Large Filing Separator Sheet

Case Number: 12-1477-EL-EEC

File Date: 5/15/2012

Section: 2

Number of Pages: 201

Description of Document: Annual Efficiency Status Report

e. ____ coordination with contractor
f. ____ coordination with lending institution
g. ____ Recommendation of someone else (*Probe*: **Who?**_____)
h. ____ Wanted to reduce energy costs
i. ____ The information provided by the Program
j. ____ Past experience with this program
k. ____ Because of past experience with another Duke Energy program
l. ____ Recommendation from other utility program
(*Probe*: **What program?** _____)
m. ____ Recommendation of family/friend/neighbor
n. ____ Other (SPECIFY) _____
o. ____ Don't know/don't remember/not sure (DK/NS)

If multiple responses: 3.a. **Were there any other reasons?** *(number responses above in the order they are provided - Repeat until 'no' response.)*

Program Free-Ridership Questions

4. **Before you heard about the Energy Solutions at Home from Duke Energy, had you already been considering getting a home energy assessment?**

   a. Yes
   b. No
   c. Don't Know

5. **If the assessment from Duke Energy's Energy Solutions at Home Program had not been available, would you still have:**

   5a. **Purchased a home assessment from someone else?**

   a. Yes
   b. No – *skip to question 6*
   c. Don't Know – *skip to question 6*

   If yes, **Assessments from private suppliers typically cost from $150 to $300 dollars compared to the $90 charged by Duke Energy.**
   What do you think you would have had to pay for the assessment if you would not have obtained it from Duke Energy?

   $ _____

   5b. **Would you have purchased the assessment within the next year, the next two years, the next three years or after three years?**

   a. Within the next year
   b. Within the next two years
   c. Within the next three years
   d. After three years
   e. Don't Know

SATISFACTION QUESTIONS

Now I am going to ask you some general satisfaction statements. On a scale from 1-10, with 1 indicating that you strongly disagree, and 10 indicating that you strongly agree, please rate the following statements.

6. **Scheduling the over-the-phone energy assessment was easy to do.**

   1 2 3 4 5 6 7 8 9 10

   ❑ Don't Know

   If 7 or less, **How could this be improved?**_____

   _____

7. **The interactions and communications I had with the over-the-phone energy assessor were satisfactory.**

   1 2 3 4 5 6 7 8 9 10

   ❑ Don't Know ❑ Not Applicable (no interaction)

   If 7 or less, **How could this be improved?**_____

   _____

8. **The over-the-phone energy assessor was helpful and knowledgeable.**

   1 2 3 4 5 6 7 8 9 10

   ❑ Don't Know ❑ Not Applicable (no interaction)

   If 7 or less, **How could this be improved?**_____

   _____

9. **Scheduling the home energy assessment was easy to do**

   1 2 3 4 5 6 7 8 9 10

   ❑ Don't Know ❑ Not Applicable (no interaction)

10. **The interactions and communications I had with the home energy assessor were satisfactory.**

    1 2 3 4 5 6 7 8 9 10

    ❑ Don't Know ❑ Not Applicable (no interaction)

If 7 or less, **How could this be improved?**_____

_____

11. **The home energy assessor was helpful and knowledgeable.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know ❑ Not Applicable (no interaction)

If 7 or less, **How could this be improved?**_____

_____

12. **The interactions and communications I had with Duke Energy staff were satisfactory.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know ❑ Not Applicable (no interaction)

If 7 or less, **How could this be improved?**_____

_____

13. **The assessment report was easy to read and understand.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**_____

_____

14. **The recommendations in the assessment report provided new ideas that I was not previously considering.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**_____

_____

15. **The recommendations in the assessment report increased the likelihood that I would take recommended actions.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**_____

_____

16. **The coordination offered between Duke Energy and a contractor increased the likelihood that I would take recommended actions.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**_____

_____

17. **The rebate offered by Duke Energy above and beyond the federal stimulus rebate increased the likelihood that I would take recommended actions.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**_____

_____

18. **Overall I am satisfied with the program.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**_____

_____

Measure Questions

19. If <Insulation/AC/furnace/caulking and sealing/heat pump> was recommended:
Did you install the <measure> as recommended in the Energy Solutions at Home Assessment Report?
a. Yes
What did you do? _____
b. No
c. DK

19a. If yes to q19. **For this measure, we have <contractor name> listed as the contractor who performed the installation. Is this correct?**
a. Yes – skip to 20
b. No – skip to 20
c. Not sure – skip to 20

If no to question 19,
19b. **Do you have plans to install <measure> within the next**
a. Six months
b. Year
c. 2 years or more
d. Never

If no to question 19,
19c. **Can you tell me why you have decided to delay or skip installation?**
a. Don't believe it will improve comfort
b. Don't believe it will save energy
c. Don't believe it will reduce bills
d. Installing other measures first
e. Cannot afford it at this time
f. Other (what?)

20. **On a 1-to-10 scale please rate your satisfaction with your contractor in the following areas:**

20a. Communication
1 2 3 4 5 6 7 8 9 10
❑ Don't Know

If 7 or less, **How could this be improved ?** _____

20b. Services offered

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved ?** _____

20c. Pricing

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved ?** _____

20d. Quality of work

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved ?** _____

20 e. Overall satisfaction

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved ?** _____

21. **Our records indicate that your rebate from Duke Energy, excluding the federal stimulus rebate, was <amount>. Is this correct?**
    a. Yes
    b. No – skip to question 23
    c. DK/NS – skip to question 23

22. **Did you find this rebate amount was satisfactory?**
    a. Yes -- skip to question 23
    b. No -- ask question 22a.
    c. DK/NS – ask question 22a.

22 a. If no, **what amount would you consider a satisfactory rebate for this installation?** _____

23. **Before receiving the Energy Solutions at Home assessment, what was your level of interest in this installation?**
    a. None
    b. Already been thinking about doing it
    c. Already collecting information about this type of project
    d. Already begun to get product information and price estimates
    e. Already made a firm decision to install
    f. Already negotiated with a supplier to install the project

On a 1-to-10 scale, with a 1 meaning that it had no influence and a 10 meaning it was very influential in your decision to perform the installation please rate the influence of each of the following factors on your decision to perform the installation:

24. **The level of influence of the home assessment and the report**
    1 2 3 4 5 6 7 8 9 10
    ❑ Don't Know

25. **The influence of the Duke Energy coordination with the contractor**
    1 2 3 4 5 6 7 8 9 10
    ❑ Don't Know

26. **Duke Energy coordination with the lending institution**
    1 2 3 4 5 6 7 8 9 10
    ❑ Don't Know

27. **The influence of the Duke Energy incentive amount**
    1 2 3 4 5 6 7 8 9 10
    ❑ Don't Know

For the next few questions, please indicate your likelihood of installing this measure if the following program service had NOT been available from Duke Energy.

28. **The home assessment**
    a) Would not have undertaken the project
    b) May not have undertaken the project
    c) Would have undertaken the project but at a later time – *ask question 28a*
    d) Would have undertaken he project at the same time – *ask question 28a*
    e) Not sure what I would have done.

28 a. If c or d above, **If the program was not available to you, would you have focused as much attention to the energy efficiency aspects of the project**

a) Yes
b) No
c) Not sure don't know

29. **If the Duke Energy coordination with the installation contractor was not a part of the Duke Program, would you...**
    a) not have undertaken the project
    b) probably not have undertaken the project
    c) have undertaken the project but at a later time
    d) have undertaken he project at the same time.
    e) Not sure what I would have done.

30. **What about if the Duke Energy financial incentive was not available, would you**
    a) not have undertaken the project
    b) probably not have undertaken the project
    c) have undertaken the project but at a later time
    d) have undertaken he project at the same time.
    e) Not sure what I would have done.

Repeat for all measures installed...

Spillover Questions

31. **Since you participated in the Energy Solutions at Home Program, have you purchased and installed any other type of energy efficiency equipment or made energy efficiency improvements in your home that were not recommended by the assessment report?**

a) Yes
b) No
c) Don't Know

_____
_____

32. **What type and quantity of high efficiency equipment did you install on your own?** *PROBE TO GET EXACT TYPE AND QUANTITY AND LOCATION*

Type 1: _____	Quantity 1: _____	Location 1: _____
Type 2: _____	Quantity 2: _____	Location 2: _____
Type 3: _____	Quantity 3: _____	Location 3: _____
Type 4: _____	Quantity 4: _____	Location 4: _____

33. *For each type listed in 32 above,* **How do you know that this equipment is high efficiency? For example, was it Energy Star rated?**

Type 1: _____
Type 2: _____
Type 3: _____
Type 4: _____

I'm going to read a statement about this equipment that you purchased on your own. On a scale from 1-10, with 0 indicating that you strongly disagree, and 10 indicating that you strongly agree, please rate the following statement.

34. **My experience with the Energy Solutions at Home Program in** <month/year> **influenced my decision to install** <Type 1/Type 2/Type 3/Type 4> **on my own.**

Type 1:	1	2	3	4	5	6	7	8	9	10	Don't Know
Type 2:	1	2	3	4	5	6	7	8	9	10	Don't Know
Type 3:	1	2	3	4	5	6	7	8	9	10	Don't Know
Type 4:	1	2	3	4	5	6	7	8	9	10	Don't Know

35. **What other actions, if any, have you taken in your home to save energy and reduce utility bills at least in part as a result of what you learned in this program?**
Response:1 _____
Response:2 _____
Response:3 _____
Response:4 _____

36. **What additional services would you like the program to provide that it does not now provide?**

Response: _____
_____

37. Are **there any other things that you would like to see changed about the program?**
Response: _____

38. **What do you think can be done to increase people's interest in participating in the Energy Solutions at Home Program?**

Response:1 _____
Response:2 _____
Response:3 _____
Response:4 _____

39. **What do you like most about this program?**
Response: _____

40. **What do you like least about this program?**
Response: _____

That is the end of our survey, thank you for your time and feedback today!
(*politely end call*)

Process and Energy Impact Evaluation of Duke Energy's Ohio Non-Residential Energy Assessment Program

Final Report

Prepared for
Duke Energy
139 East Fourth Street
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November 15, 2011

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Executive Summary

Key Findings and Recommendations

The key findings and recommendations identified through this evaluation are presented below.

Program Operations: Recommendations

1. RECOMMENDATION: The Non-Residential Energy Assessments Program (EAP) should work with the Account Managers to develop clear criteria for identifying prospective participants for the Smart $aver® program based upon segmentation of past Smart $aver® participants. An analysis of what projects and measures were of interest to past Smart $aver® participants in each industry sector would allow Account Managers to make suggestions of similar projects to prospective participants in the same sector. This would allow the budget for the EAP to be directed to those customers who are more likely to take action. (See "Relationship Building" on Page 14)
2. RECOMMENDATION: Track the conversion rate (i.e. percentage of EAP participants who adopt EAP recommendations through subsequent Smart $aver® projects) and identify those Account Managers who are more successful at actively converting EAP participants into Smart Saver® participants. These Account Managers may have developed successful strategies that could be shared with other Account Managers to help them increase Duke Energy's overall conversion rates from EAP to Smart $aver®. (See "Tracking Recommendation Adoptions" on Page 17)
3. RECOMMENDATION: Duke Energy or their evaluation contractors should survey customers who receive both phone and on-site assessments to determine how much additional perceived value is provided by the on-site assessment, and where this additional value comes from. This would allow Duke Energy to identify customer's needs and wants from the on-site assessment report. Duke Energy or their evaluation contractors should also compare the relative cost effectiveness of the phone assessment compared with the on-line web assessment. If the on-line assessment is not perceived as valuable and does not drive customers to participation, Duke Energy should consider discontinuing the web-based assessment (but still offer online input of assessment data for a telephone assessment). However, care should be taken in this effort as different customers may want different services, and each of these delivery approaches may define a market sub-segment that may or may not participate in the program if their assessment choices are limited compared to their expectations. The study should also examine the relative success of each approach in driving customers to participate in other Duke Energy programs, as well as identifying additional benefits to the customer not captured by the other programs (low-cost no-cost savings, customer loyalty, satisfaction, etc.) (See "Relationship Building" on Page 14)
4. RECOMMENDATION: Conduct a service needs survey to determine what customers expect from assessment reports in terms of short term versus long term recommendations and in terms of electric-only versus more comprehensive sustainability recommendations. While the primary objective is to help customers identify projects that can be implemented under the Smart $aver® program, the overall credibility of energy efficiency-related recommendations may be enhanced by including recommendations that

present a more comprehensive approach to reducing operating costs. Depending upon the survey results, Duke Energy may also elect to begin offering a "zero net energy with existing buildings" or other high savings assessments (not just cost effective for Duke Energy) for those customers who are motivated to achieve deep energy savings. This would help maintain Duke Energy's standing as the customers' primary partner in meeting all their energy needs, including sustainable energy. (See "Assessments" on Page 15)

5. RECOMMENDATION: Assess if it is possible to develop set of segment-specific recommendations that are targeted to the specific needs of different market segments to the degree that the segments can be used to target high-priority customers more likely to take segment-specific actions. If there are identifiable segment-specific actions that are specific to a segment, this can allow Duke Energy to show customers that their needs are understood, and that the assessment report's recommendations are customized especially for them. Duke Energy can begin to develop these targeted recommendations by first asking Account Managers to identify a few key market sectors that they believe has the greatest untapped potential for energy savings. Duke Energy can survey the Smart $aver® participants and non-participants within those sectors to determine their needs, wants, barriers to participation, and how well the Smart $aver® program addresses those. If Duke Energy has not already done so, we recommend that Duke Energy also conduct market characterization studies for those sectors to see what the mid- to long-term trends are for that market, and also to aid in their conversations with the customers about the projects with longer paybacks. Information from the surveys and any market characterization studies can also be used to build case studies that will help other customers understand the process and benefits of participating in Smart $aver®.(See "Demonstrating Program Value" on Page 17)
6. RECOMMENDATION: Duke Energy should conduct some contingency analyses of the recommendations adoption data to determine whether adopting low-cost no-cost recommendations affect the adoption of Smart $aver®-eligible measures. In a parallel study, Duke Energy should investigate whether there are any corollary benefits to including low-cost no-cost recommendations. For example, excluding low-cost no-cost recommendations may inadvertently emphasize the greater expense of the Smart $aver®-eligible measures, and thus increase the perceived first-cost barriers to becoming more energy efficient. (See "Tracking Recommendation Adoptions" on Page 17)
7. RECOMMENDATION: EAP should use the program's follow up activities to obtain immediate feedback on the usefulness of the assessment reports. This may allow a better leveraging of resources. Additionally, if Account Managers are conducting the follow up feedback, the program's Smart $aver® objectives and services can be kept at the forefront of customer interactions. (See "Quality Control" on Page 15)
8. RECOMMENDATION: Develop the program website so that it is easy to find on the web, has a clear presentation of the services offered and the service approach, and an easy to use web-based enrollment process. (See "Past Evaluation Recommendations" on Page 16)
9. RECOMMENDATION: Design the assessment to formally provide low-cost and no-cost recommendations to customers and incorporate estimates of the impact of these actions,

when implemented into the tally of energy saved credited to Duke Energy (and other utilities) as a result of the program. The low-cost and no-cost savings may not be eligible for cost recovery, but it is important to document the full value of the EAP, whether officially credited or not. This will allow Duke Energy to make decisions with a more comprehensive knowledge of how each energy efficiency program interacts with the other programs in Duke Energy's energy efficiency portfolio. (See "Past Evaluation Recommendations Relationship Building" on Page 16)

Implementation Rates: Key Findings

1. **Many Recommendations are Accepted and Used:** Eight participants, four receiving off-site assessments and four receiving an on-site assessment, were provided with a total of 47 recommendations:
   - The overall implementation rate for all recommended measures was 38%.
   - 32% of the recommendations were rejected by the customer and will not be implemented.

   (See "Implementation Rates" on Page 19)

2. **Participants Take Action Rapidly:** Of the recommendations that were implemented prior to the evaluation contact, 65% were completed within six months of receiving the report. 12% were completed immediately upon receipt of the recommendation or within the next 30 days. (See "Timing of Actions" on Page 22)

3. **Economy and Corporate Conditions Slow Measure Installations:** Corporate economic conditions and the firm's current financial status together represent the most common reasons provided for a recommended measure not being implemented. These two reasons are similar in that they deal with the firm's financial condition within the economies in which they operate. As a result, measures with long payback periods and/or excessive upfront capital costs become the measures cited most often as those that cannot be implemented. (See "Effect of Current Economy on Energy Efficient Actions" on Page 26)

Program Satisfaction: Key Findings

1. **Satisfaction Scores are High:** Participants gave high satisfaction scores for three program aspects: "Responsiveness of Duke Energy staff," "Length of time to receive assessment report" and "Report meets expectations," received satisfaction ratings of 9.2 or higher on a ten point scale. Overall satisfaction within nine other categories was also scored well with average scores higher than eight on a ten-point scale. (See "Program Satisfaction" on Page 23)

2. **Scheduling and practicality of report are concerns:** Two participants noted that they found it difficult to schedule their assessment and gave scores that lowered the "Ease of Scheduling" rating below an eight. Four of eight participants rated the overall practicality

of the report at less than eight. However, all participants did implement at least one report recommendation.

Engineering Impact Estimates: Key Findings

There were a total of 20 customers in Ohio that received an energy assessment. Attempts were made to contact all customers for a follow-up phone interview. Eight were able to be contacted, but only six of the 20 verified that they implemented energy saving recommendations from their Non-Residential Energy Assessment report. The energy saving measures taken by these six customers as a result of the program provide gross annual savings of 786,451 kWh, 209,649 MMBtu, and reduce peak load by 58.7 kW. A breakdown of the savings by customer can be seen in Table 1. A detailed analysis is presented in the Engineering-Based Impact Analysis section on page 30.

Table 1: Program Savings Estimate Breakdown by Customer

Customer	kWh	kW	MMBtu
Customer One	227,358	21.5	-632
Customer Two	101,740	4.7	-285
Customer Three	57,213	7.5	-160
Customer Four*	297,849	17.1	-430
Customer Five	74,998	4.7	0
Customer Six	27,293	3.3	211,156
TOTAL	**786,451**	**58.7**	**209,649**

* Customer Four implemented a compressed air system repair and maintenance program as recommended to them in their energy assessment report. Subsequent to implementing this program, this customer purchased and received a rebate for a new variable speed compressor with controller. This rebate was received through the Smart $aver® Custom program and the unit's purchase is considered to have been precipitated by the customer's participation in the Energy Assessment program. In consideration of the new, more efficient compressor, the energy savings factor (ESF) for this customer's repair and maintenance program has been lowered.

Table 2 shows all of the measures that contribute to program savings and the number of customers that implemented them. The table also details gross savings as well as per unit savings broken down by measure.

Table 2. Summary of Program Savings by Measure

Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings
Metal Halide to T5 and Occupancy Sensors	1	1,438	0.14	225,746	21.46
Vending machine motion sensor	1	1,612	0.00	1,612	0.00
Incandescent to CFL	2	507	0.03	102,320	6.03
Halogen to LED	1	365	0.02	14,580	0.67
T12 to T8	2	212	0.02	67,743	7.95
Occupancy Sensors	1	929	0.04	929	0.04
Metal Halide to T5	1	1,462	0.16	153,533	17.08

Compressed Air System Repair and Maintenance Program	1	176,602	0.00	176,602	0.00
Reduced Compressed Air Pressure	1	74,998	4.72	74,998	4.72
Na/Hg Vapor to T8	1	-8	0.00	-391	-0.13
Hg Vapor to T8 and Occupancy Sensors	1	53	0.04	1,066	0.89

Introduction and Purpose of Study

Summary Overview

This section presents a summary of the evaluation of the Non-Residential Energy Assessments Program, the evaluation objectives, and the researchable issues. This evaluation did not have a detailed evaluation plan.

Summary of the Evaluation

This report presents the results of a process and impact evaluation of the Ohio Non-Residential Energy Assessments Program (EAP).

Evaluation Objectives

The purpose of this evaluation is to provide feedback that can help the program provider consider changes to the program that can help achieve improvement in cost effective operations, help understand program impacts and obtain an understanding of customer related conditions and satisfaction.

Researchable Issues

In addition to the objectives noted above, there were a number of researchable issues for this evaluation. These were:

1. To determine which recommendations were implemented by the participant
2. The installation rate of recommendations that were low-cost/no-cost recommendations
3. The installation rate of recommendations that were incented through Duke Energy's Smart $aver Prescriptive (or Custom) Program.

Description of Program

The Energy Assessment Program provides informational and educational support and resources to non-residential customers to help identify energy savings opportunities. The program is marketed through phone and face-to-face contact with customers by Duke Energy representatives, the Duke-Energy.com web content and Duke Energy's Business Services Newsline.

The program is offered as an energy resource program marketing and participant attraction tool. Its primary purpose is to provide customers with energy efficiency recommendations that will convince them to enroll in Duke Energy's prescriptive or custom program offerings. The program is also a customer satisfaction support tool, designed to build the relationship between the customer and Duke Energy in a way that additional energy savings are acquired via the Duke Energy offerings as a result of a service that focuses on providing customers tailored information about efficiency opportunities for their facility.

The Ohio Non-Residential Energy Assessment Program is a well-designed program that is structured within the Duke Energy non-residential program portfolio. The performance of the program seems to be consistent with the objectives of the program in that participants are taking the recommended actions via participation in other programs and are very satisfied with the program and its services.

The program is not designed to focus on acquiring direct savings, thus its performance can only be measured in terms of how it affects the portfolio's ability to attract participants and acquire savings via other Duke Energy programs compared with the cost to operate the program as a marketing tool. As a result, the savings in this evaluation that are presented in two categories:

1. The savings that are part of the programmatic savings from Duke Energy's other non-residential programs are presented in this report but not counted as savings attributable to EAP.
2. The savings achieved as a result of participating in this program but not through participation in other Duke Energy programs are presented here and attributed to the Non-Residential Energy Assessments Program.

Program Participation

Program	Participation Count for 2010
Non-Residential Energy Assessments	20

Methodology

Overview of the Evaluation Approach

This evaluation was performed without an evaluation plan.

Study Methodology: Process

This section presents the methodologies used in both the process and impact evaluations for the Non-Residential Energy Assessments Program.

The evaluation was comprised of in-depth interviews with two program managers. These in-depth interviews provided a detailed investigation into program operations, goals, and suggestions for improvements and changes.

This study also implemented a participant survey with facility managers to identify the types of actions that are being taken as a result of the assessment provided through the program. The survey also included a limited number of satisfaction and program operations questions to help Duke Energy determine if the program is being implemented effectively from the perspective of the participants. This study focuses on participants from January to June of 2009. At the time of the evaluation, a total of 20 Ohio participants had received the assessment and had enough time to implement the recommended actions (at least 6 months). The evaluation focused the data collection efforts on interviewing these participants. A total of 8 participants were interviewed for this evaluation (40%).

There were three objectives to the participant survey:

1. **Process Evaluation Findings** – The in-depth interviews provided a detailed investigation into program operations, goals, and suggestions for improvements and changes.

2. **Review of Implementation Rates** – Those surveyed were asked if their company has installed or implemented each of the recommendations provided in the Energy Assessment Report. In addition, 1 or 2 follow-up questions are asked for each recommendation, depending on the response given.

3. **Review of Program Satisfaction** – We asked the responders about their satisfaction with the program, assessment staff, and the Energy Assessment Report.

The evaluation survey focused on the collection of implementation rates for the recommended measures and behaviors and their levels of satisfaction with the audit, communications, and the recommendations provided. (See Appendix C: Participant Survey Instrument.) The survey also assessed program process issues including the ease of signing up for the assessment, the convenience of scheduling the inspection, the quality and completeness of the inspection, the recommendations provided, knowledge of the auditor, and the assessment report itself. The findings from this evaluation are presented in the following sections of this document.

Study Methodology: Impact

Data were collected via phone interviews with site personnel familiar with the projects. All sites where interviewees indicated they implemented audit recommendations were studied – no sampling was done, so there was no sampling error. The phone survey resulted in eight completes out of a census of all 20 program participants resulting in a 40 percent completion rate. In total, 17 recommendations were taken, three of which were dropped due to insufficient data to complete the calculation. Program impacts were calculated from the remaining 14 measures. For the majority of the measures, calculations and baseline assumptions were taken from Ohio TRM. Methodology sources for non-TRM measures are listed in the "Use of TRM values and explanation if TRM values not used" section on page 12. No savings were assigned to customers that were not contacted or refused to be interviewed.

Data collection methods, sample sizes, and sampling methodology

Process

In-depth interviews with two program managers focusing on program operations, goals, and suggestions for improvements and changes.

