduction events that occurred during the summer.

23. How many reduction events do you think [EDC] issued this past summer?

- 1. Number of days
- 2. Never
- 98. Don't know
- 99. Refused

24. Were you at home during any of the energy reduction events?

- 1. Yes
- 2. No
- 98. Don't know
- 99. Refused

[DISPLAY Q25 IF Q24 = 1]

25. How could you tell that [EDC] AC was cycling during an event?

- 1. The house got uncomfortably warm
- 2. I didn't hear the air conditioner run as often
- 3. I looked at the thermostat and saw that the temperature had been increased
- 4. I called [EDC] to see if they had adjusted the temperature
- 5. I received a notification via my thermostat
- 97. Other (Specify)
- 98. Don't know
- 99. Refused

26. Thinking about the events that occurred when you were home, on a scale of 1 to 10, where 1 is very uncomfortable and 10 is very comfortable, how uncomfortable or comfortable was it for you?

- 1. Record 1-10:
- 98. Don't know
- 99. Refused

27. Were you aware that energy reduction events had occurred when you were not at home?

- 1. Yes
- 2. No
- 98. Don't know
- 99. Refused

[DISPLAY Q28 IF Q27 = 1]

28. How did you know that energy reduction events had occurred when you were not home during the event?

1. The house was uncomfortably warm when I returned home
2. The air conditioning ran more than usual
3. I called [EDC] to see if they had adjusted the temperature
4. I received a notification via my thermostat
97. Other (Specify)
98. Don't know
99. Refused

29. Have you called the Easy Cool Rewards (Thermostat) toll free number with any questions about energy reduction events?

1. Yes
2. No
98. Don't know
99. Refused

[DISPLAY Q30 IF Q29 = 1]

30. Were your questions sufficiently answered?

1. Yes
2. No (Record verbatim response: What was not answered?)
98. Don't know
99. Refused

[DISPLAY Q31 IF Q28 = 4]

31. You mentioned in a previous question that you had called [EDC] to ask if an energy reduction event had occurred. Were your questions answered?

1. Yes
2. No
98. Don't know
99. Refused

32. On a scale of 1-5 where, Very dissatisfied = 1, Somewhat dissatisfied = 2, Neither satisfied nor dissatisfied = 3, Somewhat satisfied = 4, Very satisfied = 5, Don't know = 98, and Refused = 99, how unsatisfied or satisfied are you with...

- a. The enrollment process?
- b. The program provided?
- c. The service professional who installed the Easy Cool Rewards device?
- d. The receipt and installation of a new thermostat as compensation for your participation in the program?
- e. Your overall experience during energy reduction events?
- f. Your overall experience with the program?

[DISPLAY Q33 IF Q32a-Q32f = 1, 2, 3, or 4]

33. What can the program do differently to make you more satisfied with [INSERT A-F WORDING]? (Record verbatim response)

34. On a scale of 1 to 10, where 1 is not at all likely and 10 is very likely, how likely are you to participate in an Easy Cool Rewards (Thermostat) program in the future?

1. Record 1-10:

98. Don't know

99. Refused

[DISPLAY Q35 IF Q34 = 1, 2, 3, or 4]

35. What can the program do differently to make you more likely to participate in the future?

1. Record verbatim response:

98. Don't know

99. Refused

36. On a scale of 1 to 10, where 1 is not at all likely and 10 is very likely, how likely are you to participate in an Easy Cool Rewards (Thermostat) program in the future if [EDC] did not offer an incentive (i.e. a free thermostat) to participate?

1. Record 1-10:

98. Don't know

99. Refused

37. What effect, if any, has the program had on how you will use energy in the future?

1. Record verbatim response:

98. Don't know

99. Refused

38. Now I would like to understand how your experience with Easy Cool Rewards (Thermostat) program has affected your satisfaction with [EDC] as your utility. Did it... (Read list)

1. Greatly improve your satisfaction with [EDC]

2. Somewhat improve your satisfaction with [EDC]

3. Make no difference in your satisfaction with [EDC]

4. Somewhat decrease your satisfaction with [EDC]

5. Greatly decrease your satisfaction with [EDC]

39. Will you please tell me why you responded [RESPONSE FROM Q38]

1. Record verbatim response:

98. Don't know

99. Refused

I would now like to ask you some questions about how you would like to receive information about your electricity use and updates about the program from [EDC].

40. Do you have internet access?

- 1. Yes
- 2. No
- 98. Don't know
- 99. Refused

[DISPLAY Q41 IF Q40 = 1]

41. Have you ever visited [EDC] or FirstEnergy's website?

- 1. Yes
- 2. No
- 98. Don't know
- 99. Refused

[DISPLAY Q42 IF Q41 = 1]

42. Have you ever used the [EDC] or FirstEnergy Home Energy Analyzer to assess your home energy usage?

- 1. Yes
- 2. No
- 98. Don't know
- 99. Refused

43. Are there other methods that [EDC] should consider using to provide feedback information about your performance during energy reduction events? (Do not read; Select all that apply)

- 1. Text message
- 2. Email
- 3. Cell phone call
- 4. Home phone call
- 5. Mail
- 6. In home display
- 97. Other (Specify)
- 98. Don't know
- 99. Refused

44. Have you been to the [EDC] website to review the energy savings tips they provide online?

- 1. Yes
- 2. No
- 98. Don't know
- 99. Refused

[DISPLAY Q45 IF Q44 = 1]

45. Please rate the usefulness of the energy efficiency information provided on the website using a scale of 1 to 10, where 1 is “not at all useful” and 10 is “very useful”.