Phone survey of program participant facility managers focusing on satisfaction and program operations. The phone survey resulted in eight completes out of a census of all 20 program participants resulting in a 40 percent completion rate.

Impact

Data were collected via phone interviews with site personnel familiar with the projects. Initial phone interviews identified sites where audit recommendations were implemented. Follow-up phone interviews were used to obtain project details. All sites where interviewees indicated they implemented audit recommendations were studied – no sampling was done.

Number of completes and sample disposition for each data collection effort

Process

The phone survey resulted in eight completes out of a census of all 20 program participants resulting in a 40 percent completion rate. All participants were contacted a maximum of five times or until the contact resulted in a completed survey or refusal to participate.

Impact

All sites were studied. Three of 17 measures were dropped due to insufficient information from the customer to complete the calculations.

Expected and achieved precision

All sites studied. No sampling error.

Description of baseline assumptions, methods and data sources

Baseline assumptions were taken from Ohio TRM for the majority of the measures. Baseline data sources for non-TRM measures are listed below:

1. High pressure sodium fixture wattage - CA SPC lighting table for fixture watts.
2. Mercury vapor fixture wattage - CA SPC lighting table for fixture watts.
3. Boiler stack economizer – Add-in measure. Baseline is boiler without economizer
4. Compressed air leak check/maintenance program – *Improving Compressed Air System Performance* from the DOE Compressed Air Challenge[1]
5. LED wattage – LED equivalency table from CA workpapers.

Description of measures and selection of methods by measure(s) or market(s)

The measures and TRM applicability are shown below. All customers are in the C&I market.

Customer	Measures	TRM
Customer 1	Lighting: Metal Halide to HO T8	yes
	Lighting: Metal Halide to T5 and Occupancy Sensors	yes
Customer 2	Lighting: Incandescent to CFL	yes
	Lighting: Halogen to LED	no
Customer 3	Lighting: Incandescent to CFL	yes
	Lighting: T12 to T8	yes
	Lighting: Occupancy Sensors	yes
Customer 4	Lighting: Metal Halide to T5	yes
	Compressed Air System Repair and Maintenance Program	no
Customer 5	Reduced Compressed Air Pressure	no
Customer 6	Lighting: T12 to T8	yes
	Lighting: Na/Hg Vapor to T8	no
	Lighting: Hg Vapor to T8 and Occupancy Sensors	no
	Economizer	no

Use of TRM values and explanation if TRM values not used

TRM used as applicable. Methodology source for non-TRM measures listed below:

Measures	
Lighting: Halogen to LED	Standard lighting calculations with baseline fixture watts defined above

[1] *Improving Compressed Air System Performance: A Sourcebook for Industry.* Prepared for the US Department of Energy by Lawrence Berkeley Laboratory and Resource Dyanmics.

Compressed Air System Repair and Maintenance Program	Calculation method specified in *Improving Compressed Air System Performance.*
Reduced Compressed Air Pressure	Calculation method specified in *Improving Compressed Air System Performance.*
Lighting: Na/Hg Vapor to T8	Standard lighting calculations with baseline fixture watts defined above
Lighting: Hg Vapor to T8 and Occupancy Sensors	Standard lighting calculations with baseline fixture watts defined above. TRM equation adapted to include combination of fixture upgrades and occupancy sensors
Boiler Economizer	Standard boiler consumption equation, with process hours defined by customer. Energy savings factors from MI workpapers.

Threats to validity, sources of bias and how those were addressed

Process

Results from the participant survey portion of this report should be viewed with the understanding that EAP's participant response rate of 40% indicates that the results are reliable within the program population. However, the fact that the participant population is so low (20) means these results may not reflect the overall market population.

The participant responses are self-reports and therefore may be affected by self-selection bias, false response bias or positive result bias. However, since the energy savings impacts from EAP are captured in other programs, bias adjustments were neither calculated nor applied in the presentation of survey data.

Impact

Census of participants attempted. Some customers refused to participate or did not respond. Some non-response bias likely, but no savings were assigned to customers that were not contacted or refused to be interviewed. Some measures were not calculated due to insufficient data, which will also bias the results downward. Engineering biases may exist, but TRM followed where possible. Sources of engineering methods and secondary data sources listed.

Evaluation Findings

Process Evaluation

Introduction

The Energy Assessment Program (EAP) has two objectives. First, it is designed to assist Commercial and Industrial customers in identifying energy efficiency projects for their facilities that would qualify for Duke Energy's Non-Residential Smart $aver® Program. The EAP is marketed through Duke Energy's Account Managers. Duke Energy shares the cost of the facility assessment with the customer. At the time of these interviews, the facility assessment cost $3,000 for a one day assessment and $600 for each additional day. If the customer chooses to undertake a Smart $aver® project after receiving the assessment report, Duke Energy then reimburses the customer's half of the assessment costs. Second, the EAP is provided as a customer service, to help build relationships between the customer and Duke Energy Account Managers.

Background

The current program was launched when the Non-Residential Smart $aver® program was started, and in the fall of 2010 changed its management structure, moving from one program manager to two: one dedicated to the Midwest including Ohio and one dedicated to the Carolinas. Both program managers work closely together so that the program offering is identical in both regions, and the internal control procedures and administrative help is provided by the same people for both regions. Both program managers were interviewed as a part of this process evaluation.

Relationship Building

Although the EAP is explained on Duke Energy's website, it is hard to find using typical subject search engines and the presentation of services and enrollment processes is difficult to navigate. This restricts program information availability and enrollment into the program. However, the EAP is mostly marketed through Duke Energy's large customer Account Managers. The Account Managers discuss with the customer their plans and help review how customers are managing their energy usage. If customers need help, they are told about the Energy Assessment Program and offered an energy assessment of their facility.

The program manager reports that the Account Managers see the EAP more as a relationship-building tool rather than a lead generation program that may eventually bring Duke Energy revenue through the Smart $aver® program. Program managers and business relationship managers have found the EAP to be very successful at building relationships with customers. However, that relationship objective sometimes overshadows the objective of increasing Smart $aver® participation and capturing the available savings. The Duke Energy program manager reports that Account Managers sometimes will offer the EAP on-site assessments as a "freebie", without qualifying the customer to see whether they may be good candidates for the Smart $aver® program. The other program manager agrees, saying that it is not clear that the Account Managers are identifying proper customers or effectively marketing the program to a wider group of customers who may want this service.

Assessments

Duke Energy's non-residential customers can participate in the Energy Assessment Program in three ways: Customers can look for the assessment tool on Duke Energy's website at any time, and this online assessment is available to customers of all sizes. For larger customers (> 500kW), Duke Energy also offers an off-site phone-based assessment, and an on-site assessment. Duke Energy provides the online and off-site phone assessments at no cost to the customers. The on-site assessments are more expensive, and cost $3,000 for a one-day assessment, and $600 for each additional day. Duke Energy will pay half the cost of the on-site assessment if the customer has paid into the energy efficiency rider. All customers who want to participate in the on-site assessment must first participate in the off-site phone assessment.

During the off-site assessment, the customer is asked to provide information about their facilities. Duke Energy retrieves their facility's historical usage and rate comparison, and provides this information to an assessor. The assessors are contractors with different areas of expertise, and are assigned based upon the facility's characteristics. The assessor contacts the customer and provides an off-site report.

Assessors

There are three outside companies who conduct the assessments: Advanced Energy, Petra Engineering, and ThermalTech. Both Duke Energy program managers agree that these firms are doing a good job for Duke Energy and for their customers. One program manager reports, "*Most of my interactions have been with ThermalTech; I think they are doing an outstanding job. We had a meeting with a client and he was thrilled with the report.*"

Reports and Recommendations

The assessment reports are generated a couple of weeks after the assessments, but can take "a little" longer if the customer requests that the reports' findings and recommendations be delivered in person. Reports focus on energy efficiency measures, but one of the Duke Energy program managers suggests it should also include referrals to other Duke Energy programs such as PowerShare®, or include suggestions for on-site generation. The assessment reports do sometimes include water savings recommendations. The lack of a strong referral component within the program service and materials does not take advantage of the exposure to the customer that has already been captured by the program.

In 2010, the EAP provided five customers with on site assessments of their facilities.

Quality Control

The Energy Assessment Program does not generate revenue for Duke Energy so management of the program consists of managing expenses and managing the assessment contractors. Program managers also try to review the assessment reports to maintain quality control whenever they can, but they rely upon a different independent contractor to review the report and offer a second opinion on the recommendations. The program manager reports that the independent reviewer has generally been in agreement with the assessor's recommendations; occasionally the reviewer will ask whether the assessor has considered a particular recommendation, and the assessor would then explain why they made their particular decision.

Past Evaluation Recommendations

An early feedback mini process evaluation of Ohio's EAP was conducted early in 2010. Due to the program management change and the fact that the feedback report identified areas of improvement so recently, we do not expect that the recommendations could have been fully implemented. Because the Ohio program was identical to the Carolinas EAP, we will address those recommendations here as well.

Tracking: the Early Feedback study found that Duke Energy was in the midst of improving their customer tracking system for the then-new Energy Assessment Program. At the time of the interviews for this process evaluation, Duke Energy is using Salesforce.com to provide their customer relationship management (CRM) software. This CRM system is only available to Duke Energy employees, and allows the program managers to track a comprehensive set of customer data including: customer name, facility name, account name, location of facility, account owner, Account Manager, type of assessment requested, the assigned assessor, the status of the assessment, the dates of key events such as the date of the assessment and date of the report, and the status of the Account Manager follow up. The Duke Energy program manager reported that there are currently plans to integrate the assessment report's recommendations into "*opportunity records*" for each customer, to better track recommendations.

Low-cost and no-cost recommendations and actions with two-year paybacks: The Early Feedback report recommended that the EAP's reports include low-cost and no-cost recommendations, and actions that have a payback period of less than two years. At the time of this interview, the program management reports that the assessment reports do include these recommendations whenever they exist. One program manager reports that one of the assessors sort their recommendations by payback, according to a "proprietary algorithm".

Another program manager reiterates the concern pointed out in the Early Feedback report that the low-cost no-cost measures generally cannot be claimed by Duke Energy: "*There's a discontinuity of goals there between Duke Energy's investments to achieve impacts and the low-cost no-cost recommendations... if Duke Energy is helping customers uncover and realize [more energy savings], there should be a recovery mechanism for the low-cost no-cost measures.*"

There are no plans at this point to develop recovery mechanisms for these measures. This needs to be addressed, while the regulatory authorities in the Duke Energy states typically do not like to allow credit for recommendations that have less than a one-year payback. The Commissions have not to our knowledge excluded low-cost or no-cost measures from being credited to Duke Energy when the payback is greater than one year. As a result, Duke Energy is not now receiving credit for the energy savings generated via the no-cost or low cost recommendations. These should be incorporated into the program as a formal part of the program and savings estimates for these changes should be credited.

One program manager reports that they are finding that manufacturers have already implemented the low-cost and no-cost measures "*because they have been squeezed for so long*", while they report that the commercial building customers have just started to think about these types of measures. Duke Energy has also identified hospitals as a sector that has yet to implement low-cost and no-cost measures. The program manager reports that while they had not been tracking

the types of low-cost and no-cost recommendations, the current effort to review and document the assessment report recommendations should provide useful data on the number and types of low-cost no-cost recommendations that have been made and adopted when they have been included into the report and when follow-up tracking efforts have been completed.

Other recommendations made in the Early Feedback report were still being considered by Duke Energy at the time of the interviews, including the recommendation for Duke Energy to provide a package incentive that motivates customers to push for deeper savings for completing a group of actions.

Program Challenges

One of the program managers said "*Ultimately we want customers to take advantage of the Smart $aver® incentives, once they realize what advantages there are. We're not yet successful in linking the two.*" The other program manager concurs, "*We can have some improvement in the frequency with which we convert assessments to energy projects, and we have some momentum in that.*"

One program manager believes that a coordinated approach between the Account Managers, the vendors, and the EAP is key to getting more EAP participants converted to Smart $aver® participants. When asked, this program manager acknowledged that following up on the assessment reports is very important, but that Duke Energy was still gathering data on whether customers were being followed up consistently by the Account Managers.

To Be Improved

Demonstrating Program Value

Both program managers are interested in a better understanding of whether the customer perceives value in the existing program. One program manager reports that Account Managers have indicated that customers desire more details, but it is not clear what kind of details are desired. The program manager is currently exploring this, "*We're stepping in to it, working with a client to identify the specific need.*"

Both program managers also agree that their objective is to be able to demonstrate that the program is profitable for Duke Energy as well as the customer.

The program managers believe that the EAP has significant value as a relationship-building service for large nonresidential customers. They report that while they do not yet have quantitative metric of the EAP's effectiveness, the fact that customers keep requesting energy assessments in the absence of a significant marketing effort is an indicator of its value. "Customers will often request an onsite assessment, saying '*I understand the costs and am willing to pay*'".

Tracking Recommendation Adoptions and Program Overlap

Duke Energy analyzed program records to determine whether the EAP recommendations were adopted by the participants. It is easier to track adoption if customers participate in the Non-

Residential Smart $aver® Custom program because there are fewer participants and applications must be preapproved by Duke Energy. In contrast, the Non-Residential Smart $aver® Prescriptive program participants are more numerous and do not need to obtain project preapproval from Duke Energy. In order to track adoption, Duke Energy compiled all the 2010 EAP reports and determined whether there was a correlation between the EAP recommendations and the customers' installations, as measured by the Non-Residential Smart $aver® Prescriptive rebates that were given. One such correlation was found; see Customer Four in the Engineering-Based Impact Analysis section on page 32.
The program management recognizes that customer adoption of recommendations is one of the best metrics of whether the EAP provides a useful service or not, along with the value of the savings achieved.

Duke Energy is also conducting pilot tests of a "*white glove*" assessment program that offers a $30,000 in-depth assessment and provides additional services such as obtaining contractor quotes for the customer, providing calculations to prove that the financial case is sound, and filling out applications. Only a few qualified customers have been offered this pilot program but the program managers report that the preliminary response has been good. "*It's a test case but it's working very well.*" This pilot program is still in the development stages.

Program Successes

The program managers agree that the program works smoothly and cite the program's smooth and successful operations as one of the program successes. One program manager reports, "*I have a lot of good interactions with our vendor, and the account reps are very involved... I think it's a coordinated effort to stay in front of the customer.*"

Results from Participant Interviews

The following parts of this evaluation present the results of the interviews with 8 participants.

Implementation Rates

In general, TecMarket Works found no significant differences in implementation or satisfaction rates between those participants who received on-site evaluations and those who did not. TecMarket Works completed eight interviews from the 20 facilities that participated in the Energy Assessment Program in Ohio. These eight facilities were provided with a total of 47 program-generated recommendations. Figure 1 presents the status of the recommendations provided for these 8 facilities.

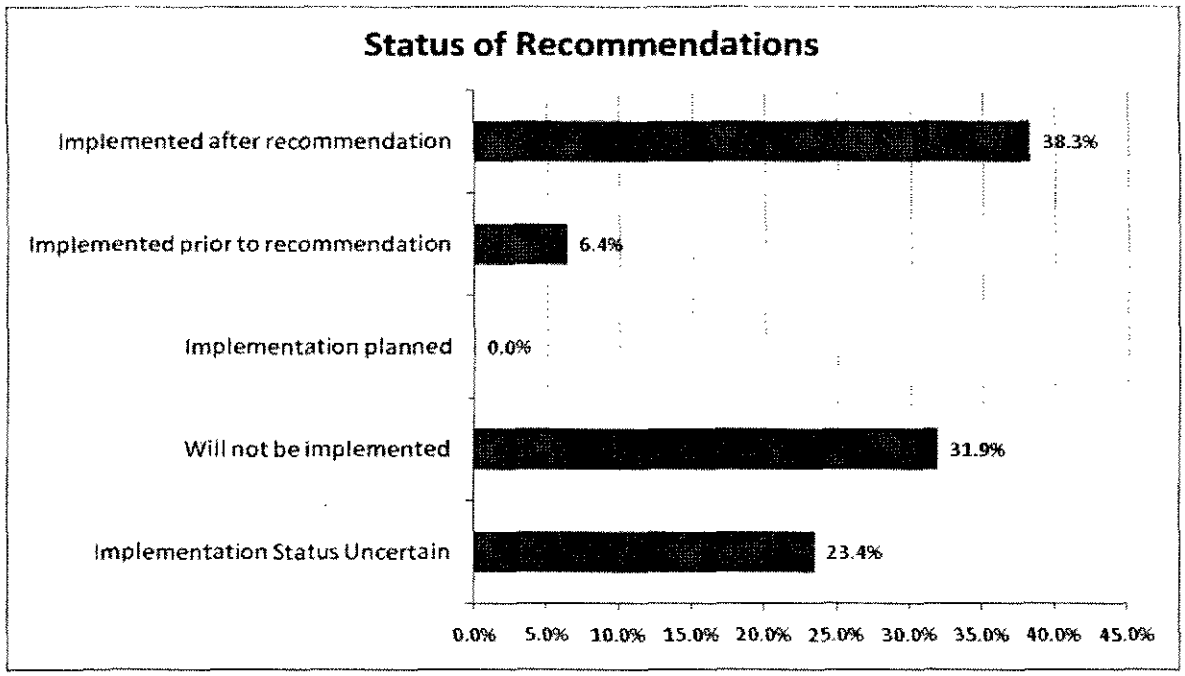

Figure 1. Status of Recommendations

The overall implementation rate for recommended measures is 38.3%, with 18 out of 47 recommendations implemented.

Recommendations That Will Not Be Installed and Why

There were 15 recommendations (31.9%) that will not be implemented that were provided to the eight facility representatives interviewed. These recommendations are provided in the table below. In three cases, the respondent declined to give a reason. The reasons for not installing the measure or making the improvements were subjectively divided into three summary categories: *Technical, Economic, or Other*. Eight (53.3%) of the reasons are categorized as Economic reasons for non-implementation, and three (20%) were classified as "Other" reasons. None of the reasons for certain non-implementation were classified as "Technical."

Table 3. Reasons Recommendations Will Not Be Installed

Recommendation	Reason for Not Implementing, If Provided	Economic, Technical, or Other
Utilize high efficiency heat pumps	Building is fairly new. Heat pumps are already high efficiency	Other
Investigate production activity during 2nd shift ramp-up	Conflicts with production needs	Economic
Centralized Energy Management for Lighting	Not provided	
Computer energy management	Switched from desktop computers to tablets. Employees take them home.	Other
HVAC Optimization	Cost. Payback greater than 3 years.	Economic
Compressed air system optimization	Facility is production driven, improvements are not a priority.	Economic
High efficiency motors (replace <30HP)	Cost	Economic
Put hot water circulation pump on a timer	Eliminated large hot water tank.	Other
HVAC economizer and control strategy	Cost	Economic
High Efficiency Motors for elevators	Not cost effective.	Economic
Energy Management System (EMS)	Too costly.	Economic
Chiller Tower VFD (variable frequency drive)	Too costly.	Economic
Demand Control practices	Not provided.	
Solar Panels for Hot Water	Not provided.	
Energy Management System (EMS)	Not provided.	

We asked if there was anything the program or Duke Energy could do to help the participant decide to take the program-provided recommendations. All of the responses were variations of "no," indicating that the participants could not provide indications for what the program could do to overcome resistance to implementing the recommended energy efficient action.

Recommendations That Are Under Consideration and Why

There were 11 recommendations categorized as "installation uncertain" by the respondents, indicating that they were not sure if they would take the action. These recommendations are provided in the table below. The reasons provided were likewise subjectively divided into three summary categories: *Technical, Economic, or Other.*

Table 4. Recommendations under Consideration

Recommendation	Reason for Not Implementing, If Provided	Economic, Technical, or Other
Utilize energy Management System	Not provided.	
Use 28 watt T8 lamps instead of 32W T8's	May replace with 28w as 32w burn out	Other
Utilize Energy Profiler Online (EPO)	Would like more information about EPO	Technical
Destratification fans	ROI not sufficient	Economic
Heat Recovery / Process Heat evaluation	Disrupted process during trial. Put on back burner	Technical
Lighting Occupancy sensors	Not provided	
Elevator high efficiency Motors	Not provided	
Glycol coolers	ROI not sufficient	Economic

Obtain Energy Star Certification	Not provided	
Daylighting	Overlooked, will reconsider	Other
Replace metal halide lamps with lower wattage	Not provided	

Again, we asked if there was anything the program or Duke Energy could do to help the participant decide to take appropriate recommendations. The responses for this group were identical to the responses for the recommendations that will not be installed. They all responded by indicating that they could not think of what the program could do to cause them to implement the recommendations. Essentially, customers consider the matter in their hands once the recommendation has been received.

Figure 2 summarizes the reasons for not implementing the recommendation or for the uncertainty over implementing the recommendation. The reasons are based in corporate economic conditions in almost half of the cases, and were least likely to be linked to technical barriers. Half of the reasons for not implementing a measure fall into the "Other" category. These primarily include lack of time to take the action or lack of a perceived need to make the change, even if there are savings.

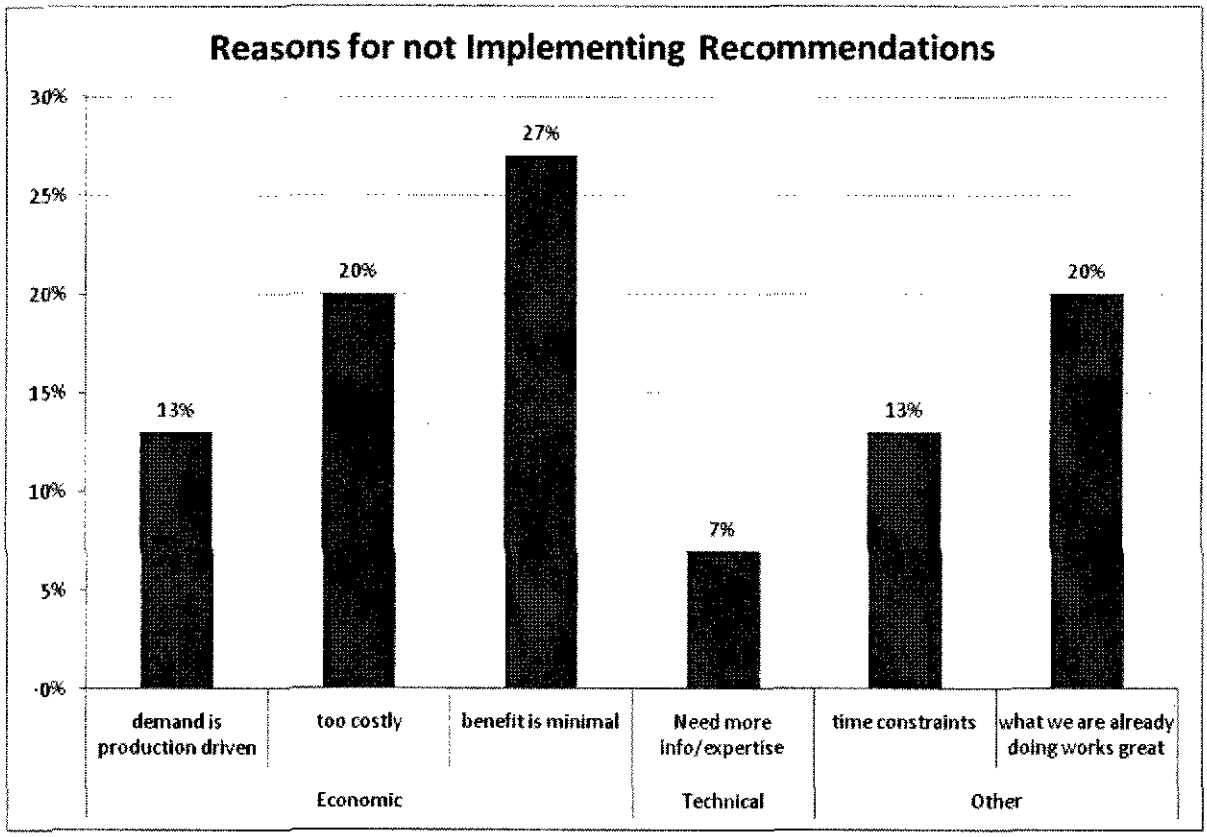

Figure 2. Reasons for Not Implementing Recommendations: recommendations that will not be done and recommendations that are under consideration

Timing of Actions

For each recommended action taken, we asked the responder how many months had passed between the time they received the report and the time when the action was taken. Seventeen of the 18 respondents were able to answer this question. The question was open-ended, allowing the respondent to provide an answer specific to their conditions. These respondents provided answers that grouped into five distinct periods of time: one month or less, six months, ten months, 12 months and 18 months. The percentage of each response is provided below in Figure 3.

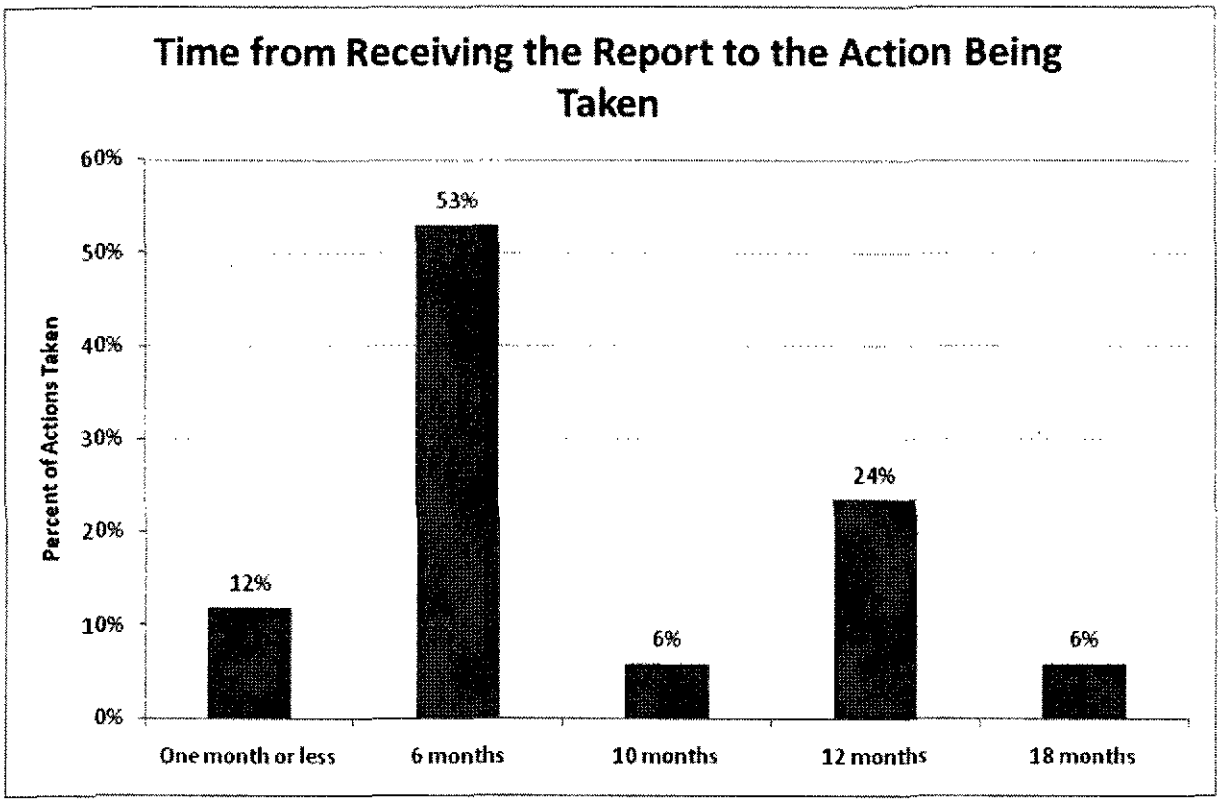

Figure 3. Months from Receiving the Report to the Action Being Taken

Figure 3 shows that 12% of the installed recommendations are installed almost immediately and that 65% are installed within six months of the facilities receiving the report. However, 30% of these participants required a year or more to implement the recommendations with another 6% requiring almost a year (10 months).

Table 5 below shows each recommendation taken and the number of months between the participant receiving the report recommendations and implementation of those actions.

Table 5. Individual Recommendations Implemented

	Measure	Months
1	T12 to T8 lighting retrofit	18
2	Lighting Occupancy sensors	12

3	Improve building envelope	12
4	Occupancy sensors and metal halide to T5 conversion	12
5	Incandescent to CFLs conversion	12
6	Demand control strategy	10
7	Motion sensors for vending machines	6
8	Incandescent to CFL conversion	6
9	Lighting Conversion	6
10	Compressed air system maintenance program	6
11	Compressed air, electric distribution, and space conditioning systems	6
12	Power factor correction	6
13	Lighting Conversion	6
14	Natural gas usage reduction study / boiler optimization	6
15	Compressed air system repair and maintenance program	5
16	Lighting conversion	1
17	Reduce compressed air pressure	1
18	Install programmable thermostats	NA

Program Satisfaction

Respondents were asked to rate various aspects of the program on a scale of one to ten, with one meaning they were very dissatisfied and ten meaning they were very satisfied. If a respondent provided a satisfaction score of seven or lower, they were asked how that aspect of the program could be improved.

The average satisfaction response across the eight respondents is presented in Table 6. The ability to answer each satisfaction question varied from participant to participant, therefore the sample size for each question varied from n=4 to n=8.

Table 6. Participant Satisfaction

Criteria	Satisfaction Rating	Range	N	Percent of ratings greater than 7
Responsiveness of Duke Energy staff	9.4	8-10	5	100%
Length of time to receive assessment report	9.3	8-10	6	100%
Report meets expectations	9.2	7-10	6	83%
Knowledge of energy specialists	9.0	8-10	7	100%
Ease of requesting assessment	8.9		7	86%
Review and discussion of the recommendations	8.9	7-10	7	71%
Comprehensiveness and completeness of assessment report	8.9	7-10	7	86%
Quality of inspection	8.7	7-10	6	67%
Completeness of inspection	8.5	7-10	4	50%
Clarity and ease of understanding assessment report	8.3	6-10	7	71%
Convenience of scheduling inspection	7.6	5-10	5	60%
Practicality of the recommendations provided	7.0	2-10	8	50%

Overall satisfaction with the assessment and report was high with scores higher than eight on all but two aspects of the program. The program's lowest marks come from the "Practicality of

Recommendations" and "Convenience of scheduling inspection" categories. One survey respondent who gave the inspection scheduling a rating of 7 stated that the inspection was "hard to arrange" and another respondent who gave the inspection scheduling a rating of 5 stated that the inspection "took a while to get scheduled."

While overall the ratings are high, the following are all the reasons given for lower ratings in the "Practicality/usefulness of Recommendations" category:

- "Many are not very practical"
- "Our building is new and we have already switched to CFLs."
- "Demand control practices are impractical for us."
- "We would like more return-on-investment information about the recommendations."

It should also be noted that while respondents gave practicality the lowest satisfaction marks of the categories, all respondents indicated that they had implemented at least one of the recommendations regardless of their rating of overall practicality. That is, each respondent found at least one program recommendation to be practical enough to implement.

Perception of Realized Savings

Participants who indicated that they had installed a recommended measure were then asked follow-up questions regarding whether they felt they were achieving the savings estimated in the report. Participants were then asked to provide an estimate of the cost of implementation and whether that cost was more or less than they had expected.

Five respondents answered the question for 10 of the installed measures. For seven of the measures, survey participants responded with a "yes" they had achieved the estimated savings and one responded with a "probably". Two respondents also stated that they were "unsure" about the savings of two of the measures installed.

Participants were also asked if the cost to implement the recommended measures was more, less, or in line with their expectations. Four surveyed respondents indicated that the cost for seven measures was in line with their expectations.

One respondent also indicated that four of the installed measures cost less than expected, and two other respondents indicated that their installation costs for four measures was in line with their expectations. No respondents stated that costs were more than expected. The measures with cost and saving expectations are listed in Table 7 below. The high level of met expectations suggests that participants are receiving accurate information from the assessment regarding implementation costs and savings estimates in several categories (lighting, building envelope, compressed air system maintenance).

Table 7. Measure Costs and Savings Compared to Expectations

Measure	Cost	Achieved Estimated Savings?
Motion sensors for vending machines	As expected	Yes
Lighting Occupancy sensors	Less than expected	Yes

T12 to T8 lighting retrofit	Less than expected	Yes
Improve building envelope	Less than expected	Yes
Occupancy sensors and metal halide to T5 conversion	As expected	"Probably"
Compressed air system repair and maintenance program	As expected	Yes
Lighting conversion	As expected	Yes
Incandescents to CFL conversion	Less than expected	Yes
Demand control strategy	NA	Unsure
Convert incandescents to CFLs	NA	Unsure
Lighting Conversion	NA	NA
Compressed air system maintenance program	NA	NA
Power factor correction	NA	NA
Lighting Conversion	NA	NA
Natural gas usage reduction study / boiler optimization	NA	NA
Reduce compressed air pressure	NA	NA
Install programmable thermostats	NA	NA

Additional Comments about the Program

The concluding questions had participants identify attributes of the program that they did and did not like. The most frequently mentioned positive was that the information and recommendations that the program provided. The most frequently mentioned negative aspects were a difficulty with scheduling the on-site assessment and the impracticality of some of the recommendations. Lastly, participants were asked if they could change one thing about the program, to identify what change they would make. Two respondents would like to see more time and energy spent during the on-site assessment, and one respondent would like to see scheduling for the visit improve. The responses can be seen in the lists below.

What Participants Liked Most About the Program

- "Assurance that staff was doing a good job."
- "Overall ease of participating."
- "The report confirmed actions that we were already taking, and added information and insight."
- "It was free. Some of the recommendations were useful and saved money."
- "Technical verification of energy saving measures."

What Participants Liked Least about the Program

- "Many recommendations were not practical."
- "Inconvenience of setting up the inspection."
- "Took awhile to get everybody scheduled."
- "Would have liked more info to understand how to apply recommendations to very large old facility."

What Participants Would Like To See Changed

- "More hands-on on-site inspection."

- "Easier scheduling."
- "More on-site time, more details of motor management."

Effect of Current Economy on Energy Efficient Actions

Survey participants were asked if their company was more or less likely to investigate and implement energy saving measures given the current state of the economy. Two of four total respondents to this question indicated that their company would spend more investigating energy efficient measures if the economy improved. One respondent indicated his or her company would spend the same amount and one respondent was unsure of company spending. No respondents indicated that their company would spend less.

Participant Program Referrals

Finally, participants were asked if they had referred the Non-Residential Energy Assessment program to other companies. Out of the four total respondents to this question, two indicated that they had recommended the program to others and two indicated that they had not. One respondent indicated that he had referred the program to 5 to 10 business owners and building operators, and one respondent indicated he had recommended the program to other facilities within his own company.

Market Analysis

Because all savings acquired through EAP are captured in other programs, there was no net to gross analysis conducted in this report. EAP is not designed to focus on acquiring direct savings, and its performance can only be measured in terms of how it affects the portfolio's ability to attract participants and acquire savings via other Duke Energy programs compared with the cost to operate the program as a marketing tool.

Participants were asked if the current state of the economy affected their likelihood to investigate and implement energy saving measures. Two participants (25%) indicated that an improvement in the economy would positively affect their allocation of capital to energy saving improvements. One participant indicated that the state of the economy would have no effect on energy saving activities. One participant was unsure of the economy's impact, and four participants declined to answer the question.

Conclusions and Recommendations for Program Changes

Program Operations: Recommendations

1. RECOMMENDATION: The Non-Residential Energy Assessments Program (EAP) should work with the Account Managers to develop clear criteria for identifying prospective participants for the Smart $aver® program based upon segmentation of past Smart $aver® participants. An analysis of what projects and measures were of interest to past Smart $aver® participants in each industry sector would allow Account Managers to make suggestions of similar projects to prospective participants in the same sector. This would allow the budget for the EAP to be directed to those customers who are more likely to take action.
2. RECOMMENDATION: Track the conversion rate (i.e. percentage of EAP participants who adopt EAP recommendations through subsequent Smart $aver® projects) and identify those Account Managers who are more successful at actively converting EAP participants into Smart Saver® participants. These Account Managers may have developed successful strategies that could be shared with other Account Managers to help them increase Duke Energy's overall conversion rates from EAP to Smart $aver®.
3. RECOMMENDATION: Duke Energy or their evaluation contractors should survey customers who receive both phone and on-site assessments to determine how much additional perceived value is provided by the on-site assessment, and where this additional value comes from. This would allow Duke Energy to identify customer's needs and wants from the on-site assessment report. Duke Energy or their evaluation contractors should also compare the relative cost effectiveness of the phone assessment compared with the on-line web assessment. If the on-line assessment is not perceived as valuable and does not drive customers to participation, Duke Energy should consider discontinuing the web-based assessment (but still offer online input of assessment data for a telephone assessment). However, care should be taken in this effort as different customers may want different services, and each of these delivery approaches may define a market sub-segment that may or may not participate in the program if their assessment choices are limited compared to their expectations. The study should also examine the relative success of each approach in driving customers to participate in other Duke Energy programs, as well as identifying additional benefits to the customer not captured by the other programs (low-cost no-cost savings, customer loyalty, satisfaction, etc.)
4. RECOMMENDATION: Conduct a service needs survey to determine what customers expect from assessment reports in terms of short term versus long term recommendations and in terms of electric-only versus more comprehensive sustainability recommendations. While the primary objective is to help customers identify projects that can be implemented under the Smart $aver® program, the overall credibility of energy efficiency-related recommendations may be enhanced by including recommendations that present a more comprehensive approach to reducing operating costs. Depending upon the survey results, Duke Energy may also elect to begin offering a "zero net energy with existing buildings" or other high savings assessments (not just cost effective for Duke

Energy) for those customers who are motivated to achieve deep energy savings. This would help maintain Duke Energy's standing as the customers' primary partner in meeting all their energy needs, including sustainable energy.

5. RECOMMENDATION: Assess if it is possible to develop set of segment-specific recommendations that are targeted to the specific needs of different market segments to the degree that the segments can be used to target high-priority customers more likely to take segment-specific actions. If there are identifiable segment-specific actions that are specific to a segment, this can allow Duke Energy to show customers that their needs are understood, and that the assessment report's recommendations are customized especially for them. Duke Energy can begin to develop these targeted recommendations by first asking Account Managers to identify a few key market sectors that they believe has the greatest untapped potential for energy savings. Duke Energy can survey the Smart $aver® participants and non-participants within those sectors to determine their needs, wants, barriers to participation, and how well the Smart $aver® program addresses those. If Duke Energy has not already done so, we recommend that Duke Energy also conduct market characterization studies for those sectors to see what the mid- to long-term trends are for that market, and also to aid in their conversations with the customers about the projects with longer paybacks. Information from the surveys and any market characterization studies can also be used to build case studies that will help other customers understand the process and benefits of participating in Smart $aver®.
6. RECOMMENDATION: Duke Energy should conduct some contingency analyses of the recommendations adoption data to determine whether adopting low-cost no-cost recommendations affect the adoption of Smart $aver®-eligible measures. In a parallel study, Duke Energy should investigate whether there are any corollary benefits to including low-cost no-cost recommendations. For example, excluding low-cost no-cost recommendations may inadvertently emphasize the greater expense of the Smart $aver®-eligible measures, and thus increase the perceived first-cost barriers to becoming more energy efficient.
7. RECOMMENDATION: EAP should use the program's follow up activities to obtain immediate feedback on the usefulness of the assessment reports. This may allow a better leveraging of resources. Additionally, if Account Managers are conducting the follow up feedback, the program's Smart $aver® objectives and services can be kept at the forefront of customer interactions.
8. RECOMMENDATION: Develop the program website so that it is easy to find on the web, has a clear presentation of the services offered and the service approach, and an easy to use web-based enrollment process.
9. RECOMMENDATION: Design the assessment to formally provide low-cost and no-cost recommendations to customers and incorporate estimates of the impact of these actions, when implemented into the tally of energy saved credited to Duke Energy (and other utilities) as a result of the program. The low-cost and no-cost savings may not be eligible for cost recovery, but it is important to document the full value of the EAP, whether officially credited or not. This will allow Duke Energy to make decisions with a more comprehensive knowledge of how each energy efficiency program interacts with the other programs in Duke Energy's energy efficiency portfolio.

Implementation Rates: Key Findings

4. **Many Recommendations are Accepted and Used:** Eight participants, four receiving off-site assessments and four receiving an on-site assessment, were provided with a total of 47 recommendations:
   - The overall implementation rate for all recommended measures was 38%.
   - 32% of the recommendations were rejected by the customer and will not be implemented.

   (See "Implementation Rates" on Page 19)

5. **Participants Take Action Rapidly:** Of the recommendations that were implemented prior to the evaluation contact, 65% were completed within six months of receiving the report. 12% were completed immediately upon receipt of the recommendation or within the next 30 days. (See "Timing of Actions" on Page 22)

6. **Economy and Corporate Conditions Slow Measure Installations:** Corporate economic conditions and the firm's current financial status together represent the most common reasons provided for a recommended measure not being implemented. These two reasons are similar in that they deal with the firm's financial condition within the economies in which they operate. As a result, measures with long payback periods and/or excessive upfront capital costs become the measures cited most often as those that cannot be implemented. (See "Effect of Current Economy on Energy Efficient Actions" on Page 26)

Program Satisfaction: Key Findings

3. **Satisfaction Scores are High:** Participants gave high satisfaction scores for three program aspects: "Responsiveness of Duke Energy staff," "Length of time to receive assessment report" and "Report meets expectations," received satisfaction ratings of 9.2 or higher on a ten point scale. Overall satisfaction within nine other categories was also scored well with average scores higher than eight on a ten-point scale. (See "Program Satisfaction" on Page 23)

4. **Scheduling and practicality of report are concerns:** Two participants noted that they found it difficult to schedule their assessment and gave scores that lowered the "Ease of Scheduling" rating below an eight. Four of eight participants rated the overall practicality of the report at less than eight. However, all participants did implement at least one report recommendation.

Engineering-Based Impact Analysis

There were a total of 20 customers in Ohio that received an energy assessment. Attempts were made to contact all customers for a follow-up phone interview. Eight were able to be contacted, but only six of the 20 verified that they implemented energy saving recommendations from their Non-Residential Energy Assessment report. The energy saving measures taken by these six customers as a result of the program provide gross annual savings of 818,736 kWh, 209,649 MMBtu, and reduce peak load by 58.7 kW. A breakdown of the savings by customer can be seen in Table 8.

Table 8: Program Savings Estimate Breakdown by Customer

Customer	kWh	kW	MMBtu
Customer One	227,358	21.5	-632
Customer Two	101,740	4.7	-285
Customer Three	57,213	7.5	-160
Customer Four*	297,849	17.1	-430
Customer Five	74,998	4.7	0
Customer Six	27,293	3.3	211,156
TOTAL	786,451	58.7	209,649

* Customer Four implemented a compressed air system repair and maintenance program as recommended to them in their energy assessment report. Subsequent to implementing this program, this customer purchased and received a rebate for a new variable speed compressor with controller. This rebate was received through the Smart $aver® Custom program and the unit's purchase is considered to have been precipitated by the customer's participation in the Energy Assessment program. In consideration of the new, more efficient compressor, the energy savings factor (ESF) for this customer's repair and maintenance program has been lowered.

All savings calculations were made using equations from the Ohio TRM (unless otherwise noted in the section "Use of TRM values and explanation if TRM values not used" on page 12), which are presented alongside each customer's energy savings in the individual customer sections. Savings adjustment factors used include:

WHFe = 0.095

WHFe is the lighting-HVAC interaction factor for energy. This factor represents the reduced electric space cooling requirements due to the reduction of waste heat rejected by the efficient lighting.

WHFd = 0.2

WHFd is the lighting-HVAC waste heat factor for demand. This factor represents the reduced electric space cooling requirements due to the reduction of waste heat rejected by the efficient lighting.

IFMMBtu = -.0028

IFMMBtu is the lighting-HVAC interaction factor for gas heating impacts. This factor represents the increased gas space heating requirements due to the reduction of waste heat rejected by the efficient lighting.

CF = Varies

CF is the summer peak coincidence factor and is dependent on building type.

ESF = Varies

ESF is the energy savings factor. This factor represents the additional savings percentage achieved and is dependent on the measure and installation types.

Customer One

This project involved a lighting retrofit and vending machine motion sensors installed in an office building with annual operating hours of 8,760. For the lighting retrofit, 157 215-Watt metal halide lamps were replaced with 93-Watt CFLs. One refrigerated vending machine was fitted with a motion sensor. These measures provide gross annual savings of 227,358 kWh and reduce the peak load by 21.5 kW. A breakdown of the savings by measure can be seen in Table 9.

Table 9: Customer One Savings Estimate Breakdown by Measure

Customer One	kWh	kW	MMBtu
Lighting retrofit + sensors	225,746	21.5	-632
Vending machine motion sensor	1,612	0.0	0
TOTAL	**227,358**	**21.5**	**-632**

Lighting with occupancy sensors:

ΔkWh = [WATTSbase – WATTSee * (1-ESF)] * HOURS * (1 + WHFe) / 1000
ΔkW = [WATTSbase – WATTSee * (1-ESF)] * CF * (1 + WHFd) / 1000
ΔMMBtu = ΔkWh * IFMMBtu

Vending machine motion sensor:

ΔkWh = WATTSbase / 1000 * HOURS * ESF

Customer Two

This project involved two separate lighting retrofits installed in condominiums with annual operating hours of 8,760. For the first lighting retrofit, 150 incandescent bulbs averaging 87.5-Watts were replaced with CFLs averaging 26.9-Watts. For the second, 40 50-Watt halogen bulbs were replaced with 12-Watt LEDs. These measures provide gross annual savings of 101,740 kWh and reduce peak load by 4.7 kW. A breakdown of the savings by measure can be seen in Table 10.

Table 10: Customer Two Savings Estimate Breakdown by Measure

Customer Two	kWh	kW	MMBtu
Lighting retrofit (CFLs)	87,160	4.0	-244
Lighting retrofit (LEDs)	14,580	0.7	-41
TOTAL	**101,740**	**4.7**	**-285**

Lighting:

ΔkWh = (WATTSbase – WATTSee) * HOURS * (1 + WHFe) / 1000
ΔkW = (WATTSbase – WATTSee) * CF * (1 + WHFd) / 1000
ΔMMBtu = ΔkWh * IFMMBtu

Customer Three

This project involved two separate lighting retrofits as well as occupancy sensors installed in a school with annual operating hours of 4,160. For the first lighting retrofit, 244 96-Watt T12 lamps were replaced with 59-Watt T8s. For the second, 52 90-Watt incandescent bulbs were replaced with 26-Watt CFLs. Occupancy sensors were hooked up to 22 fixtures with a total

controlled wattage of 680-Watts. These measures provide gross annual savings of 57,213 kWh and reduce peak load by 7.5 kW. A breakdown of the savings by measure can be seen in Table 11.

Table 11: Customer Three Savings Estimate Breakdown by Measure

Customer Three	kWh	kW	MMBtu
Lighting retrofit (CFLs)	15,160	2.0	-42
Lighting retrofit (T8s)	41,124	5.4	-115
Occupancy sensors	929	0.04	-3
TOTAL	**57,213**	**7.5**	**-160**

Lighting:

ΔkWh = (WATTSbase – WATTSee) * HOURS * (1 + WHFe) / 1000
ΔkW = (WATTSbase – WATTSee) * CF * (1 + WHFd) / 1000
ΔMMBtu = ΔkWh * IFMMBtu

Occupancy sensors:

ΔkWh = kWcontrolled * HOURS * (1 + WHFe) * ESF
ΔkW = kWcontrolled * (1 + WHFd) * ESF * CF
ΔMMBtu = ΔkWh * IFMMBtu

Customer Four

This project involved a lighting retrofit and the adoption of a compressed air system repair and maintenance program implemented in a light industrial building with annual operating hours of 7,488. For the lighting retrofit, 140 400-Watt metal halide lamps were replaced with 105 355-Watt T5s. The company has three single stage screw type air compressors totaling 525hp and averaging 1120cfm. These measures provide gross annual savings of 297,849 kWh and reduce peak load by 17.1 kW. A breakdown of the savings by measure can be seen in Table 12.

Following a comparison of NREA and Smart $aver® participants, it was discovered that this customer received a rebate through the Smart $aver® program for the adoption of a measure related to a recommendation in their energy assessment. Savings achieved through the implementation of the repair and maintenance program has been adjusted to account for the purchase of a new compressor through the Smart $aver® Custom program. The energy savings factor (ESF) was reduced to address the savings calculation's dependence on compressor efficiency.