- 1. Record 1-10:
- 98. Don't know
- 99. Refused

46. What types of additional information would you like on the website?

Next, I want to better understand the types of energy using equipment you have in your home.

47. How many plasma TV's do you have?

- 1. Record response:
- 98. Don't know
- 99. Refused

48. How many LCD/LED TV's do you have?

- 1. Record response:
- 98. Don't know
- 99. Refused

49. How many conventional (tube-based) TV's do you have?

- 1. Record response:
- 98. Don't know
- 99. Refused

50. How many projection TV's do you have?

- 1. Record response:
- 98. Don't know
- 99. Refused

51. How many other TV's do you have?

- 1. Record response:
- 98. Don't know
- 99. Refused

52. What type of stove do you have?

- 1. Natural Gas
- 2. Electric
- 3. Propane
- 97. Other (Specify)
- 98. Don't know
- 99. Refused

53. What type of water heater do you have?

- 1. Natural Gas
- 2. Electric
- 3. Propane
- 97. Other (Specify)
- 98. Don't know
- 99. Refused

54. What type of clothes dryer do you have?

- 1. Natural Gas
- 2. Electric
- 3. Propane
- 97. Other (Specify)
- 98. Don't know
- 99. Refused

55. Which of the following best describes your home/residence?

- 1. Single-family home, detached construction (Not a duplex, townhome, or apartment; attached garage is ok)
- 2. Single family home, factory manufactured/modular
- 3. Single family, mobile home
- 4. Row House
- 5. Two or Three family attached residence—traditional structure
- 6. Apartment (4 + families)---traditional structure
- 7. Condominium---traditional structure
- 97. Other (Specify)
- 98. Don't know
- 99. Refused

56. Do you own or rent this residence?

- 1. Own
- 2. Rent
- 98. Don't know
- 99. Refused

57. Approximately when was your home constructed? (Do not read 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

58. How many square feet is the above-ground living space (If necessary, this excludes walk-out basements)?

1. Numerical open end (Range 0-99,999)_____

98. Don't know

99. Refused

[DISPLAY Q59 IF Q58 = 98 or 99]

59. Would you estimate the above-ground living space is about:

1. Less than 1,000 sqft

2. 1,001-2,000 sqft

3. 2,001-3,000 sqft

4. 3,001-4,000 sqft

5. 4,001-5,000 sqft

6. Greater than 5,000 sqft

98. Don't know

99. Refused

60. How many square feet of conditioned living space is below- ground (If necessary, this excludes walk-out basements)?

1. Numerical open end (Range 0-99,999)_____

98. Don't know

99. Refused

[DISPLAY Q61 IF Q60 = 98 or 99]

61. Would you estimate the below-ground living space is about:?

1. Less than 1,000 sqft

2. 1,001-2,000 sqft

3. 2,001-3,000 sqft

4. 3,001-4,000 sqft

5. 4,001-5,000 sqft

6. Greater than 5,000 sqft

98. Don't know

99. Refused

62. What kind of air conditioning does your home have? (Select all that apply)

1. Central Air Conditioning

2. Heat Pump

3. Window A/C (Number)

4. None

98. Don't know

99. Refused

63. How many window A/C units does your home have?

1. Record response:

98. Don't know

99. Refused

Finally, I would like to ask you a few questions to better understand your household.

64. How many years have you lived at your current address? (Do not read list)

1. 1 year or less
2. 2 to 5 years
3. 6 to 9 years
4. 10 to 20 years
5. More than 20 years
98. Don't know
99. Refused

65. I'm going to read several age groups. Please stop me when I come to the group in which your age belongs. (Read list)

1. Under 24
2. 25 to 34
3. 35 to 44
4. 45 to 54
5. 55 to 64
6. 65 to 74
7. 75 or over
98. Don't know
99. Refused

66. How many people were living in your home during the summer of 2012?

1. Number of people:
98. Don't know
99. Refused

[DISPLAY Q67IF Q66 > 0]

67. On average, how many of these people were home during week during the hours of [Savings period] during the summer?

1. Number of people:
98. Don't know
99. Refused

END: Thank you, those are all the questions I have for you today.

10. Appendix C: Temperature Humidity Index

For the cooling season (June, July, August, and September), Temperature-Humidity Index (THI) is used as the weather variable:

If $DB \geq 58$, $THI = DB - 0.55 * (1 - HUM) * (DB - 58)$

If $DB < 58$, $THI = DB$

Where: THI = Temperature humidity index;

DB = Dry bulb temperature (°F),

HUM = Relative Humidity (where 100% = 1).

For shoulder months (March, April, May, October and November), the average daily dry bulb temperature serves as the weather variable.

The weighted temperature-humidity index (WTHI) is constructed by incorporating “lag terms” in the THI. The WTHI as calculated as:

$$WTHI = 1/14 \times (10 \times THI_n + 3 \times THI_{(n-24)} + THI_{(n-48)})$$

Where: THI_n = Temperature humidity index for hour n .

$THI_{(n-24)}$ = THI for hour $n-24$ (same hour from the previous day)

$THI_{(n-48)}$ = THI for hour $n-48$ (same hour from the previous day)