Table 12: Customer Four Savings Estimate Breakdown by Measure

Customer Four	kWh	kW	MMBtu
Lighting retrofit (T5s)	**153,533**	**17.1**	**-430**
Maintenance program	**144,316**	**0.0**	**0**
TOTAL	**297,849**	**17.1**	**-430**

Lighting:

ΔkWh = (WATTSbase – WATTSee) * HOURS * (1 + WHFe) / 1000
ΔkW = (WATTSbase – WATTSee) * CF * (1 + WHFd) / 1000
ΔMMBtu = ΔkWh * IFMMBtu

Compressed air system repair and maintenance program:

ΔkWh = cfm * kW/cfm * ESF * HOURS

Customer Five

This project involved just one measure, a reduction of compressed air pressure. This was implemented in a light industrial building with annual operating hours of 6,032. Air pressure was lowered from 110 to 95 psi on two 100hp compressors. This measure provides gross annual savings of 74,998 kWh and reduces peak load by 4.7 kW.

Reduced compressed air pressure:

ΔkWh = BHP * 0.746 / ηmotor x HOURS x ESF
ΔkW = ΔkWh / HOURS * CF

Customer Six

This project involved three separate lighting retrofits across multiple buildings and the installation of a stack economizer for a steam boiler. For the first lighting retrofit, 75 96-Watt T12 lamps were replaced with 59-Watt T8s in an industrial building. For the second, 50 223-Watt high pressure sodium and mercury vapor lamps were replaced with 226-Watt T8s in a warehouse. The third lighting retrofit was for a different warehouse. Occupancy sensors were added and 20 205-Watt mercury vapor fixtures were replaced with 226-Watt T8s. The stack economizer was installed on a 200hp steam boiler. The boiler runs 24 hours a day five days a week in warm weather and 24 hours a day seven days a week in cold weather. These measures combine to provide gross annual savings of 27,293 kWh, 211,156 MMBtu, and reduce peak load by 3.3 kW. A breakdown of the savings by measure can be seen in Table 13.

Table 13: Customer Six Savings Estimate Breakdown by Measure

Customer Six	kWh	kW	MMBtu
Lighting retrofit (T12-T8)	26,618	2.5	-75
Lighting retrofit (Na/Hg-T8)	-391	-0.1	1
Lighting retrofit with sensors	1,066	0.9	-3
Economizer	0	0.0	211,232
TOTAL	**27,293**	**3.3**	**211,156**

Lighting:

ΔkWh = (WATTSbase – WATTSee) * HOURS * (1 + WHFe) / 1000
ΔkW = (WATTSbase – WATTSee) * CF * (1 + WHFd) / 1000
ΔMMBtu = ΔkWh * IFMMBtu

Lighting with occupancy sensors:

ΔkWh = [WATTSbase – WATTSee * (1-ESF)] * HOURS * (1 + WHFe) / 1000
ΔkW = [WATTSbase – WATTSee * (1-ESF)] * CF * (1 + WHFd) / 1000
ΔMMBtu = ΔkWh * IFMMBtu

Stack Economizer:

ΔMMBtu = HP x kBtuh/HP / 10 x FLH x ESF

Appendix A: Required Savings Tables

The required table showing measure-level participation counts and savings for each program is below. **Also include tables showing calculations done to achieve Adjusted Gross Savings for each program.**

Required tables will include the following (see Excel file for details):

1. Participation counts and ex ante savings estimates at the measure level for each program
2. Gross savings calculations at the measure level for each program.
    - At a minimum, *Gross Verified Savings* must be reported.
    - If additional adjustments are made, *Adjusted Gross Savings* can be reported using Option A, B, C only.

Measure	Participation Count	Verified Per unit kWh impact	Verified Per unit kWh impact	Gross Verified kWh Savings	Gross Verified kW Savings
Metal Halide to T5 and Occupancy Sensors	1	1,438	0.14	225,746	21.46
Vending machine motion sensor	1	1,612	0.00	1,612	0.00
Incandescent to CFL	2	507	0.03	102,320	6.03
Halogen to LED	1	365	0.02	14,580	0.67
T12 to T8	2	212	0.02	67,743	7.95
Occupancy Sensors	1	929	0.04	929	0.04
Metal Halide to T5	1	1,462	0.16	153,533	17.08
Compressed Air System Repair and Maintenance Program	1	176,602	0.00	176,602	0.00
Reduced Compressed Air Pressure	1	74,998	4.72	74,998	4.72
Na/Hg Vapor to T8	1	-8	0.00	-391	-0.13
Hg Vapor to T8 and Occupancy Sensors	1	53	0.04	1,066	0.89

Appendix B: Management Interview Instrument

Name: _____

Title: _____

Position description and general responsibilities:

_____

_____

_____

We are conducting this interview to obtain your opinions about and experiences with the Facility Assessment Program. We'll talk about the Program and its objectives, your thoughts on improving the program and its participation rates, and the technologies the program covers. The interview will take about an hour to complete. May we begin?

Program Objectives

1. In your own words, please describe the Facility Assessment Program's objectives.

2. In your opinion, which objectives do you think are being met or will be met? How do you think the program's objectives have changed over time?

3. Are there any program objectives that are not being addressed or that you think should have more attention focused on them? If yes, which ones? How should these objectives be addressed? What should be changed? Do you think these changes will increase program participation?

4. Should the program objectives be changed in any way because of market conditions, other external or internal program influences, or any other conditions that have developed since the program objectives were devised? What changes would you put into place, and how would it affect the objectives?

5. Please describe your role and scope of responsibility in detail. What is it that you are responsible for as it relates to this program? When did you take on this role? *If a recent change in management*... Do you feel that Duke Energy gave you enough time to adequately prepare to manage this program? Did you get all the support that you needed to manage this program?
6. Do you think the incentives application process offered through the Facility Assessment program is easy to understand and complete?

7. Which recommendations have been implemented? Why, and why have other measures not been adopted?

8. What kinds of marketing, outreach and customer contact approaches do you use to make your customers aware of the program and its options? Are there any changes to the program marketing that you think would increase participation?

9. How do you inform trade allies and contractors about the program? How effective has this been in getting participation from the contractors?

10. Are there any changes to the marketing that could possibly increase participation in the program?

Overall Facility Assessment Management

11. Describe the use of any advisors, technical groups or organizations that have in the past or are currently helping you think through the program's approach or methods. How often do you use these resources? What do you use them for?

12. Overall, what about the Facility Assessment Program works well and why?

13. What doesn't work well and why? Do you think this discourages participation?

14. Can you identify any market or operational barriers that impede a more efficient program operation?

15. If you could change any part of the program what would you change and why?

Program Design & Implementation

16. What market information, research or market assessments are you using to determine the best target markets or market segments to focus on?

17. What market information, research or market assessments are you using to identify market barriers, and develop more effective delivery mechanisms?

18. How do you manage and monitor or evaluate contractor involvement or performance? What is the quality control and tracking process? What do you do if contractor performance is exemplary or below expectations?

23. In your opinion, did the incentives cover enough different kinds of energy efficient products and recommendations?

1. ☐ Yes 2. ☐ No 99. ☐ DK/NS

If no, 22b. What should be included?

_____

_____

24. In what ways can the Facility Assessment Program's operations be improved?

25. Do you have any suggestions for how program participation can be increased?

Appendix C: Participant Survey Instrument

Hello, my name is <*name*> with TecMarket Works and I am calling in regard to the assessment that was provided to your facility through Duke Energy in <*Month Year*>. From that assessment, you were provided with a report that listed energy saving opportunities for your facility to pursue. The purpose of this call is to find out if you or your company have implemented any of the energy savings opportunities that were recommended in the report and to ask you a few questions about your satisfaction with the program's services. This call will only take about 5 or 10 minutes. Is now a good time?

In that report there were <#> energy and cost saving opportunities recommended. There were: <*list*>.

For each (some, if over 4 recommendations) **of these recommendations we would like to know…**

1. **If you have already taken the action,**
2. **If you have decided to take the action, but have not yet done so,**
3. **If you have decided not to take the action,**
   Or,
4. **If you are not sure if you are going to take the action**
5. **Already doing the action before the assessment was done.**

1. **Let's start with <*action1*>. For <*action1*> please tell me…**

   1. **If you have already taken the action,**
   2. **If you have decided to take the action, but have not yet done so,**
   3. **If you have decided not to take the action,**
      Or,
   4. **If you are not sure if you are going to take the action.**
   5. **Already taking the action prior to the assessment.**
   6. **Don't remember that recommendation**

Follow-up questions to Q1

If Q1 = a above…

2. **If you recall, about how many months after the assessment did you take this action?**
3. **Do you feel you are achieving the savings estimated in the report?**
4. **What were the costs associated with implementation?**
   a. **Was this more or less than what you had expected?**

If Q1 = b above…

5. **What are the reasons why your business has not yet taken this action?**

If Q1 = c above…

6. What are the main reasons that you have decided not to take this action?

If Q1 = d above…

7. What are some of the reasons why you are not sure if you are going to take this action?

If Q1 = b,c, or d above.

8. Is there anything that you think the program can do to help you decide to implement this action or to make taking this action an easier or faster process?

Read each of the energy saving recommendations and ask the above questions for each of the top 4 recommendations.

If time is an issue for participant, or if there are a more recommendations, ask the questions above for the top four energy savings recommendations, then ask about the remaining actions as a group…. For example:

9. I am now going to read the rest of the recommendations contained in the report. Please tell me which of these actions you have already taken, and which of these you plan to take within the next year or two.

Read remaining recommendations and ask which they have taken and which they are currently planning on taking within the next year or two.

Recommendation 5	_Have taken	_Plan to take in the next year or two
Recommendation 6	_Have taken	_Plan to take in the next year or two
.		
.		
Recommendation 14	_Have taken	_Plan to take in the next year or two
Recommendation 15	_Have taken	_Plan to take in the next year or two

I would now like to ask you about your level of satisfaction with the assessment service and the interaction with the assessment staff. I will read a series of statements. Please rate your satisfaction with each item on a scale from 1 to 10 with 1 meaning that you were not satisfied at all and 10 meaning that you were extremely satisfied.

10. How satisfied are you with...

	Score
a. The ease of signing up for the assessment?	
b. The convenience of scheduling the inspection?	
c. The completeness of the inspection.	
d. The quality of the inspection.	
e. The review and discussion of the recommendations	
f. The knowledge of the energy specialists who conducted the inspection and explained your assessment report.	
g. The length of time it took to receive the assessment report	
h. The clarity and ease of understanding the assessment report	
i. The comprehensiveness and completeness of the assessment report	
j. The practicality/usefulness of the recommendations provided	
k. The report meeting your expectations	
l. The responsiveness of Duke Energy staff	

If customer scores a 7 or less for any of these, ask

11. **What would you like to see changed about …?**

Ask this as you go, so that if we get a 7 or lower score, we ask about changes to that item at the same time, then go on to the next item.

12. **What did you like most about this program?**

13. **What did you like least about this program?**

14. **If you could change one thing about the program, what would it be?**

15. **Given the current state of the economy, is your company more or less likely to investigate and implement energy saving measures?**

16. **Have you recommended this program to others?**

    a. *If yes*, **How many companies did you refer to this program?**
       i. **Who or what company did you refer to this program?**

We have completed the survey. Thank you for your time. Are there any questions comments you have for me or that you would like for me to convey to Duke Energy?

Appendix D: Responses to Installation Questions

The following pages consist of a table that lists each of the recommendations and the outcome of that recommendation for each of the eight facilities for which we were able to complete an interview.

The facilities are listed in no particular order.

Facility #	On/Off Site	# of Recom-mendations	Measure	Installed	Months	Note	What Duke Can Do
EA-00031	Off	8	Utilize Energy Management System	No		Unsure of future status	
EA-00031	Off	8	Centralized Energy Management for Lighting	No			
EA-00031	Off	8	Occupancy sensors and metal halide to T5 conversion	Yes	12		
EA-00031	Off	8	Elevator high efficiency motors	No		Unsure of future status	
EA-00031	Off	8	Motion Sensors for Vending Machines	Yes	6		
EA-00031	Off	8	Obtain Energy Star Certification	No		Unsure of future status	
EA-00031	Off	8	Chiller Tower VFD	No			
EA-00031	Off	8	Solar Panels for Hot Water	No			
EA-00052	Off	5	Utilize High Efficiency Heat Pumps	No		Building is new.	
EA-00052	Off	5	Use 28 watt T8 lamps instead of 32W T8's	No		May replace 32W with 28W as they burn out	
EA-00052	Off	5	Convert to CFLs	Yes	12		
EA-00052	Off	5	Lighting Occupancy Sensors	No		Unsure of future status	
EA-00052	Off	5	Elevator high efficiency motors	No		Not deemed cost effective	
EA-00179	On	9	Convert to CFLs	Yes	6		
EA-00179	On	9	Computer Energy Management	No		Had already adopted alternative strategy	
EA-00179	On	9	Utilize Energy Profiler Online	No		Unsure of future status	Provide more information on EPO
EA-00179	On	9	Put hot water circulation pump on a timer	No		Eliminated large hot water tank	
EA-00179	On	9	Lighting Occupancy sensors	Yes	12		
EA-00179	On	9	Daylighting	No		Overlooked, will reconsider	
EA-00179	On	9	Replace metal halide lamps with lower wattage	No		Unsure of future status	
EA-00179	On	9	T12 to T8 lighting retrofit	Yes	18		
EA-00179	On	9	Improve building envelope	Yes	12		
EA-00063	On	7	Lighting upgrades	Yes	2	Had already begun prior to assessment	

EA-00063	On	7	HVAC Optimization	No		ROI greater than three years	
EA-00063	On	7	Compressed air system evaluation and maintenance	Yes		Already completed before received report	
EA-00063	On	7	Heat Recovery / Process Heat evaluation	No		Disrupted process during trial. Put on back burner.	
EA-00063	On	7	Energy Management System	No		Deemed too costly	
EA-00063	On	7	High Efficiency Motor replacement	Yes		Already ongoing as part of regular replacement	
EA-00063	On	7	Demand Control Strategy	No		Not possible due to production schedule	
EA-00084	Off	4	Demand Control Strategy	Yes	10		
EA-00084	Off	4	Compressed air system optimization	No		Would interfere with production	
EA-00084	Off	4	High efficiency motors	No		Deemed too costly	
EA-00084	Off	4	HVAC economizer and control strategy	No		Deemed too costly	
EA-00304	Off	3	Investigate production activity during 2nd shift ramp-up	No		Interferes with production	
EA-00304	Off	3	Compressed air system repair and maintenance program	Yes	5		
EA-00304	Off	3	Lighting conversion	Yes	1		
EA-00266	Off	5	Reduce compressed air pressure	Yes	1		
EA-00266	Off	5	Lighting conversion	Yes	6		
EA-00266	Off	5	Install destratification fans	No		Not deemed cost effective	
EA-00266	Off	5	Install glycol coolers	No		Not deemed cost effective	
EA-00266	Off	5	Install programmable thermostats	Yes	6		
EA-00293	On	5	Compressed air, electric distribution, and space conditioning systems	Yes	6		
EA-00293	On	5	Compressed air system maintenance program	Yes	1		
EA-00293	On	5	Power factor correction	Yes	6		
EA-00293	On	5	Lighting conversion	Yes	6		

EA-00293	On	5	Natural gas usage reduction study / boiler optimization	Yes	6		

Final Report

Evaluation of the Non-Residential Smart $aver® Custom Program in Ohio

Results of a Process Evaluation

Prepared for
Duke Energy
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Table of Contents

Executive Summary

Key Findings and Recommendations

The key findings and recommendations identified through this evaluation are presented below.

Significant Process Evaluation Findings

Duke Energy's Smart $aver® Custom program is playing an important role in helping non-residential customers to implement projects using measures not in the Smart $aver® Prescriptive program. The program is also being marketed very well, through a network of dealers and distributors, as well as through Duke Energy's account managers. While all customers appreciate that Duke Energy offers a Custom program, they are only moderately satisfied with the program. Two areas where customers express less satisfaction are in the application's difficulty and in the time for application review. (See section titled "Satisfaction Ratings" on page 13.) Duke Energy's Smart $aver® Custom program managers are well aware of the challenges facing their program, and have already taken steps to address them. Smaller customers find that the application is difficult if the applicant does not have a technical or engineering background. Duke Energy's program managers report that the time to review larger project applications is only marginally greater than the time to review smaller project applications. They also report that while the program's overall success depends critically on those larger projects, they are expending the majority of their resources on reviewing the smaller applications. As it is right now, the Smart $aver® Custom program may have reached a point of equilibrium, with the difficulty of the application process serving to reduce the number of applications from the smaller projects. (See section titled "Feedback on Application Process" on page 14.)

Recommendations

1. Duke Energy should decide what size projects (in terms of energy savings) the Custom program should target. Duke Energy program managers have expressed a greater need to encourage larger projects, in order to increase program effectiveness. Duke Energy may determine that it is not cost prohibitive to provide technical support for all the "onesie, twosie" projects. Whether or not Duke Energy decides to support projects of all sizes, making an explicit decision one way or the other may allow Duke Energy to allocate their resources and outreach more efficiently. (See section titled "Feedback on Application Process" on page 14.)
2. If Duke Energy decides to continue to encourage customers with smaller projects to apply, Duke Energy should find a way to provide technical support to qualified unassigned customers who are filling out their own applications. Alternately, Duke Energy may also want to consider temporarily assigning those customers to a Duke Energy representative, or temporarily requesting technical assistance from WECC to meet those unassigned customers' needs. This would allow those smaller customers to receive the assistance they say they need. (See section titled "Feedback on Application Process" on page 14.)
3. Duke Energy should also consider managing all customers' expectations for the amount of work involved in filling out an application, and perhaps provide data on what types of projects had been approved in the past. This may allow customers to make more

informed choices on whether it is worthwhile for them to undertake the work of applying. (See section titled "Feedback on Application Process" on page 14.)

Introduction and Purpose of Study

Summary Overview

This process evaluation of the Smart $aver® Custom program was conducted through in-depth interviews with the Duke Energy program manager for the Ohio program and the Duke Energy program manager for the Carolinas program. Short interviews were also conducted with 11 Duke Energy nonresidential customers and 10 vendors who had submitted applications for the Custom program. The Smart $aver® Custom program is offered in all five states in Duke Energy service territory. This evaluation focuses on the Smart $aver® Custom program being offered in Ohio

Summary of the Evaluation

This report presents the results of a process and impact evaluation of the Ohio Non-Residential Smart $aver® Custom Program.

Researchable Issues

In addition to the objectives noted above, there were a number of researchable issues for this evaluation. These were:

1. To determine which measures were implemented by the participant, and the timing and reasons for implementation.
2. Participant satisfaction with the program application, communications, and rebates
3. To determine the level of freeridership and spillover associated with the program.

Description of Program

The Duke Energy Smart $aver® Custom program is intended to supplement the Smart $aver® program, which provides Prescriptive rebates on pre-selected measures. Customers who want to install measures not on the Smart $aver® Prescriptive list are provided the opportunity to apply for a rebate through the Custom program. One Duke Energy manager states, "*We lead with the Prescriptive program.*"

The Custom program is tightly coordinated with the Smart $aver® Prescriptive program: the program managers of both programs meet regularly, and any change to the Smart $aver® Prescriptive program is also made to the Custom program. One Duke Energy program manager reports that when the Custom program starts seeing repeated applications for the same measure, they begin considering that measure for inclusion in the Prescriptive program, in order to lower administrative costs.

Program Participation

Program	Participation Count for 2010
Non-Residential Smart $aver Custom	70

Methodology

Overview of the Evaluation Approach

This evaluation was performed without an evaluation plan.

Study Methodology: Process

This section presents the methodologies used in both the process and impact evaluations for the Non-Residential Smart $aver® Custom Program.

The evaluation was comprised of in-depth interviews with two program managers. These in-depth interviews provided a detailed investigation into program operations, goals, and suggestions for improvements and changes.

This study also implemented a participant survey with facility managers and with program vendors to identify the types of actions that are being taken as a result of the program. The survey also included a limited number of satisfaction and program operations questions to help Duke Energy determine if the program is being implemented effectively from the perspective of the participants. This study focuses on participants from late 2009 through 2010. A total of 11 customers and 10 vendors were interviewed for this evaluation.

The evaluation survey focused on the collection of implementation rates for the recommended measures and behaviors and their levels of satisfaction with the program, communications, and the rebates provided. The survey also assessed program process issues including the ease of signing up for the program, the program application process. The findings from this evaluation are presented in the following sections of this document.

Data collection methods, sample sizes, and sampling methodology

Process

Short interviews were conducted with 11 customers and 10 vendors. The sample was drawn from the pool of customers who had received notification in late 2009 through 2010 from Duke Energy about whether their applications were approved or denied. An average of 2.14 phone calls were made and 0.68 emails were sent to each of the 41 people in the sample, with an overall response rate of 46%. Across the sample, 8 respondents had their projects approved, completed and rebated; 6 had their applications denied, and 7 had their applications approved but Duke Energy did not know the status of their projects. See Table 2 for the sample disposition.

Number of completes and sample disposition for each data collection effort

Process

Short interviews were conducted with 11 customers and 10 vendors. In these 15-minute interviews, respondents were asked to provide feedback on their experiences with aspects of the Custom program as well as provide satisfaction ratings. Respondents were assured their answers would remain anonymous and were allowed to decline to answer any of the questions. The sample sizes are too small to allow responses to be considered statistically representative; as a

result, the responses should be considered indicative of the program but should not be generalized to all Custom program participants.

Table 1. Sample Disposition

Completed	19
Couldn't Remember Details	2
Declined	3
Left Company	6
Out of Business	1
Retired	1
No Response	6
No Show	3

Threats to validity, sources of bias and how those were addressed

Process

The sample sizes for the participant surveys are too small to allow responses to be considered statistically representative; as a result, the responses should be considered indicative of the program but should not be generalized to all Custom program participants.

Process Evaluation

Program Design and Implementation

Duke Energy implements the Smart $aver® Custom program with support from the Wisconsin Energy Conservation Corporation (WECC). The Duke Energy program managers' responsibilities include overall management of costs and revenue, and management of the third party vendors who help deliver the program.

WECC provides support for the Smart $aver® Custom program in a number of ways. WECC representatives act as "trade ally representatives" and have supported Duke Energy's Smart $aver® programs over several years in building a "trade ally network". Dealers, vendors and distributors of energy efficient equipment constitute Duke Energy's trade allies. Through the network supported by WECC these vendors can receive information about Duke Energy's Smart $aver® program eligibility, program benefits, and application requirements. In many cases, WECC representatives serve as the main source of information about Duke Energy's Smart $aver® program. WECC also provides technical staff who helps Duke Energy review the Custom applications.

Marketing

The Duke Energy program managers report that the Smart $aver® Custom program is not marketed as a separate program. "*We just market Smart $aver® incentives as a whole.*" The Custom program is designed for non-residential energy efficiency projects that propose to use measures not already approved in the Smart $aver® Prescriptive measures program.

Program information and forms are available on Duke Energy's website. However, the main channels for marketing for the program are through vendors and through Duke Energy account managers. For Duke Energy customers who have been assigned to an account manager, that account manager serves as the primary contact and provides assistance with Custom program applications. For mass market or unassigned customers, Duke Energy markets the Custom program through trade shows and through their network of trade allies and vendors. The trade ally network is cultivated by WECC. Unassigned customers can also call a toll free number operated by a third party vendor with questions about the Custom program. "*I see a lot of volume through our trade allies,*" one Duke Energy program manager reports. A Duke Energy program manager also reports that the Custom program is also marketed through pilot programs, such as the Smart Building Advantage program, and the Energy Savings Master Plan programs. "*A lot of this is marketing internally, so our colleagues can market externally.*"

Applications

Applications can come in through the trade ally network, directly from the customer, or from the account manager on behalf of the customer. The Smart $aver® Custom application asks customers to provide information about their facility, information about the proposed project, equipment specification sheets, a calculation of energy savings from the project, and the payback period. The program manager reports that customers generally ask the equipment vendor to provide these calculations for them. The program manager acknowledges that this is not a simple process, "*It's only worthwhile for the large projects.*"

As part of the application process, customers are required to answer questions that would determine whether they were a "freerider". The term "freeriders" refer to customers who would install the measures whether or not any rebate was given. Customers need to obtain approval for the rebate prior to commencing any work on the project, including signing any purchase orders with their vendors. Those who began their projects prior to application approval are disqualified from the rebate because they are considered freeriders and therefore do not provide net energy savings for the program. This approach keeps the program cost effective and assures low freeridership.

Application Review

Once a Custom application is submitted, the Duke Energy program managers conduct a quick initial screening to determine if the application must be disqualified due to obvious reasons, such as missing information. The application then undergoes a technical review by in house staff, or is sent to WECC for review by their engineers. WECC makes sure the applications are complete, and contacts the customer if any information is missing or needs clarification. Duke Energy's program managers try to review as many applications as they can themselves. The technical reviewers determine the energy savings that can be expected from each project.

The turnaround time on the technical reviews had been one month, but recently increased to six weeks. At the time of these interviews, WECC had recently expanded their scope of work with Duke Energy to include conducting technical reviews for the Custom program. WECC was in the process of developing the additional capacity to process Duke Energy's applications in much shorter periods of time. One Duke Energy program manager acknowledges that some of the delay may be due to that: "*They've been building up their knowledge*," but also believes that once WECC finishes staffing up, this timing problem will be resolved.

Duke Energy is aware of the complexity of the Custom application, "*We get the complaint all the time that the Custom application is too hard and too complicated. We have ideas on how to make it easier, but at the end of the day, the customer or vendor still needs to tell us about the project. We cannot take on the work of doing that for them.*" Because incentive decisions must be made based on the energy savings of each project, the application must provide the information needed to make cost effective energy efficiency supply decisions.

Incentive Calculation

The energy savings calculations are sent to Duke Energy's Market Analytics division, which determines how much revenue Duke Energy can earn on the project through "Save-a-Watt". This stage was taking two weeks, but the Duke Energy program manager is working to reduce the turnaround time to approximately one week. The Duke Energy program manager takes the revenue estimate and makes the final determination on what incentive amount is offered to the customer on their Smart $aver® Custom project. The customer then makes a decision whether or not to go forward with their proposed project, taking their other needs into consideration.

Results

Customer demand for the program is high. At the time of these interviews, the Duke Energy program managers report that they are ahead of program targets in Ohio. "*We have more requests than we can handle...* " One program manager reports that level of interest from customers recently had increased to the extent that it became another factor in the increased turnaround time for reviewing applications.

When asked what might have caused the increased level of interest, the Duke Energy program manager suggested it might simply be because "*Customers have started to hear about the program. Word gets out, customers say [I'll apply] when I get around to doing it. Even when they are aware of the program, takes a while to participate. [They may] want to wait until building is not occupied, etc.*"

Future Growth of the Custom Program

The program managers were asked about the possibility of future growth of the Custom program, in two ways: growth in terms of increased numbers of participants and growth in terms of types of technologies that are accepted.

When asked, one Duke Energy program manager was hesitant about what continued participant growth of the Custom program would entail. This program manager estimates, "*there are probably two or three incentives in each state that make up the vast majority of the overall revenue [from Custom] for Duke. [We usually get] a couple of projects that are so massive that they carry everything else. If those projects don't get done, we're not going to do well... We only need a handful of big projects, rather than a bunch of onesie and twosies.*" The program manager then suggested one approach that Duke Energy is considering, "*One way is to take the large project ideas and work with account managers to see if they have customers who may be interested.*"

The Duke Energy program manager also cites market conditions as a consideration in their decisions about growing the Custom program. "*We have more applications that we approve than get implemented; that's because of economics.*" The program manager estimates that at that point, there were 69 applications across Duke Energy's service territory that had had been approved, but Duke Energy has no indication from the customers about whether they are planning to implement the projects.

In terms of growth in types of technologies allowed, the other Duke Energy program manager believes that the Custom program currently covers most of the opportunities in electric energy savings, but that more opportunities might be available if gas and electric utilities were allowed to work together and current regulations were changed to allow fuel switching. "*Geothermal applications will not take off until we let the gas companies participate.*"

Customer and Vendor Interviews

Short interviews were conducted with 11 customers and 10 vendors. In these 15-minute interviews, respondents were asked to provide feedback on their experiences with aspects of the Custom program as well as provide satisfaction ratings. Respondents were assured their answers would remain anonymous and were allowed to decline to answer any of the questions. The sample sizes are too small to allow response to be considered statistically representative; as a result, the responses should be considered indicative of the program but should not be generalized to all Custom program participants. Survey instruments were used as guidelines for the interviews. These interviews are intended to gather some concrete examples of some of the issues that Smart $aver® Custom applicants have faced, and to allow the evaluation team to delve into issues more deeply than would be possible in a typical customer satisfaction survey.

Table 2. Sample Disposition

Completed	19
Couldn't Remember Details	2
Declined	3
Left Company	6
Out of Business	1
Retired	1
No Response	6
No Show	3

The sample was drawn from the pool of customers who had received notification in late 2009 through 2010 from Duke Energy about whether their applications were approved or denied. An average of 2.14 phone calls were made and 0.68 emails were sent to each of the 41 people in the sample, with an overall response rate of 46%. Across the sample, 8 respondents had their projects approved, completed and rebated; 6 had their applications denied, and 7 had their applications approved but Duke Energy did not know the status of their projects. See Table 2 for the sample disposition.

Table 3. Satisfaction with the Custom Program

	Satisfaction with Incentive	Ease of Filling Out Application	Satisfaction with Time to Review Application	Satisfaction with Technical Expertise of Duke Energy Staff	Satisfaction with Program Information Provided	Overall Satisfaction with Smart $aver® Custom
Mean Rating	7.00	6.63	7.37	7.88	7.73	7.70
Std Dev	2.86	2.25	2.78	1.81	1.67	2.25
N	15	13	16	9	14	16

Note: Ratings are on a scale of 0 to 10, with 10 being highest and 0 being lowest. Some ratings were not solicited from the respondent if they were not appropriate, for example if the customer did not fill out the application, or if no technical help was requested from Duke Energy.

Satisfaction Ratings

While not statistically representative, the satisfaction ratings may be used as an indication of trends among the customer and vendors. These ratings suggest that while there is moderate satisfaction with the Custom program overall, there may be less satisfaction with the incentive level, with the application process, and with the time it takes for Duke Energy to review the applications (all rated below 7.5). These trends in the satisfaction ratings are reflected in the interviewee's feedback, reported below.

Awareness of the Smart $aver® Custom Program

Respondents were asked how they first heard about the Custom program. The Smart $aver® program and the trade ally network were designed so the Duke Energy account managers would market to large customers, vendors would market to the mass market (including unassigned customers), and WECC would provide technical support for the vendors. Through the interviews, this was exactly what was found: Customers tended to report that they first heard about the Custom program from their vendor or a Duke Energy representative. Vendors tended to have first heard about the program from WECC. Duke Energy's website was mentioned only a couple of times by both customers and vendors as their first exposure to the Custom program. Customers also reported that they were able to get all the information they needed from their source. Vendors also reported that their source, WECC, was able to provide all the information they needed.

The relationship between the vendors and WECC seems to be an excellent one. Most vendors referred to their WECC representative by name, and highly praised WECC's support: *"Great support from Rob", "Rob knows this thing inside and out. Rob is indispensible so to speak", "Everybody in our area knows Rob.", "When you mention the rebate program, Rob's name comes up. He's the area expert." "I give WECC a 10+ [satisfaction rating out of 10 maximum]"*

Feedback on the Influence of the Rebate

Customers generally reported that the rebate was a major influence on their decision to do the project. One customer said the influence of the rebate was "*one of more important; if it had been offered by the other utility we would have thought about switching [to the other utility].*" One vendor offered that the rebate was "*extremely crucial; that was what the project hinged upon.*"

When asked what they would have done (or did) in the absence of a rebate, customers were evenly divided among those who said they would not have done the project, those said they would have had to use less expensive equipment, and those who would have scaled back or delayed the project. Likewise, most customers reported their primary reason for undertaking their projects was to lower energy costs. Two of them reported that their primary motivation was to replace aging (but still functional) equipment; one would have had to select cheaper equipment without the rebate, and the other would not have been able to do the project without the rebate. One customer reported he wanted to lower his peak demand use, because his energy

costs for the rest of the year were to be calculated off his peak usage. Only one customer reported that the Custom rebate would have only played a small part in the advancement of the project; that customer also had his application denied. These responses indicate that the freerider screen is working and assures that the program is the primary or one of the important drivers of the energy efficient changes being made. These responses also indicate that when the program is not a main reason for the change, that project is not approved, helping to maintain cost effectiveness, but at the price of lower levels of satisfaction especially from denied applications.

Feedback on Application Process

Technical content of applications. Customers and vendors had mixed reactions when asked if the application was easy to understand. There were two respondents who said it was easy if you knew what you were doing, or if you had a mechanical background. The others needed to engage with the technical review team to answer additional questions and the delays arising in the second or third rounds of questions were mentioned as difficulties with the application. One customer had difficulty because the application required information about the existing lights, but he didn't have the records due to the age of the building. Another customer reported the application contained an unclear question and that they couldn't find anyone to help them at Duke Energy. One customer suggested that Duke Energy could have a representative assist the businesses that were filling out the applications by themselves.

In contrast, vendors who were filling out the applications for customers also had questions, but most of them reported that they were answered by WECC.

Delays during the application approval process. Several respondents discussed issues related to the application approval time. One customer was dealing with a Duke Energy representative who went on leave and experienced "*five months of transferring. I was on a deadline. Got to a point where I couldn't get a hold of anyone. [Original rep's phone message said] call this number, but that [voice mailbox] was full.*" Two vendors mentioned that it took a long time and many phone calls to meet the Custom program's calculation requirements, particularly exacerbated by the fact that their clients were on a deadline. This is a problem of which Duke Energy program managers are well aware, and as discussed elsewhere in this report, the managers are currently working to shorten the approval process by working with third party vendors to provide more technical assistance.

The complexity of the application process does serve as a deterrence to some prospects. Two vendors mentioned that they have declined to submit applications. "*I'll ignore jobs that require the Custom rebate, I'm [just] selling the materials and don't charge for [submitting] the application; I need an answer on a rebate within a day.*" This vendor had already had a negative experience with a two month long delay after submitting the application. Another vendor reports, "*sometimes it's not worth it. I did a whole project for $9 cheaper a ballast [rather than doing the paperwork]. I don't usually [absorb the costs] I just don't say anything [about the rebate] sometimes.*"

While it may be discomfiting to some to hear that there are vendors who do not want to participate in the Custom program because the application process is too complicated or drawn out, this may act as a filter that helps Duke Energy better serve customers with larger projects

that have higher impact. Duke Energy program managers have already mentioned that there needs to be a balance between serving as many customers as possible and remaining cost effective as a program. As one vendor puts it, "*The process for Custom is tedious. You have got to really want to do it... it eliminates a lot of the smaller projects.*"

This is not to say that Duke Energy does not need to continue refine program operations and reduce the delays that affect customers. Rather, Duke Energy should find a way to manage customer expectations so that customers are aware the Custom program may not suitable for smaller projects. Customer and vendor interview responses suggest that vendors may currently be providing that filtering, in deciding not to mention rebates for certain projects. However, not every customer chooses to work with vendors, and it is that group of customers whose expectations may need to be addressed.

Rebate Checks

For those who completed their approved projects and received the rebate, there were no reports of problems associated with receiving the checks. One vendor praised the speed with which the checks were sent out. "*Their turnaround time is phenomenal.*"

Most Successful Aspect

When asked to state the most successful aspect of the Custom program, some respondents stated that the fact that Duke Energy provides the Custom program is valuable in itself. "*We're glad that Duke has been partnering with us and giving us something [to work with]*". "*I really like the Custom program. It enables you to kind of go outside the box.*", "*The fact that Custom exists: so that if you do something that's not Prescriptive you still get some incentive for doing it.*" Another customer reports the Custom rebate was a selling point for their management.

Top Priority for Improvement

When asked which area should have top priority for improvement, responses were varied, sometimes reflecting a lack of knowledge of program requirements. One customer wanted to be able to apply for a Custom rebate retroactively, after completing a project. Another customer wanted Duke Energy to streamline the application process so that customers could apply without having to have vendors sign off on the application. Another customer echoed that suggestion, saying when she had to involve vendors she felt obligated to compensate them, but she only had enough budget to install the fixtures with in-house staff. One customer who had extreme difficulty finding help when her original contact at Duke Energy went on leave wanted to be able to check the status of an application online. Several suggested that Duke Energy make it a top priority to find a way to reduce uncertainty about the amount of the rebate.

Increasing Participation

When asked if they had any suggestions on how Duke Energy could increase participation, six respondents suggested more marketing. They believe that a lot of people are not well informed about the benefits of the program. Two vendors suggested that Duke Energy could increase participation by "blessing" qualified vendors, citing the need to overcome customers' distrust because the incentives sounded too high: "*I don't think they actually believe the numbers*" and "*People know there are new lights and they saves energy, but they have no idea how much.*

People roll their eyes and walk away because it sounds too good to be true." One vendor mentioned that having Duke Energy account managers involved to provide customer rate information would be helpful.

Comparisons to Other Utilities

Vendors who worked with clients of other utilities did make some unsolicited comparisons. While they were appreciative that Duke Energy offers a Custom program, the most frequent comparison was that Duke Energy's program was harder to sell than those of other utilities because of the uncertainty involved in the amount of the rebate. Another common comparison was that other utilities had online application submission: "*Hand writing and printing and scanning [the application] is old school...a lot of other utilities have spreadsheets that you populate.*" Duke Energy program managers report that while applications cannot be submitted online, they are already developing spreadsheets for certain Custom measures including lighting, VFDs and compressors that allow fields to be autofilled with calculations once certain parameters are entered.

Overall, the vendors had no serious issues "*Very easy to work with Duke.*"

Program Improvements Under Way

Duke Energy's program managers report that they already have a worksheet-based application for Custom lighting projects and that they are currently developing a similar application for VFDs and air compressors. These templates have been completed and were being tested at the time of these interviews, with an anticipated release date at the end of January of 2011. The Custom program staff is also in the process of putting together some case studies, targeted to specific market segments.

The program managers are aware of customer dissatisfaction with the application response times and are working to reduce the time to one month. However, one program manager cautions, *"it's a careful balance. The market moves very fast, and we don't let it govern the quality of our review, but customer satisfaction would be diminished if they had to wait [longer]...I would say the quality of the review is high; I feel confident when M&V comes back, based on the information we've reviewed [to determine the level of incentives], it would be very cost effective."*

Market Analysis

Freeridership & Spillover – Manager Opinions

One Duke Energy program manager reports that there may be some freeridership in the Custom program, even though customers are prescreened for freeridership during the application stage. This low level of freeridership comes as a result of the other reasons customers have for undertaking their retrofit projects, and as a result of the algorithm used to quantify freeridership. To qualify for a program incentive, the customer's freeridership score is calculated based on a set of questions provided to Duke Energy by TecMarket Works. These questions are included in the program application forms. Each applicant is required to complete the freeridership question battery from which the scores are calculated. Typically the customer simply answers the

freeridership questions along with a set of other enrollment and project questions included on the application form. If a customer had issues with the questions or if a customer answered questions in a way that provided questionable results, TecMarket Works evaluation staff then conducted a telephone freeridership interview with the applicant and scored their responses to the questions during that interview. Very few applicants had issues with the freerider questions. Duke Energy program managers used the freeridership score to estimate the level of incentive provided and to test for net cost effectiveness of each project submitted. According to Duke Energy managers, they were able to accept small levels of freeridership for the Custom projects as long as the project was cost effective.

The Duke Energy program managers only occasionally hear of instances of spillover from the Custom program, such as an anecdote about a customer who started a lighting project and ended up installing more lights than planned. However, spillover is not formally assessed for the Custom program.

Freeridership Calculations

The freeridership score is based on applicant responses to a battery of freeridership questions. The freeridership battery of questions consists of four questions and focuses on the reason for the applicant's decision to implement their energy efficiency project. The scoring approach is a linear approach which allocates from zero percent to full freeridership (100%) scores based on the responses provided by the applicant to cause-and-effect questions. Applicants with scores too low to make custom projects cost effective are rejected by the program and incentives are not paid. This approach allows the pre-screening of projects so that only cost effective projects are funded. This approach pioneered by Duke Energy represents a "Best Practice" within United States for Custom programs because it helps assure that program funds are spent obtaining net new energy savings. Other approaches approve projects before the net savings are known, increasing the probability that program funds will be spent on projects that would have been implemented without the program's financial or informational assistance. The questions are presented below along with the scoring approach. The scoring approach *(in italics)* does not appear on the application form.

1. **Please indicate if the Duke Energy incentive is/was a factor in your choice to install the more energy efficient equipment instead of other equipment that may not have saved as much energy.**
    1. Incentive had an influence on the decision (*move to next question*)
    2. Incentive had no influence on the decision (*100% freerider*)

2. **If the Duke Energy incentive/program was a factor in your choice, please indicate how much of an influence the program incentive had on your energy efficient equipment choice. Please circle the number that best represents the influence the program has on your equipment choice.** (*allowed responses = 0 to 10*)

    0 = The Duke Energy program had no effect on our equipment choice (*100% freerider*).

    1 or 2 = The Duke Energy program may have a minor influence on our energy efficient equipment choice (*1=80% freerider; 2=70% freerider*)

3 or 4 = The Duke Energy program had a positive influence in our selection of energy efficiency equipment (*3=50% freerider; 4=40% freerider*)
5 or 6 = The Duke Energy program was one of the key reasons for the energy efficient equipment choice, but not the most important reason (*5=30% freerider 6=25% freerider*)
7 or 8 = The Duke Energy program was one of the most important reasons for the energy efficient equipment choice (*7=15% freerider 8= 10% freerider*)
9 or 10 = The Duke Energy program was the primary reasons for the energy efficient equipment choice (*9=5% freerider 10=0% freerider*)

3. **Do you think that you would have selected the same level of energy efficiency if the program information and technical assistance would not have been available to you?**
   A. No. We would make a somewhat different equipment selection of not do the same project (*decrease freerider score by 10% but not lower than 0%)*
   B. Not sure what we would do (*no change in score*)
   C. Yes. We would make exactly the same equipment choice (*increase freeridership score by 10% but no higher than 100%)*

4. **Do you think that you would have selected the same level of energy efficiency if the program's financial incentive would not have been available to you?**
   A. No. We would make a somewhat different equipment selection or not do the same project (*decrease freerider score by 25% but no lower than 0%)*
   B. Not sure what we would do (*no change in score*)
   C. Yes. We would make exactly the same equipment choice (*increase freerider score by 25% but no lower than 100%*)

In order to estimate program-wide freeridership the scores, the results of the scores for each incentivized (approved) application were tabulated by TecMarket Works and weighted by the percent of each project's ex ante energy savings compared to the total program-wide ex ante savings. This approach was taken because of the wide range of levels of energy savings among the Custom projects that prohibited the use of un-weighted (averaged mean) scores, and provides an average freeridership score that reflects the energy savings that are not counted as program-induced. The results of this assessment confirm that the pre-screening of applications with the use of net energy savings calculated incentives provides for very low levels of freeridership and a high level of net energy savings. The following table presents the results of the scoring process and presents both the un-weighted and the ex ante energy savings weighted freeridership scores.

State	Number of Applicants in Freerider Assessment	Mean Non-Energy Weighted Freeridership Score	Mean Ex Ante Energy Weighted Freeridership Score	Net-to-Gross Ratio
Ohio	82	13%	10%	0.9

Conclusions and Recommendations for Program Changes

The program managers seem well aware of the major issues that face their program: long turnaround times and the complexity of the Custom application process. They are actively working to address these issues. However, Duke Energy may need to make a business decision about whether they should overtly focus projects with higher impacts, and become more selective about which small projects are cost effective to support, and manage customer expectations so that only projects with larger impacts would likely apply. Conversely, if Duke Energy decides that all customers who pay the rider need to be served equally, then the unassigned customers who choose to fill out their own applications should be provided some technical assistance with the application or provided direction as to where they might obtain technical resources.

There is agreement among the interviewees that the Custom program has significant value. As one Duke Energy program manager says, "*There's no question that customers are coming up with interesting and unique projects that would never fit in the Prescriptive program. It's really important that we have the Custom program to offer them. There are really interesting projects that have very large impacts that are out there... that makes everyone happy.*"

Appendix A: Program Manager Interview Protocol

Name: _____

Title: _____

Position description and general responsibilities:

_____

_____

_____

We are conducting this interview to obtain your opinions about and experiences with the Commercial and Industrial Incentive Program. We'll talk about the Program and its objectives, your thoughts on improving the program and its participation rates, and the technologies the program covers. The interview will take about an hour to complete. May we begin?

Program Objectives

1. In your own words, please describe the Commercial and Industrial Incentive Program's objectives.

2. In your opinion, which objectives do you think are being met or will be met? How do you think the program's objectives have changed over time?

3. Are there any program objectives that are not being addressed or that you think should have more attention focused on them? If yes, which ones? How should these objectives be addressed? What should be changed? Do you think these changes will increase program participation?

4. Should the program objectives be changed in any way because of market conditions, other external or internal program influences, or any other conditions that have developed since the program objectives were devised? What changes would you put into place, and how would it affect the objectives?

5. Do you think the incentives application process offered through the C&I Incentive program is easy to understand and complete?

6. Do you think the incentives offered through the program are large enough to entice the C&I community to purchase the high efficiency items? Why or why not?

7. Do you think the incentives cover the right equipment? Do you think there is equipment that is currently incentivized that should not be, or equipment that is not covered that should be?

8. Which measures have been most used?

9. What kinds of marketing, outreach and customer contact approaches do you use to make your customers aware of the program and its options? Are there any changes to the program marketing that you think would increase participation?

10. How do you inform trade allies and contractors about the program? How effective has this been in getting participation from the contractors?

11. Are there any changes to the incentives or marketing that could possibly increase participation in the program?

12. Thinking about how your program enrolls participants, what do you think your level of freeridership is for this program? (*That is, what percent of the equipment rebated through the program would have been purchased and installed without the program's incentive?*)

13. What do you think the level of spillover is for this program? *(That is, what percent of the participants take similar actions in their business that are not rebated through the program?)*

Overall C&I Incentives Management

14. Describe the use of any advisors, technical groups or organizations that have in the past or are currently helping you think through the program's approach or methods. How often do you use these resources? What do you use them for?

15. Overall, what about the Commercial and Industrial Incentive Program works well and why?

16. What doesn't work well and why? Do you think this discourages participation?

17. Can you identify any market or operational barriers that impede a more efficient program operation?

18. If you had a magic wand and could change any part of the program what would you change and why?

Program Design & Implementation

19. What market information, research or market assessments are you using to determine the best target markets or market segments to focus on?

20. What market information, research or market assessments are you using to identify market barriers, and develop more effective delivery mechanisms?

21. How do you manage and monitor or evaluate contractor involvement or performance? What is the quality control and tracking process? What do you do if contractor performance is exemplary or below expectations?

23. In your opinion, did the incentives cover enough different kinds of energy efficient products?

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If no, 23b. What other products or equipment should be included? Why?

_____

_____

24. In what ways can the Commercial and Industrial Incentive Program's operations be improved?

25. Do you have any suggestions for how program participation can be increased?

Appendix B: Participant Survey Instrument, Closed Won

Name: _____
Company: _____
Title: _____

Hello, my name is _____. I am calling on behalf of Duke Energy to conduct a customer satisfaction interview about the Smart $aver® Custom Program. May I speak with _____ please?

If person talking, proceed. If person is called to the phone reintroduce.
If not free to talk, ask when would be a good time to call and schedule the call-back:

Call back 1:	Date: _____,	Time: _____	❑AM or ❑PM
Call back 2:	Date: _____,	Time: _____	❑AM or ❑PM
Call back 3:	Date: _____,	Time: _____	❑AM or ❑PM
Call back 4:	Date: _____,	Time: _____	❑AM or ❑PM
Call back 5:	Date: _____,	Time: _____	❑AM or ❑PM

❑ Contact dropped after fifth attempt.

We need your help. Duke Energy has given us your name as someone who might be able to share some of your experiences with the Smart $aver® Custom Program. We are not selling anything. We would like to conduct a short interview that will take about 15-20 minutes and all your answers will be kept confidential. This information will enable Duke to make improvements to the program and the application process. Would you be able to help us?

Establishing Questions:

ES-0. **Would you please tell me what your company does, and what your role is in your company?** _____

ES-1. **Our records indicate that you participated in the Smart $aver® Custom Program in <date> and that you installed <technology> through the program and received an incentive for your purchase. Do you recall participating in this program?**

1. ❑ Yes, *begin* — *Skip to Q2.*
2. ❑ No,
99. ❑ DK/NS

1a. **This program was provided through Duke Energy. In this program, your company installed <technologies>. In exchange for purchasing the energy efficient option, Duke Energy provided your company with an incentive.**

Do you remember participating in this program?

1. ❑ Yes, *begin* → *Go to Q2.*
2. ❑ No,
99. ❑ DK/NS

If No or DK/NS terminate interview and go to next participant.

ES-3. **Please tell me what you remember about the project: How long did it take? Why did you decide to undertake the project at that time, rather than sooner or later?**_____

Information-Gathering Phase

INFO-1. **How did you become aware of the Smart $aver® Custom Program?**

a. ❑ Duke Energy sent me a brochure
b. ❑ A Duke Energy representative told me about it
c. ❑ Duke Energy website.
d. ❑ A contractor I was working with told me about the program
e. ❑ An equipment supplier
f. ❑ I saw an ad in _____
g. ❑ Other _____
h. ❑ DK/NS

INFO-2. **At the time you became aware of the program and considered taking advantage of the incentive, did you do any additional investigation to confirm the program's participation requirements and program benefits, or was the information you had enough for you to make a participation decision?**

a. ❑ The information received was adequate
b. ❑ Didn't need to confirm/ already knew about it
c. ❑ Went to the program or Duke Energy web site
d. ❑ Called or emailed a Duke Energy contact
e. ❑ Called or emailed a contractor
f. ❑ Called or emailed an equipment salesperson
g. ❑ Other: _____
h. ❑ DK/NS

If c, d, e, f, g:

INFO-3. **Were you able to get the information you needed about the program's participation requirements and benefits?** *Note: many may have only heard about this through their contractors and thus had minimal involvement, so this question may only apply to a few of them.*

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

INFO-4. **While you were deciding whether or not you wanted to participate, did you have additional questions that were not answered or did you need information that you were unable to obtain?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

INFO-4a. **What were they?**

_____

_____

Decision Making

DM-1. **What was the primary reason that you decided to purchase or upgrade your equipment?** (*check all that apply*) *(FR Survey = #7)*

1. ❑ Remodeling
2. ❑ Cost of repair or maintenance of old unit(s)
3. ❑ Parts availability
4. ❑ Reliability issues of old equipment
5. ❑ Equipment was near or past its projected life❑ Equipment failure
6. ❑ Poor performance of old equipment
7. ❑ Contractor recommendation
8. ❑ Energy or energy cost Savings
9. ❑ Environmental concerns
10. ❑ Got a good deal
11. ❑ Needed more modern, smarter equipment (energy manager systems integration or SmartGrid compatible)
12. ❑ Other: *list them*: _____

Please indicate if the *Duke Energy* incentive is/was a factor in your choice to install the more energy efficient equipment instead of other equipment that may not have saved as much energy.

A. Program assistance/incentive has an influence on our decision, or

B. Program assistance/incentive has no influence at all on our decision

If the *Duke Energy* incentive was a factor in your decision, please indicate how much of an influence

the program

incentive/service had on your energy efficient equipment choice. Please circle the number that best represents

the level of influence the program has on your equipment choice. *(Read 0 and read 10 to customer, only read intermediate ratings if customer asks for clarification)*

The Duke Energy program had no effect on our equipment choice	The Duke Energy program may have had a minor influence on our energy efficient equipment choice.		The Duke Energy program had a positive influence in our selection of the energy efficient equipment		The Duke Energy program was one of the key reasons for the energy efficient equipment choice, but not the most important reason		The Duke Energy program was one of the most important reasons for the energy efficiency equipment choice		The Duke Energy program was the primary reason for the energy efficient equipment choice	
0	1	2	3	4	5	6	7	8	9	10

3. Do you think that you would have or will select the same level of energy efficiency the program information and technical assistance would not have been available to you?

A. No, we would make a somewhat different equipment selection or not do the same project

B. Not sure what we would do

C. Yes, we would make exactly the same equipment choice.

DM-2. **If Duke Energy did not offer an incentive for _____, what would you have installed?** *(FR = #1 and #3)*

a. ❑ I would not have installed anything at this time
b. ❑ I would have installed the same equipment but would have needed to wait longer

DM-3. **How much later do you think you might have waited to make the purchase without the incentive?**

i. Months ___
ii. Years ___
iii. Other: _____

c. ❑ I would have installed _____

DM-4a. **Why would you have chosen that particular piece of equipment?**

_____

DM-4b. **Do you remember whether it was more or less expensive than the equipment you eventually installed?** _____
DM-4c. **Do you remember whether it was of higher or lower efficiency than the equipment you eventually installed?**_____

(Repeat for every type of technology in the project)

DM-6. **Were there other reasons in addition to the incentive that you went with the higher efficiency choice instead of something less efficient?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

DM-6a. *If yes....* **What were the other reasons?**

_____

_____

Application Process

App-1. **Who filled out the program application forms for your company?** *(check all that apply).*

a. ❑ I did
b. ❑ Someone from my company did
c. ❑ The contractor
d. ❑ The salesperson
e. ❑ Someone from Duke Energy
f. ❑ Other: _____

App-2. **Who submitted the completed forms to Duke Energy?**

a. ❑ I did
b. ❑ Someone from my company did
c. ❑ The contractor
d. ❑ The salesperson
e. ❑ Someone from Duke Energy
f. ❑ Other: _____

If they filled it out.

App-2a. **On a scale of 1 to 10, please rate how easy it was for you to understand the application form. Please rate 10 for extremely easy and 1 for extremely difficult.** *(A zero would mean it was too difficult to fill out at all.)*

If they don't recall the application,

App-2b. **I've emailed you a copy of the application form to refresh your memory: Do you remember what part of it was difficult?**

_____

App-3. **Did you have any problems receiving the incentive or having the application approved?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If yes, App-3a. **Please explain the problem and how it was resolved. Was it resolved to your satisfaction?**

_____

_____

Spillover – Channeling into Other Programs

Ch-1. **When firms have experience with energy efficiency programs or products they sometimes make similar decisions to continue the energy savings in other parts of their business. Has your firm taken advantage of any other Duke Energy's energy efficiency programs as a result of your participation in the Smart Saver® Custom program? If yes, what?**

1. 1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If yes,

Ch-1a. **What have you done? – get as much detail as possible.**_____

Ch-1b. **How much energy or money do you think you have saved as a result?**

Spillover - Electric

Sp-1. **As a result of your participation in Duke Energy's Smart Saver® Custom program, have you made any other electric energy efficiency improvements that do not qualify for any incentive or rebate?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If yes,

Sp-1a. **What have you done?** – *get as much detail as possible.*

Sp-1b. **How much energy or money do you think you have saved as a result?**

If response provided above,

Sp-2. **Any others?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If yes,

Sp-2a. **What have you done?** – *get as much detail as possible.*

Sp-2b. **How much energy or money do you think you have saved as a result?**

Improvements

Impr-1. **One of the objectives that the program would like to see over the next year is increased participation of businesses like yours. Can you think of things that the program can do to help increase participation or help increase interest from people like yourself?**

a. ❑ Increase general advertising
b. ❑ Increase advertising in trade media
c. ❑ Present the program in trade or associated meetings
d. ❑ Offer larger incentives
e. ❑ Offer incentives on other items/include other items
f. ❑ Have program staff call small C&I customers
g. ❑ Make the process more streamlined for customers
h. ❑ Make the process more streamlined for contractors
i. ❑ Other: _____

Impr-2. **At any time during your application process, did you need to contact Duke Energy to obtain information, or ask about progress on the application, or to obtain any other help, assistance or information?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If yes, Impr 2-a. **Were your questions or needs effectively handled by the Duke Energy?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

Impr 2b. **How might this be improved?**

_____

_____

Impr-3. **Overall, what about the Smart $aver® Program works well and why?**

_____

_____

Impr-4. **What doesn't work well and why?**

_____

_____

Satisfaction

We would like to ask you a few questions about your satisfaction with the program. For these questions we would like you to rate your satisfaction using a 1 to 10 scale where a 1 means that you are very dissatisfied with the program and a 10 means that you are very satisfied.

How would you rate your satisfaction with:

Sat-1. **The incentive levels provided by the program**

1 2 3 4 5 6 7 8 9 10

If score is 8 or less ask: **What could have been done to make this better?**

_____

Sat-2. **The ease of filling out the participation and incentive forms**

1 2 3 4 5 6 7 8 9 10

If score is 8 or less ask: **What could have been done to make this better?**

_____

Sat-3. **The time it took for you to receive your incentive**

1 2 3 4 5 6 7 8 9 10

If score is 8 or less ask: **What could have been done to make this better?**

_____

Sat-4. **The number and kind of technologies covered in the program**

1 2 3 4 5 6 7 8 9 10

If score is 8 or less ask: **What could have been done to make this better?**

Sat-5. **The technical expertise of Duke Energy staff**

1 2 3 4 5 6 7 8 9 10

If score is 8 or less ask: **What could have been done to make this better?**

Sat 6. **The information you were provided explaining the program**

1 2 3 4 5 6 7 8 9 10

If score is 8 or less ask: **What could have been done to make this better?**

Sat 7. **Considering all aspects of the program, how would you rate your overall satisfaction with the Smart Saver® Custom Program?**

1 2 3 4 5 6 7 8 9 10

Sat-7a. If score is 8 or less ask: **What could have been done to make your experience better, or have we already covered it?**

Appendix C: Program Manager Interview Protocol

Name: _____
Company: _____
Title: _____

Hello, my name is _____. I am calling on behalf of Duke Energy. Duke Energy is currently evaluating how well their Smart $aver® Custom program is doing, and your name came up as someone who might be willing to share any ideas you have on how Duke might increase customer participation in the Smart $aver® Custom. Would you be willing to help? I would like do a short interview you that will take about 15 minutes. May I speak with _____ please?

If person talking, proceed. If person is called to the phone reintroduce.
If not free to talk, ask when would be a good time to call and schedule the call-back:

Call back 1:	Date: _____,	Time: _____ ❑AM or ❑PM
Call back 2:	Date: _____,	Time: _____ ❑AM or ❑PM
Call back 3:	Date: _____,	Time: _____ ❑AM or ❑PM
Call back 4:	Date: _____,	Time: _____ ❑AM or ❑PM
Call back 5:	Date: _____,	Time: _____ ❑AM or ❑PM

❑ Contact dropped after fifth attempt.

Establishing Questions:

ES-0. **Would you please tell me what your company does, and what your role is in your company?** _____

ES-1. **Our records indicate that you submitted an application to the Smart $aver® Custom Program in <date> and that you either did not or were not able to participate in the program.**

Do you recall submitting the application for this program?

1. ❑ Yes, *begin* — *Skip to Q2.*
2. ❑ No,
99. ❑ DK/NS

1a. **This program was provided through Duke Energy. In this program, Duke Energy provides incentives for companies to install an energy efficient technologies.**

Do you remember submitting an application for this program?

1. ❑ Yes, *begin* → *Go to Q2.*

2. ❑ No,
99. ❑ DK/NS 

If No or DK/NS terminate interview and go to next participant.

ES-3. **Please tell me what you remember about the intended project: Did you go ahead and do the project? Is it completed? How long did it take? Why did you decide to undertake the project at that time, rather than sooner or later?**_____

Information-Gathering Phase

INFO-1. **How did you become aware of the Smart Saver® Custom Program?**

i. ❑ Duke Energy sent me a brochure
j. ❑ A Duke Energy representative told me about it
k. ❑ Duke Energy website.
l. ❑ A contractor I was working with told me about the program
m. ❑ An equipment supplier
n. ❑ I saw an ad in _____
o. ❑ Other _____
p. ❑ DK/NS

INFO-2. **At the time you became aware of the program and considered taking advantage of the incentive, did you do any additional investigation to confirm the program's participation requirements and program benefits, or was the information you had enough for you to make a participation decision?**

i. ❑ The information received was adequate
j. ❑ Didn't need to confirm/ already knew about it
k. ❑ Went to the program or Duke Energy web site
l. ❑ Called or emailed a Duke Energy contact
m. ❑ Called or emailed a contractor
n. ❑ Called or emailed an equipment salesperson
o. ❑ Other: _____
p. ❑ DK/NS

If c, d, e, f, g:

INFO-3. **Were you able to get the information you needed about the program's participation requirements and benefits?** *Note: many may have only heard about this through their contractors and thus had minimal involvement, so this question may only apply to a few of them.*

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

INFO-4. **While you were deciding whether or not you wanted to participate, did you have additional questions that were not answered or did you need information that you were unable to obtain?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

INFO-4a. **What were they?**

_____

_____

Decision Making

DM-1. **What was the primary reason that you decided to purchase or upgrade your equipment?** *(check all that apply)*

13. ❑ Remodeling
14. ❑ Cost of repair or maintenance of old unit(s)
15. ❑ Parts availability
16. ❑ Reliability issues of old equipment
17. ❑ Equipment was near or past its projected life❑ Equipment failure
18. ❑ Poor performance of old equipment
19. ❑ Contractor recommendation
20. ❑ Energy or energy cost Savings
21. ❑ Environmental concerns
22. ❑ Got a good deal
23. ❑ Needed more modern, smarter equipment (energy manager systems integration or SmartGrid compatible)
24. ❑ Other: *list them*: _____

DM-1a. **Once you learned you were not able to participate in Smart $aver®, what did you decide to do?**

a. ❑ Installed anyway
b. ❑ Installed later
c. ❑ Delayed indefinitely
d. ❑ Cancelled Project

If DM-1a=Installed anyway,

DM-2a. **What did you have installed?** _____

Repeat the following questions for each measure installed:

DM-2b **Is this the same equipment on your Smart $aver® application?** Y/N_____

DM-2c *If not,* **how is it different?**_____

a. ❑ Price higher
b. ❑ Price lower
c. ❑ More efficient
d. ❑ Less efficient
e. ❑ Other _____

If DM-1a=Installed later.

DM-3a. **When did you install the equipment?** _____
DM-3b. **Why did you decide to install at that time rather than sooner?**
DM-3c. **What did you have installed?**
_____

Repeat the following questions for each measure installed:

DM-3d. **Is this the same equipment on your Smart $aver® application?** Y/N_____

DM-3e. *If not,* **how is it different?**_____

a. ❑ Price higher
b. ❑ Price lower
c. ❑ More efficient
d. ❑ Less efficient
e. ❑ Other _____

If DM-1a=Delayed indefinitely:

DM-4a. **When do you realistically expect the project to start?**
_____
DM-4b. **Why do you expect the project to start then, rather than sooner?**
DM-4c. **What do you plan to install?**
_____

Repeat the following questions for each measure installed:

DM-4d. **Is this the same equipment on your Smart Saver® application?** Y/N_____

DM-4e. *If not,* **how is it different?**_____

a. ❑ Price higher
b. ❑ Price lower
c. ❑ More efficient
d. ❑ Less efficient
e. ❑ Other _____

If DM-1a=Cancelled project.

DM-5a. **Can you please share with me the reasons you cancelled the project?**

_____

Skip DM-6 and DM-7, go to next section.

DM-6. **I would like to ask how important the project cost (or the cost of the initial capital outlay), was in your decision making. Would you say the *project cost* was…** *(read and check the best response).*

a. ❑ The primary deciding factor for selecting the equipment,
b. ❑ One of the more important deciding factors.
c. ❑ An important reason, but not more so than other reasons
d. ❑ One of the reasons, but it was a minor or unimportant reason, or
e. ❑ It was not a reason at all,
f. ❑ DK/NS.

DM-7. **I would like to ask how important the cost of energy (or the ongoing costs of energy usage), were in your decision making. Would you say the energy *cost* was…** *(read and check the best response).*

a. ❑ The primary deciding factor for selecting the equipment,
b. ❑ One of the more important deciding factors.
c. ❑ An important reason, but not more so than other reasons
d. ❑ One of the reasons, but it was a minor or unimportant reason, or
e. ❑ It was not a reason at all,
f. ❑ DK/NS.

_____

_____

Application Process

App-1. **Who filled out the program application forms for your company?** *(check all that apply).*

a. ❑ I did
b. ❑ Someone from my company did
c. ❑ The contractor
d. ❑ The salesperson
e. ❑ Someone from Duke Energy
f. ❑ Other: _____

App-2. **Who submitted the completed forms to Duke Energy?**

a. ❑ I did
b. ❑ Someone from my company did
c. ❑ The contractor
d. ❑ The salesperson
e. ❑ Someone from Duke Energy
f. ❑ Other: _____

If they filled it out.

App-2a. **On a scale of 1 to 10, please rate how easy it was for you to understand the application form. Please rate 10 for extremely easy and 1 for extremely difficult.** *(A zero would mean it was too difficult to fill out at all.)*

If they don't recall the application,

App-2b. **I've emailed you a copy of the application form to refresh your memory: Do you remember what part of it was difficult?**

_____

App-3. **Did you have any problems receiving the incentive or having the application approved?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If yes, App-3a. **Please explain the problem and how it was resolved. Was it resolved to your satisfaction?**

_____

_____

Spillover – Channeling into Other Programs

Ch-1. **When firms have experience with energy efficiency programs or products they sometimes make similar decisions to continue the energy savings in other parts of their business. Has your firm taken advantage of any other Duke Energy's energy efficiency**

programs as a result of your participation in the Smart Saver® Custom program? If yes, what?

2. 1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If yes,

Ch-1a. **What have you done?** – *get as much detail as possible.*_____

Ch-1b. **How much energy or money do you think you have saved as a result?**

Spillover - Electric

Sp-1. **As a result of your participation in Duke Energy's Smart Saver® Custom program, have you made any other electric energy efficiency improvements that do not qualify for any incentive or rebate?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If yes,

Sp-1a. **What have you done?** – *get as much detail as possible.*

Sp-1b. **How much energy or money do you think you have saved as a result?**

If response provided above,

Sp-2. **Any others?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If yes,

Sp-2a. **What have you done?** – *get as much detail as possible.*

Sp-2b. **How much energy or money do you think you have saved as a result?**

Improvements

Impr-1. **One of the objectives that the program would like to see over the next year is increased participation of businesses like yours. Can you think of things that the program can do to help increase participation or help increase interest from people like yourself?**

a. ❑ Increase general advertising
b. ❑ Increase advertising in trade media
c. ❑ Present the program in trade or associated meetings
d. ❑ Offer larger incentives
e. ❑ Offer incentives on other items/include other items
f. ❑ Have program staff call small C&I customers
g. ❑ Make the process more streamlined for customers

h. ❑ Make the process more streamlined for contractors
i. ❑ Other: _____

Impr-2. **At any time during your application process, did you need to contact Duke Energy to obtain information, or ask about progress on the application, or to obtain any other help, assistance or information?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If yes, Impr 2-a. **Were your questions or needs effectively handled by the Duke Energy?**

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

Impr 2b. **How might this be improved?**

_____

_____

Impr-3. **Overall, what about the Smart $aver® Program works well and why?**

_____

_____

Impr-4. **What doesn't work well and why?**

_____

_____

Satisfaction

We would like to ask you a few questions about your satisfaction with the program's offerings. For these questions we would like you to rate your satisfaction using a 1 to 10 scale where a 1 means that you are very dissatisfied with the program and a 10 means that you are very satisfied.

How would you rate your satisfaction with:

Sat-1. **The incentive levels provided by the program**

1 2 3 4 5 6 7 8 9 10

If score is 8 or less ask: **What could have been done to make this better?**

_____

Sat-2. **The ease of filling out the participation and incentive forms**

1 2 3 4 5 6 7 8 9 10

If score is 8 or less ask: **What could have been done to make this better?**

_____

Sat-3. **The time it took for you to receive notice on whether the application was approved or declined.**

1 2 3 4 5 6 7 8 9 10

If score is 8 or less ask: **What could have been done to make this better?**

_____

Sat-4. **The number and kind of technologies covered in the program**

1 2 3 4 5 6 7 8 9 10

If score is 8 or less ask: **What could have been done to make this better?**

_____

Sat-5. **The technical expertise of Duke Energy staff**

1 2 3 4 5 6 7 8 9 10

If score is 8 or less ask: **What could have been done to make this better?**

_____

Sat 6. **The information you were provided explaining the program**

1 2 3 4 5 6 7 8 9 10

If score is 8 or less ask: **What could have been done to make this better?**

_____

Sat 7. **Considering all aspects of the program, how would you rate your overall satisfaction with the Smart Saver® Custom Program's application process?**

1 2 3 4 5 6 7 8 9 10

Sat-7a. If score is 8 or less ask: **What could have been done to make your application experience better, or have we already covered it?**

_____

Process Evaluation of the 2011 Ohio Power Manager® Program

Final Report

Prepared for
Duke Energy
139 East Fourth Street
Cincinnati, OH 45201

November 30, 2011

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Table of Contents

Summary of Findings

Customer Satisfaction

- Satisfaction with the Power Manager® program is high with over half of the survey respondents rating their satisfaction at 9 or 10 on a 10-point scale for all program aspects: including overall program satisfaction, as well as satisfaction with program enrollment, and program information.

Motivating Factors

- More than 85 percent of the surveyed participants (n=73) were able to recall at least one benefit promoted by the program. In addition, the surveyed participants that recalled program benefits were able to provide 107 benefits (1.4 each) they recalled being promoted by the program. Of the 107 benefits recalled by these participants, 62% of them mentioned financial benefits either by recalling the bill credits or financial incentives for participating in the Power Manager program.

- Most participants rate environmental issues as important or very important to their participation. About 6 percent of respondents are members of an organization with an environmental mission.

- Many (54.8%) of the participants do not recall whether control events occurred since they joined the program. Eighty-four percent of participants did not notice the bill credits on their bill.

- Saving money is the most commonly recalled benefit (62%) of the program as well as the most cited reason (56%) for participation.

Survey Findings

- The majority of participants (83.1%) that are at home during a Power Manager activation event, experience no change in comfort during the event.

- Eleven percent of participants who indicated that they were at home during an event stated that they had noticed no Power Manager activation had occurred in the past seven days. Twenty-one percent of event participants indicated they had noticed an activation, and sixty-eight percent were unsure of whether an activation had occurred or not.

- Twelve percent of participants contacted after a hot day without a Power Manager event stated that they thought an activation event had occurred in the past seven days even though no event had actually occurred. Twelve percent of these "non-event" participants were correct in thinking that no Power Manager activation had occurred, and seventy-five percent were unsure of whether an activation had occurred or not.

- No participants who experienced a change in comfort during a Power Manager control event reported using auxiliary or room air conditioners to compensate for the reduced cooling capacity of the central air conditioner during an event. However, 25.4% reported using a fan during the control events to help maintain comfort levels, while 22.9% of the respondents report using a fan during non-event hot days during typical control time frames.

- Customers are comfortable in their home with their air conditioners on, and do not experience any significant change in comfort regardless if there is a control event or what the high temperature or heat index of the day is. There is no evidence of any correlation between high temperature (or heat index) and changes in comfort on days with Power Manager events.

Recommendations

- Consider using Home Energy House Call and Residential Smart $aver® as a lead generation tools for new Power Manager enrollees so that participants in these programs have the opportunity to learn about and request participation in Power Manager. During these efforts, HEHC audits can examine the AC unit and determine if it is a good candidate for Power Manager before informing customers. Likewise, Residential Smart $aver can serve as a lead tool by forwarding rebate information for new AC units to Power Manager marketing managers. These managers can then have contact information identifying customers who are predisposed to want to take energy efficiency actions in their home.

- If Duke Energy is interested in determining whether a new customer has the capacity to reduce by 1.5 kW, Duke Energy should consider having the installation technician gather additional information about the customer's home and the AC units at the time of the switch installation and set participation conditions for approval of the 1.5kW level based on their housing observations. For homes with "smart-meters", Duke Energy could establish assessment algorithms that test the load swings during hot periods and establish a 1.5kW participation threshold.

Introduction

This document presents the evaluation report for Duke Energy's Power Manager® Program as it was administered in Ohio.

The evaluation was conducted by TecMarket Works with assistance from Integral Analytics and Yinsight. The survey instruments were developed by TecMarket Works. The survey was administered by TecMarket Works. Yinsight (a TecMarket Works subcontractor) conducted the in-depth interviews with program management.

Methodology: Management Interviews

The in-depth management interviews were conducted with five Duke Energy program staff and three representatives from Power Manager's two main vendors, Cooper Power Systems and Good Cents.

Methodology: Recency Surveys

TecMarket Works conducted after-event surveys (recency surveys) to collect participant information for this evaluation. The survey was maintained in a "ready-to-launch" status until notified of a control event affecting Cannon switches used by Duke Energy Ohio. The surveys were launched as soon as possible following the end of the control event (at 5pm Eastern) and continued over a 51 hour period with all call attempts made during regular surveying hours (10:00 a.m. to 8:00 p.m. Eastern Standard Time, Monday through Saturday). For example, if a control event occurred on a Monday, calling hours for that particular event were:

- Monday 5pm-8pm Eastern
- Tuesday 10am-8pm Eastern
- Wednesday 10am-8pm Eastern

Recency surveys followed events occurring on July 12, July 20, July 21, July 29, and August 1, 2011. TecMarket Works surveyed a total of 111 participants in Ohio. The draft Recency Survey can be found in Appendix C: Participant Recency Survey.

Before we asked the participants about the event, we inquired if they knew that there was a control event within the last 7 days so that we could understand if they are able to identify when a control event had occurred. The surveyor then notified the customer that they had just had a control event which had begun at *<start hour of control>* and ended at *<end hour of control>*. This allowed the participants to immediately recall the time period of the event and be able to respond to questions regarding the impact of that event on their use of their air conditioner and allow recollection of other actions taken, as well as the impact of the event on their comfort. Once informed of the event that had just occurred, the survey also assessed satisfaction with the program at the point of an event.

TecMarket Works also called Power Manager participants on hot days without control events to conduct the same survey (with slight wording alterations, as shown in red text Appendix D: Participant Recency Survey for Non-Event Day Comparison). This survey was conducted on four different non-event days of at least 91°F. The heat index was also considered in

determining a non-event day. On and following the high temperature dates of July 11, July 18, July 28, and September 2, TecMarket Works surveyed at total of 53 Power Manager participants.

Methodology: Participant Surveys

TecMarket Works developed a customer survey for the Power Manager Program participants, which was implemented in July and August of 2011 after they experienced control events over the summer of 2011.

The complete survey was conducted using a random sample from 11,993 Power Manager participants in Ohio. There were 85 Ohio customers willing to participate in the survey, however only 84 were able to complete the full survey. The responses from the 85 surveyed participants are included in the analysis for all questions which they were able to complete. These participants were surveyed by TecMarket Works. The survey can be found in Appendix B: Participant Survey Instrument.

Section 1: Program Operations

Interviewees

The in-depth management interviews were conducted with five Duke Energy program staff and three representatives from Power Manager's two main vendors, Cooper Power Systems and Good Cents.

Program Description

Power Manager is a voluntary residential program, available to homeowners with central air conditioning (AC). On days where energy demand and/or energy costs are expected to be high, Duke Energy has permission from Power Manager participants to cycle their air conditioning off for a period of time.

There are two requirements that must be met for a customer to be eligible to participate in Power Manager. First, they need to own and live in their single family home. Second, they need to have a functional central air conditioner with an outside compressor that can be controlled. When customers enroll, Duke Energy installs a switch that allows the AC unit to be cycled off and on in response to signals sent over Duke Energy's internal paging system.

The Power Manager program allows customers to select which load reduction target they would be willing to achieve, either 1.0 kW or 1.5 kW. During an event, customers in the 1.5 kW option would have their air conditioner cycled off for a few minutes longer in each half hour than the 1.0 kW customers. Events may be called on non-holiday weekdays during the months of May through September.

Within Duke Energy Ohio's portfolio, Power Manager is currently the only residential demand response program[1]. The Power Manager program plays a key role in capacity planning; every year, Power Manager provides an estimate as to how much capacity it can provide during the summer season, and this information is taken into account by the capacity planners.

Program Operations

Marketing and Enrollment

Duke Energy markets the Power Manager program through direct mail and the Duke Energy website. The program is marketed primarily through direct mail. Each mail drop is targeted to customers within a geographic cluster so that switch installations for new customers minimize the need for technicians to drive long distances. In addition to geographic targeting, Duke Energy also targets customers whose market segment profiles indicate a propensity to participate in Power Manager. If a customer does not respond to the initial offer, Duke Energy sends a reminder after three weeks. Each mailed offer includes a tear-off business reply card that customers can fill out and send back in order to enroll.

[1] Not including pilot programs.

Duke Energy constantly refines their product brochure and their marketing campaigns. In 2011, Duke Energy began pilot testing new marketing approaches. In one successful pilot, Duke Energy mailed the product brochure with a cover letter from the Power Manager product manager, and reported that participant rates increased. In another pilot, Duke Energy contacted customers who had previously participated in the Home Energy House Call (HEHC) program and had indicated that they had air conditioners. Duke sent these customers a letter thanking them for participating in HEHC, and included additional information about the benefits of participating in Power Manager that were not described in the product brochure. A Duke Energy product manager reports that the campaign was so successful they have been including the additional information in their current targeted mailing campaign. A Duke Energy product manager reports that the Power Manager marketing effort in 2011 has faced some internal challenges due to staff turnover and several factors that temporarily limited switch supplies, and that program enrollments will be lower than anticipated due to the delays in launching marketing campaigns. However, those problems have been resolved and the Duke Energy product manager reports that the Power Manager team has been making up lost ground.

The Power Manager program is also marketed through Duke Energy's website. The website provides a toll free number to enroll by phone, as well as an online enrollment form. A vendor, GoodCents, receives the mail, phone and online enrollment requests. GoodCents then processes the enrollment information and schedules the switch installation with their technicians.

The Duke Energy product manager reports that they had also pilot-tested an outbound calling campaign through their internal call center staff. That pilot was so successful that Duke Energy is now exploring options to outsource that calling campaign with third party call centers, in support of the Power Manager mail campaign.

Power Manager Incentives

Ohio customers receive an incentive for enrolling as well as an incentive based upon the events that are called. Customers enrolling in the 1.0 kW option receive a $25 bill credit, and customers enrolling in the 1.5 kW option receive a $35 bill credit. Because there is no screening for kW reduction capacity during the enrollment process and because there are residential customers who do not use enough energy to have the capability to reduce demand by 1.5 kW, Duke Energy de-emphasizes the 1.5 kW enrollment option in some marketing materials. The website and online enrollment form for Power Manager mentions both options, while the mailed brochure (which is also available online) only mentions the 1.5 kW option in small print. If a customer has more than one central air conditioning unit, they are eligible for the installation incentive for each AC unit that is controlled. If they enroll, they must enroll all AC units.

If events are called, customers also receive an event credit based upon the price of energy and the duration of the event. In return for the capability to cycle a customer's AC unit off during periods of high demand, Duke Energy shares savings from not needing to purchase or generate additional energy to meet higher demand. Customers are guaranteed a minimum seasonal credit, even if no events are called: Participants in the 1.0 kW option receive a minimum of $5 per season, and participants in the 1.5 kW option receive a minimum of $8 per season. Like the installation incentive, if multiple AC units are enrolled, the event incentive is given for each AC unit that is controlled.

Switch Installation and Removal

Customers are told that a field technician will be coming out in 30-45 days, and that they should receive their installation bill credit within 60-90 days, as well as any cycling credits. Customers do not need to be home for the installation, unless there are access issues.

During the installation, technicians first make sure that the AC is compatible and in good working condition. After they install the switch, the technician will conduct some tests on the switch and leave a door hanger with Power Manager FAQs and a number to call if the customer has any questions.

If a new Power Manager participant has signed up for the 1.5 kW program, Duke Energy may wish to check whether that customer's AC energy usage (within that specific home's size and condition) offers the capacity to reduce by 1.5 kW at the time of the switch installation. This may be accomplished in different ways. For example, the installation technician could copy down the make and model number of the outdoor unit, and Duke Energy could later look up the cooling capacity (tons) and the efficiency (EER; which can be translated to kW/ton) to estimate the load reduction potential. Likewise, Duke Energy could develop rules-of-thumb regarding house age, size and condition and the size of the AC unit to set limits on the 1.5kW offer. Or, if the AC unit is running at the time of the switch installation, the technician can bring a portable watt meter and measure the unit kW and assess the characteristics of the home to make a determination while on site.

> RECOMMENDATION: If Duke Energy is interested in determining whether a new customer has the capacity to reduce by 1.5 kW, Duke Energy should consider having the installation technician gather additional information about the customer's AC units at the time of the switch installation and set participation conditions for approval of the 1.5kW level based on their housing observations. For homes with "smart-meters", Duke Energy could establish assessment algorithms that test the load swings during hot periods and establish a 1.5kW participation threshold.

GoodCents is also responsible for removing control switches and reports that the most common reason for removal requests is customer discomfort during events. However, GoodCents suggests that the perceived discomfort may be more mental than physical, since in their opinion, home temperatures only rise, on average, 2-3 degrees during an event. Homes with undersized units that would require a near 100% duty cycle to maintain set point temperatures may be impacted to a greater degree. Good Cents reports that the disconnect request rate has been fairly steady over the past few years. A Duke Energy staff member reported that customers who call to request a disconnect may be offered a lower kW program. If this is a substantial issue for Duke Energy, it may be informative for Duke Energy to conduct a study comparing the house and AC size characteristics with the disconnect or drop-out rate, to try to determine whether it is customers with undersized AC units that tend to drop out. If customers with undersized AC units are indeed the ones that tend to drop out, Duke Energy may wish to refine their targeting to avoid soliciting those customers.

Incentive Payments

Incentives are paid as credits on a customer's bill. A GoodCents project manager reports that GoodCents is responsible for maintaining the customer participation record, which requires extensive tracking of the incentive records. GoodCents provides Duke Energy with records of which customers had installations or were removed. Duke Energy in return provides GoodCents with information on the cycling credits for each event. GoodCents then applies that information in the participating customer's record, and that information is transmitted back to Duke Energy so that Duke Energy can apply a credit on the customer's bill. GoodCents reports that they've implemented tight security controls through use of firewalls and data backups. Quality control is implemented through comparison of GoodCents' files and Duke Energy's payout records.

Events

Events may be called for economic reasons that are determined by Duke Energy, or for emergency needs that are determined by MISO (the Midwest Independent Transmission Systems Operator). Emergency needs may arise when MISO determines that there is a critical shortage in the energy supply or if the reliability of the electrical grid is threatened by abnormal events. However, one Duke Energy program manager reports that emergency events have only rarely been called.

Duke Energy's Retail Energy Desk (RED) is the group responsible for monitoring several variables that may indicate the need for a Power Manager economic event. During the summer event season, a RED staff member monitors load forecasts, energy prices, system operating conditions, temperature, and tracks recent event activity. On days in which all indicators suggest an event could be called, the RED staff calls a meeting with key stakeholders to consider whether or not to call a Power Manager event. Stakeholders include customer service representatives, system operations representatives, and program managers. The meeting discussion revolves around whether there are any customer-related or system-related concerns about having an event. Because Duke Energy is an energy supplier and Ohio's energy market is deregulated, the RED also must ensure that all communications about Power Manager in the Midwest states follow the codes of conduct that have been established to keep regulated and deregulated energy market information separate.

When the decision is made to have a Power Manager event, the RED staff member notifies the appropriate personnel within Duke Energy, including the call center operators (to be ready to field customer calls), about which hours and which regions will be affected.

The RED staff triggers an event by means of a software "head-end" system. This head-end system sends out a signal to cycle AC units through a paging system over a VHF frequency channel that is owned by Duke Energy.

Customers in Ohio have the ability to opt out of one day per month without being removed from the Power Manager program. To opt out of a day (whether or not an event is actually called on that day), they only need to call the customer service number that is answered by Good Cents. If customers would like to be permanently removed from the Power Manager program, they can also make that request through the customer service number.

Technology

The control switches in Ohio are Cannon switches made by Cooper Power Systems. These switches all allow one-way communication in real time, and are intelligent switches that can adjust the AC unit's cycle duration to target a specific kW reduction. These Cannon switches also allow cycling data to be stored for 90 days. A Duke Energy program manager reports that the switch installations had been temporarily delayed due to an equipment supply chain disruption after the 9.0 earthquake and tsunami in Japan in March 2011. However, at the time of the interviews the supply chain disruption had been resolved.

Cooper Power Systems recently provided a new software package called Quick Read that provides field technicians with the capability to download data to their computers within 2-3 minutes, after which it can be emailed to the research division. The previous version of the Cannon switch software required 20 minutes for each switch to be scanned, and the scanner could only hold data for 20 switches before it had to be brought back to Duke Energy's offices to be downloaded. The new software capabilities present a significant improvement in data collection efficiency. However, soon after the switches were installed, during a testing period, Duke Energy learned of some data problems that needed to be solved. At the time of these management interviews in July of 2011, Cooper is working with Duke Energy to resolve a data file problem that prevents immediate access to the Quick Read data. Because of the way that the switch is designed, during a scan, all data is first saved in a proprietary format. After that, the separate files from each switch are decoded. Due to a software error, the separate files are not being decoded automatically. In order to retrieve the data, the proprietary format data files need to be sent to Cooper Power Systems, where it is decoded by a project manager and then sent back to the research division. A Duke Energy staff member reports that this software issue was improved before the end of the summer data collection by Cooper providing a new version of the Quick Read software.

Cooper Power Systems reports that it was Duke Energy who suggested developing a switch that enabled a targeted cycle by incorporating AC capacity into the calculation of shed time, to target a specific level of kW reduction from an AC unit. Duke Energy wanted to target a fixed kW level such as 1 kW reduction from every house, which might require some AC units to be turned off for different lengths of time, depending upon their power usage. That type of switch had not yet been developed, "No one had that; no one could do that." Cooper Power Systems reports that, working in response to Duke Energy's needs, they developed an intelligent Target Cycle switch that was able to convert the amp draw into a kW value. The Target Cycle switch has the additional benefit of preventing lower impacts from oversized AC units: if a customer had an AC unit that was twice as big as they really needed, then the AC's natural duty cycle would fit into a legacy switch's 50/50 cycle, resulting in zero load shed against that customer's baseline AC energy use. By using the intelligent switches, Duke Energy is assured of achieving the target kW during each event by controlling the duty cycle until that load attainment is achieved. This is a substantial improvement in the ability to acquire the contracted load reduction via residential AC load control programs. The availability of the new switches impacts load control programs well beyond Duke Energy's territory.

One Cooper Power Systems project manager mentioned that the Duke Energy Power Manager product manager gave a presentation on target cycling at their annual Cannon switch Users

Group Meeting and that it was very helpful. They would recommend that Duke Energy continue to do that for several reasons: 1) it was an opportunity to receive more training on the technology, 2) it was an opportunity to meet and talk with Cooper's firmware and hardware developers face to face, 3) it was an opportunity for Duke Energy to direct the development of future technologies, and 4) it would allow Duke Energy to see what other utility customers were doing with the same equipment and perhaps give Duke Energy new ideas for demand response programs.

Vendor Relationships

Both vendors interviewed volunteered that Duke Energy staff was very easy to work with. One vendor states, "*I enjoy the partnership with them. They have been a great partner and it's always a joint venture.*" Another vendor reports that they consider Duke Energy's "spring training" sessions to be an industry best practice. Every spring, Power Manager's team invites both GoodCents and Cooper Power Systems project managers to a multi-day session where all parties are free to share ideas and work collaboratively towards addressing any upcoming issues. "*It's such a nice way to run a program. We've taken that concept and tried to work with other big utilities to encourage them to do the same. Talking before there are problems or issues, and solving little things before they turn into big things; that's so helpful for everybody.*" This opportunity gives all parties a chance to build relationships that can facilitate open communications in the future, and to delve into "big picture" issues without interruption in a way that may not be possible in a normal work day.

Power Manager Research

The Retail Energy Desk's research analysts have responsibility for determining the impact of the Power Manager program. The research analysts conduct two main studies, an AC duty cycle study and a switch operability study. The AC duty cycle study provides a regression model of residential energy use (assuming all switches are in working order) during summer months if no events were called. This natural duty cycle can then be used as a baseline against which to calculate kW reduction when events are called. The AC duty cycle study is conducted with a sample of residents (referred to as "the M&V sample") who are often not cycled during events, in order to capture their energy use on peak load days.

The operability study provides an estimate of the number of AC units in the field that are responding as expected. By combining the operability ratio with results from the regression model, Duke Energy is able to provide an estimate of load reduction from the population of AC units with operable switches.

This year, Duke Energy's research division is planning to conduct a separate payback study that looks at overall payback from an event. After an event call, air conditioners tend to run longer to handle the rise in indoor temperature that occurs after AC units have been cycled off. The payback study will look at event energy use including the period of time after an event call. Data collection occurs throughout the event season and is completed by October of each year to allow for impact analyses.

Impact Analysis

One recommendation from the previous evaluation study was to estimate load reduction directly from a representative sample of the population, instead of modeling reduction using a natural duty cycle model. Duke Energy has adopted this recommendation and reports that they will be testing a methodology based upon that recommendation that uses data from a particular event to estimate "snapback[2]", instead of using data that are averaged across several events.

Data Collection Efforts

Data collection efforts throughout the summer event season allow Duke Energy to monitor the quality of data being obtained. According to Cooper Power Systems, Duke Energy is unique among their customers for monitoring data quality and this has allowed Duke Energy to identify any problems with enough time to resolve them. "*What is going really well is what the [Duke team] does with the M&V data, and the fact that they're continuously collecting data so that they know what their system is capable of doing at any time. I have so many customers that wait until the end of the year to collect data only to find out something was not working... they might have had [switch] addressing wrong or some other little problem. These kinds of issues don't get past Duke... If I could copy what they do for our other utilities it would be a good thing.*"

A research division staff member reports that her group had faced some challenges in 2011 with unanticipated data collection needs. Duke Energy hires contractors to collect data in the field, but in order to scope their contracts, the research division had to estimate its sample sizes in February, prior to being able to finalize their kW model for Power Manager 2011. When a problem arose with a planned data collection effort and the research division needed more data, they had initial difficulty obtaining additional data because it required efforts that were beyond the planned scope of the contract. That problem was resolved. Another Duke Energy staff member explains that their data collection vendors are routinely accommodating of requests outside of their contract terms but that each data collection effort requires planning and staffing. This staff member explains that each year's research needs are delineated during the Power Manager spring training sessions, well in advance of the event season. Because the timing and geographic coverage of these data needs vary depending on each research study, the vendor must have sufficient time to plan for and hire enough temporary staff for each effort: the wider the geographic coverage, the more staff they need to hire and train. The Duke Energy staff member explains that current contracts with vendors do include provisions for unanticipated data collection needs, but these data collection efforts cannot be fielded immediately simply because it takes time to adequately staff each effort.

AC Duty Cycle Study

Data for the AC duty cycle study is collected throughout the summer. However, due to a bug in the new Quick Read software, the research division has not received the AC run time data at the time of these interviews (July of 2011). This is expected to be a temporary problem since Cooper Power Systems can manually decode the data files. This problem should be considered a one-time event because Cooper Power System is currently working on a permanent solution.

[2] "Snapback" refers to an increase in load after a demand response event, as ACs must operate longer to return to the set temperature. Duke Energy's Research Group internally refers to snapback as "payback".

The sample for the impact analysis of Power Manager Ohio is combined with the sample for Power Manager Kentucky. Together, the sample size is 72. While not overly robust, this is a reasonable sample and we do not recommend increasing it at this time.

Program Changes

One recommendation from the previous evaluation study was to add more staff to help with administrative needs during the control season. The Duke Energy program managers reports that staff has been added, and that program management has been restructured so that there is now a RED staff member dedicated to Power Manager and one dedicated to PowerShare®, the nonresidential demand response program. In past years, program management was assigned based on geography so that the Midwest region had one RED staff member and the Southeast region had another RED staff member, with each one responsible for both Power Manager and PowerShare within their region. A Duke Energy manager reports that he has seen an improvement in operations with this new program management structure: "*It's working out better, to date*".

Future Plans for Power Manager

The Duke Energy product manager is currently considering improvements to the Power Manager program, one of which is a communications network with HVAC dealers and repair service groups. This would allow Duke Energy to notify them of the start and stop times of any events so that they can properly respond to any calls from customers about inoperable air conditioners. Another improvement that Duke Energy is considering is using the Duke Energy website to inform customers of events. While there exists a hotline that customers can call for information, providing event information on a website would meet the needs of customers who prefer web-based communications.

There do not seem to be any other major improvements to Power Manager that are needed at this point, according to the interviewees. Although interviewees described several current efforts under way to address Power Manager program challenges, most interviewees could not identify any new issues that had not or were not already being addressed. One vendor explained, "*That's the benefit of [getting to know each other so well during] 'spring training', if we see it we can just tell them. I don't see anything outstanding.*"

Section 2: Participant Survey Results

TecMarket Works conducted telephone surveys with 85 randomly selected program participants in the state of Ohio. This section presents the results from the surveys. The survey instrument can be found in Appendix B: Participant Survey Instrument. Of the 85 participant surveys, completed surveys were obtained from 84 participants. The results from the 84 completed surveys are presented below, with the results of the partial survey included as applicable.

Participation Drivers

Surveyed Power Manager program participants in Ohio were very likely to have been involved with the decision to participate in the Power Manager Program with all but one out of 85 surveyed (98.8%) indicating that they were involved.

Table 1. Were you involved in the decision to participate in Duke Energy's Power Manager Program?

	OH	
	N	Percent
No	1	1.2%
Yes	84	98.8%
Don't Know	-	-

Most of the surveyed participants learned of the Power Manager program from a direct mail offer, through a bill insert, or through a call from a Duke Energy employee. Very few surveyed participants learned of the program from the Duke Energy web site or through word of mouth. Direct mail continues to be the most successful approach for enrolling customers compared to all other approaches examined.

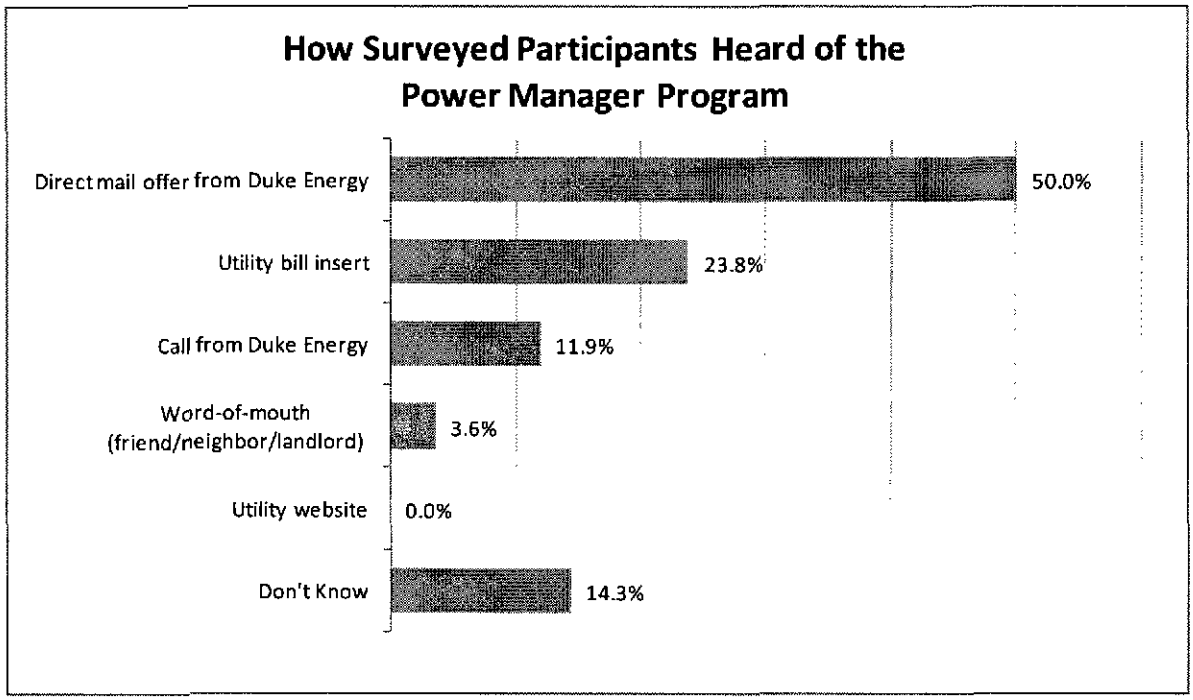


Figure 1. How Participants Learned of the Power Manager Program

Recalling Promoted Program Benefits

During the survey, we asked participants an unprompted question to recall what the promoted program benefits were. The results are presented per participant in the table below, and illustrated as a percentage of all responses in Figure 2. The "Tags" column categorizes the survey responses using five tag words to summarize various responses, including:

1. Money savings: used if the participant mentioned bill credits or lowered bills
2. Energy savings: used if the participant mentioned energy savings
3. Reduced outages: used if the participant mentioned reduced load or preventing brown-outs or black outs
4. Environmental benefits: used if the participant mentioned environmental benefits
5. Other: used if the participant mentioned benefits such as "helping the community" or other benefits that do not fall into the above categories.

The tag words/responses are then summarized in Figure 2.

Table 2. Participants' Recalled Program Benefits

Recalled Benefits	Number of times mentioned	Percentage of participants (n=84) recalling each benefit
Lower bills by using less energy	43	43.0%
Save Energy	41	26.6%
Reduce Outages	15	21.5%
Bill credits	4	19.0%
Incentive	3	11.4%
Helping the Environment	1	2.5%

Note: adds to more than 100% due to multiple responses

Eighty-six percent (73 out of 84) of the surveyed participants were able to recall benefits promoted by the program. The surveyed participants that did recall program benefits were able to provide 107 benefits that they recalled being promoted by the program. Of the 107 benefits recalled by these participants, 46.7% of them mentioned money savings either by recalling the bill credits or financial incentives for participating in the Power Manager program. The next most commonly recalled program benefit was the energy savings that can be obtained through participation at 38.3% of all recalled benefits. Fourteen percent of the recalled benefits included a mention of the load control function of the program as a means of reducing blackouts and/or brownouts.

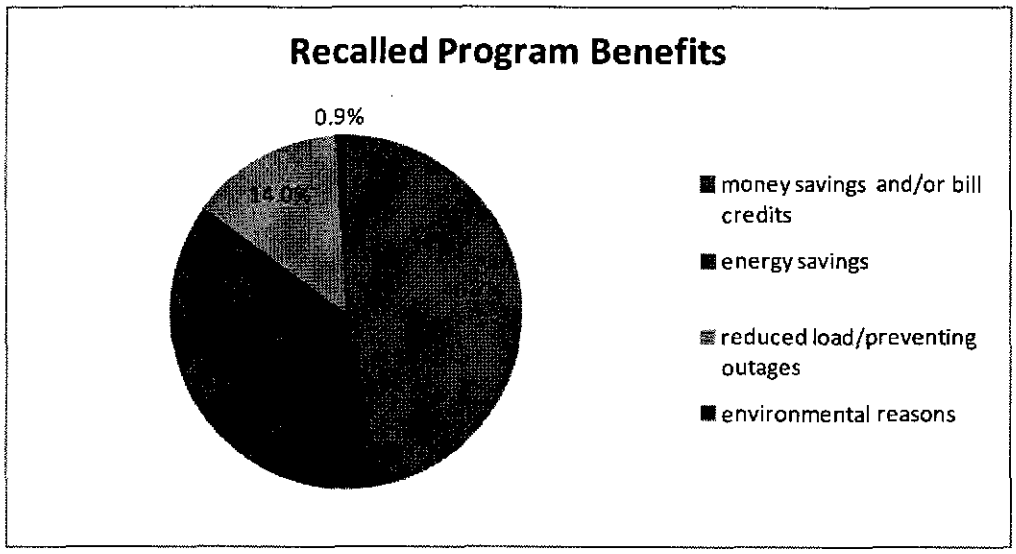


Figure 2. Recalled Program Benefits: Summary of Responses

In addition to asking about the benefits of the program, TecMarket Works also asked the surveyed participants about their reasons for participating in the Power Manager program. The most common response was "to save energy", however many respondents expected to have

lower utility bills (31.3%) if they participated. "Helping Duke Energy avoid power shortages" was also an often-cited response.

Table 3. Reasons for Participation in Power Manager

Reason for Participation	N	Percent
To save money (through lower utility bills)	29	34.1%
For the bill credits	19	22.4%
To save energy	18	21.2%
Helping Duke avoid power shortages/outages	15	17.6%
To help the environment	4	4.7%

After respondents told us why they participated in Power Manager, we asked them if they recalled reading about the benefits or reasons presented in the program brochure. Table 4 summarizes their responses. Fifty-four percent (45 of 84) of all respondents did not remember the brochure. However, nearly all of the respondents who did remember getting the brochure also remembered reading about the specific benefits.

Table 4. Reason for Participation: Read in Program Brochure

	Do you recall reading about this benefit on the program brochure?					Total
	No	Yes	Do not remember brochure	Did not get brochure	Don't Know	
To save money (through lower utility bills)	1	14	14	0	0	**29**
For the bill credits	0	6	12	0	1	**19**
To save energy	0	6	10	0	2	**18**
Helping Duke avoid power shortages/outages	1	5	7	1	1	**15**
To help the environment	0	2	2	0	0	**4**
Total	**2**	**33**	**45**	**1**	**4**	**84**

Importance of Environmental Issues to Participants

Most (91.7%) surveyed Power Manager participants indicated that environmental issues are either "important" or "very important" to them. Only one respondent indicated that environmental issues were "not at all important", and a few said that they thought environmental issues were "not important" or "neither important nor unimportant."

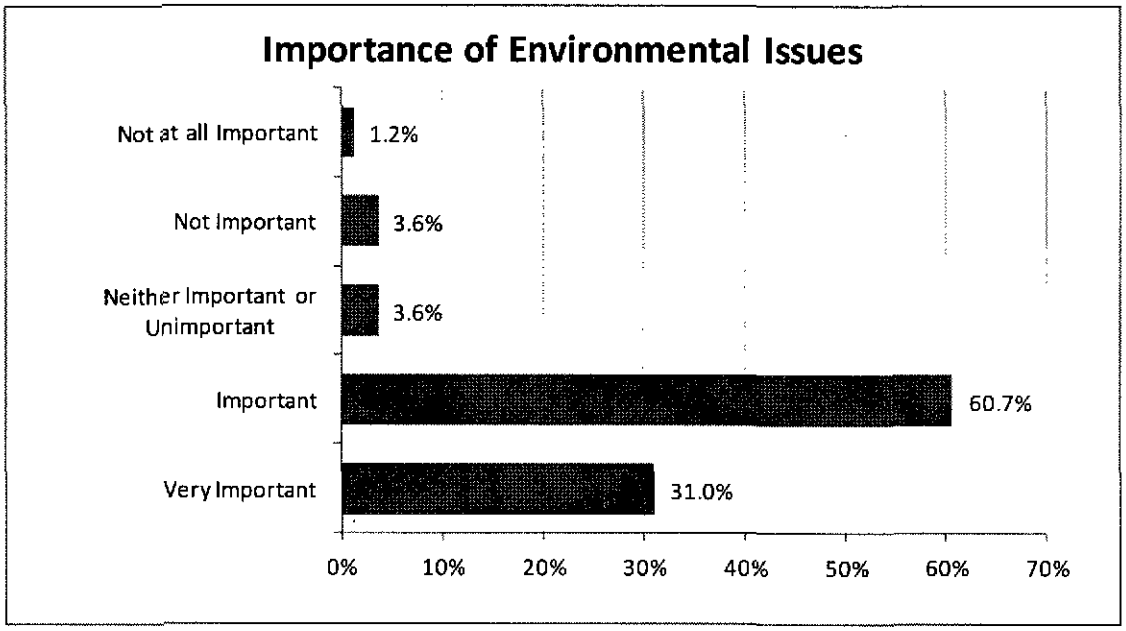


Figure 3. Importance of Environmental Issues to Power Manager® Participants

When TecMarket Works asked the surveyed participants about the importance of climate change issues; responses shifted. About a third (28.6%) of the surveyed participants found climate change issues to be "very important" and an additional 36.9% said they were "important". Together, 65.5% said that climate change issues were important or very important. However, 20.2% found them to be "not important," and 4.8% said that climate change issues were "not at all important".

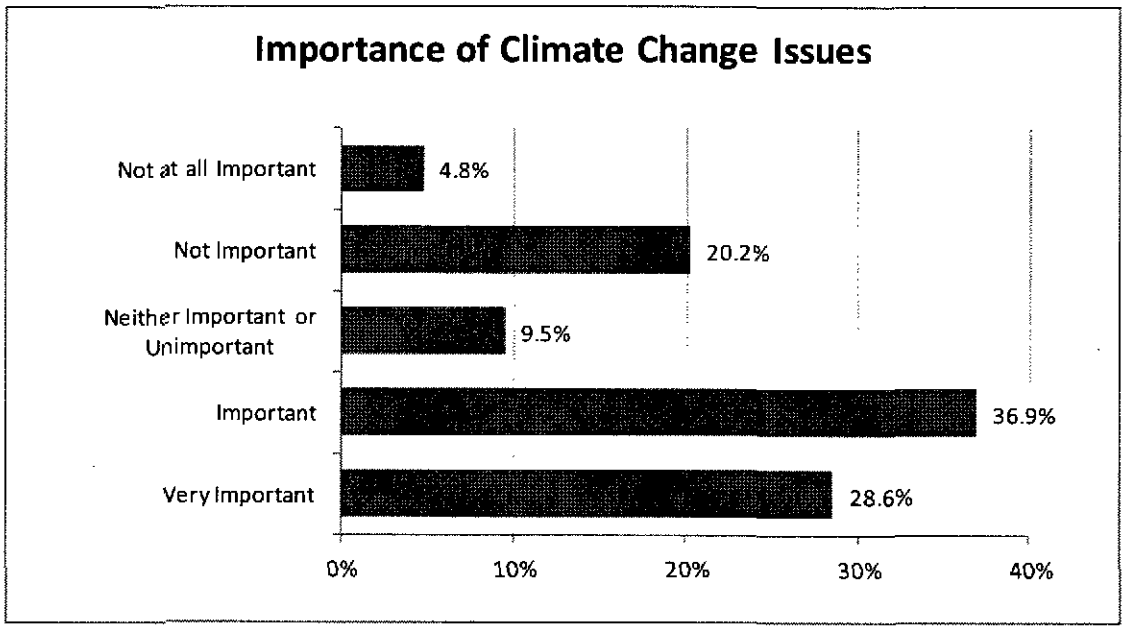


Figure 4. Importance of Climate Change Issues to Power Manager Participants

Reducing air pollution was more important to participants than climate change issues. Together over 93% of respondents said that reducing air pollution was "important" or "very important" in their participation decision. Power Manager participants represent a population segment that is focused on environmental issues and considers these issues important or very important in their participation decisions.

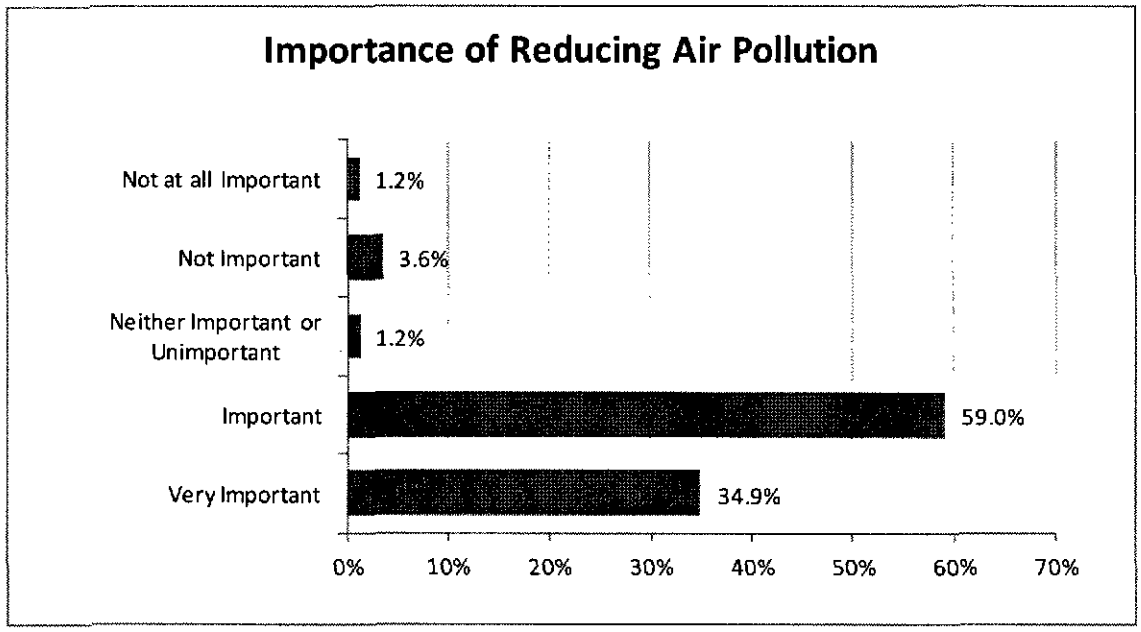


Figure 5. Importance of Reducing Air Pollution to Power Manager Participants

When the respondents were asked how important it was to reduce the need for new power plants, opinions varied more than with previous environmental issues. About 37 percent of Ohio surveyed participants said that reducing the need for new power plants was not important. Only 11.9% of Ohio respondents rated this issue as "very important" to them. Participants seem to be okay with building new power plants as long as they do not result in increased pollution or, to a lesser degree impact climate change.

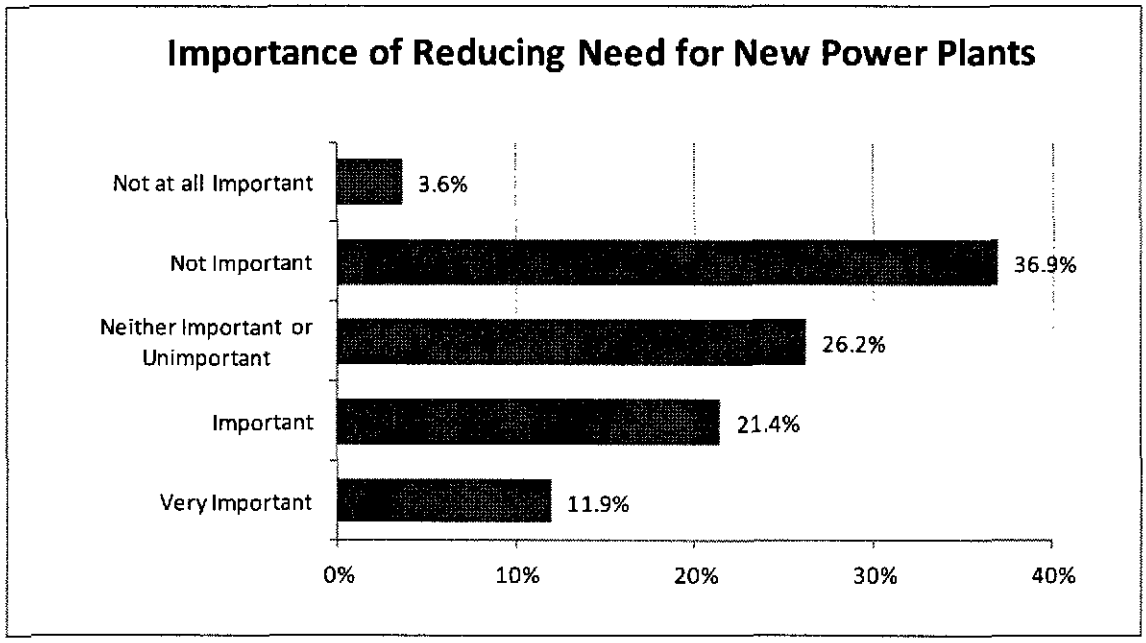


Figure 6. Importance of Reducing Need for New Power Plants to Power Manager Participants

While environmental issues are important or very important to these customers, only ten of the eighty-four surveyed participants are members of a group or club that has an environmental mission (11.9%).

Table 5. Are you a member of any groups or clubs that have environmental missions?

No	Yes	Total
74	10	84
88.1%	11.9%	100%

If respondents indicated that there were a member of an organization with an environmental mission, we asked for the name of the organization. Some of them were able to provide specific names while others could not. In addition, most of these respondents identified organizations that are not environmentally focused as their primary mission, indicating that very few of the participants are assoicated with an organization that has environmental causes as their primary mission. Their responses are listed below.

- "Nature Conservancy" (n=3)
- "Sierra Club" (n=2)
- "Enviromental science professionals association"
- "Arbor Day"
- "IMAGO"
- "Animal rights and rescue organizations"

- "Earth Club"

Participant Understanding of the Program

Participants are satisfied with the program information that was provided to them, giving the program information a mean score of 8.7 in Ohio on a 1-10 scale with 10 indicating that they were "very satisfied". Thirteen participants answered "Don't Know" for this question giving it a sample value of 71.

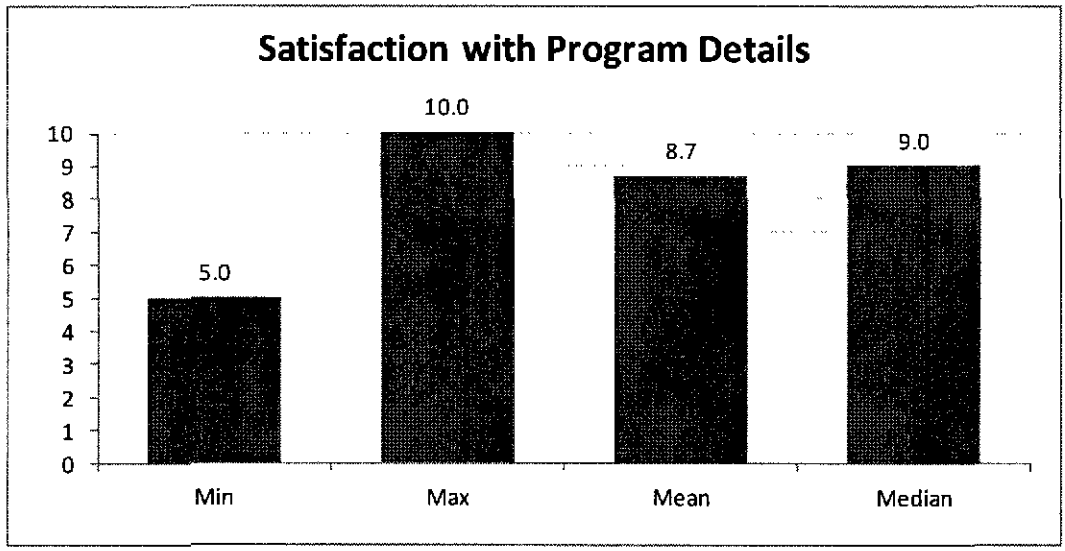


Figure 7. Participant Satisfaction with Program Details

If a respondent indicated that their satisfaction with the program details was 8 or lower, we asked them why they were less than satisfied. Seven of the twenty-three respondents that provided scores of 8 or lower provided a reason. The reasons for low satisfaction scores that were provided are listed below.

- "Description was too vague." (n=2)
- "Program information was too limited."
- "I didn't know that it was an annually self-renewing program."
- "It left some worry and doubt about the program."
- "It was average stuff."
- "I am not sure it's credible because I do not recall any bill credits."

Expectations of Power Manager Events

Surveyed participants were asked how many times Duke Energy said it would activate the Power Manager device in a summer. About 57% (or 47 out of 83) of the surveyed participants didn't know how many control events to expect. Fifteen others didn't provide a number of events but thought they would occur as needed and determined by Duke Energy.

Response	Percentage	N
Don't Know	56.6%	47
As Needed	18.1%	15
Did not say	8.4%	7
A couple times a month	7.3%	6
A few times a year	2.4%	2
Once a year	2.4%	2
Once a week	2.4%	2
Once a day	2.4%	2

Expectations of Monetary Incentives for Participation

Surveyed participants were asked to estimate how many dollars they would receive in bill credits for their participation in the Power Manager program. The responses are in Table 6 and are varied considerably, indicating a general lack of awareness of the bill credit amounts. Most respondents (over 78%) didn't respond with an answer, and instead said they didn't know.

Table 6. Expected of Bill Credits for Participating in Power Manager

Response	n	Percent
Don't know	66	78.6%
Negligible amount	4	4.8%
$5	4	4.8%
$10	2	2.4%
$15	1	1.2%
$20	1	1.2%
$25	1	1.2%
$40	2	2.4%
$50	2	2.4%
$60	1	1.2%
Total	**84**	**100%**

When surveyed participants were asked if they have received any bill credits for their Power Manager program participation, three-quarters of survey respondents didn't know. Eight (9.5%) respondents said that they did not get any credits when they did in fact get them on their bill (due to there being events in the summer of 2011). Only thirteen of the participants noticed the bill credits for their participation.

Table 7. Did you receive bill credits this year from Duke Energy for participating in this program in 2011?

	OH	
	N	Percent
No	8	9.5%
Yes	13	15.5%
Don't Know	63	75%

Despite the uncertainty of many of the participants over bill credits and control events, few of the survey respondents indicated that anything about the program was unclear to them. Only ten (11.9%) of respondents surveyed in Ohio had some questions about the program.

Table 8. Is anything unclear to you about how the program works?

	OH	
	N	Percent
No	74	88.1%
Yes	10	11.9%

What respondents indicated was unclear about the program:

- "What is the duration of the AC-off cycle?" (n=2)
- "Are there any off-peak-hour events?"
- "When will I get bill credits? "
- "Where do I find bill credits as an even-billing customer?"
- "How often does it get cycled off?"
- "I am concerned that the device might be damaging my AC unit."
- "How is a Cincinnati Bell electricity customer affected?"

Table 9. Did you ever call or email Duke Energy to find out more about the Power Manager® Program?

	OH	
	N	Percent
No	79	94%
Yes	5	6%
Don't Know	-	-

Four of these five respondents gave satisfaction ratings for their interactions with Duke Energy employees. Those four surveyed participants that contacted Duke Energy to find out more about the Power Manager® program were satisfied (average score of 9.75 on a 10-point scale) with the ease of reaching a Duke Energy representative to discuss the program. All four respondents who gave ratings were also satisfied (also an average score of 9.75 on a 10-point scale) with how the representative responded to their questions.

Awareness and Response to Activation

More than half of the surveyed respondents are not aware of the Power Manager control events when they occur either because they are not at home, or do not notice the event or the bill credits for events.

Table 10. Has Duke Energy activated the Power Manager device since you joined the program?

	OH

	N	Percent
No	-	-
Yes	38	45.2%
Don't Know	46	54.8%

In Ohio, 54.8% were aware of an event occurring because of the following reasons.

- The AC shuts down (N=22)
- Home temperature rises (N=13)
- Light on the AC flashes (N=9)
- Bill Credits (N=5)

Few if any of the Ohio participants that were surveyed knew the number of control events that had occurred at the time of their survey. Ten surveyed participants offered guesses; however, 88% reported that they didn't know. Participants were surveyed in July and August, after a time in which they would have experienced three to seven events out of a total of 8 control events that occurred in the 2011 cooling season.

Table 11. About how many times did Duke Energy activate your Power Manager device during this past summer?

	OH	
	N	Percent
Zero	2	2.4%
One	2	2.4%
Two	4	4.8%
Four	1	1.2%
Ten	1	1.2%
Don't Know	74	88.0%

Most participants do not know how many times their units have been activated, with many not knowing if they have been activated at all. However, 81.9% of the surveyed participants in Ohio report that someone is usually home on weekday afternoons with 18.1% of respondents saying that no one is usually home during this time.

Table 12. How many people are usually at home on a weekday afternoon?

	OH	
	N	Percent
Zero	15	18.1%
One or more	68	81.9%

When TecMarket Works asked the participants if they were home during any of the control events, most did not know, but some (10.7%) said that they were home during at least one of the events.

Table 13. Were you or any members of your household home when Duke Energy activated your Power Manager device this past summer?

	OH	
	N	Percent
No	1	1.2%
Yes	9	10.7%
Don't Know	74	88.1%

TecMarket Works then asked the nine respondents who reported being at home during control events to think back to the event time and then to rate their comfort before and during the event on a 1-to-10 scale with 1 being very uncomfortable and 10 being very comfortable.

Table 14. Comfort ratings before and during control events

Participant	Rating before event	Rating during event	Difference
1	9	9	0
2	9	8	1
3	10	10	0
4	9	9	0
5	9	9	0
6	9	9	0
7	9	9	0
8	9	9	0
9	10	9	1
Mean	**9.2**	**9**	**0.2**
Median	**9**	**9**	**0**

Seven of the nine reported no difference in comfort as a result of the event. When considering only the two respondents whose in-event rating was lower than the pre-event rating, the average difference in ratings is one with a median of one.

The two respondents that indicated that they felt uncomfortable during the periods of activation both indicated that they felt their discomfort was a direct result of the Power Manager control unit activation. They both also indicated that a higher temperature was causing their discomfort.

TecMarket Works then asked the respondents if they recalled doing anything to keep cool during the control event. Only one respondent recalled trying to keep cool during the event by adjusting the thermostat from 70 degrees to 68 degrees.

Reasons for the Power Manager Program and Events

We asked the surveyed participants the following question: "*Why do you think Duke Energy activates your Power Manager device on summertime weekdays during the afternoon as opposed to other times of the day or year?*" The responses are presented in Table 15. Sixty-two percent of the respondents mentioned peak demand or load control in their answer.

Table 15. Perceived Reasons for Power Manager

Reasons mentioned	N	Percentage of all survey respondents mentioning reason (n=84)
Peak Demand	54	61.9%
Hottest time of day	23	27.4%
Fewer people are home	24	28.6%
Don't Know	7	8.3%

Note: Multiple responses allowed.

Program Satisfaction

Surveyed respondents indicate a high level of satisfaction with the enrollment process of the Power Manager program. Ohio participants report a mean satisfaction score of 9.4 with the enrollment process on a scale of 1 to 10 with 10 meaning they were very satisfied.

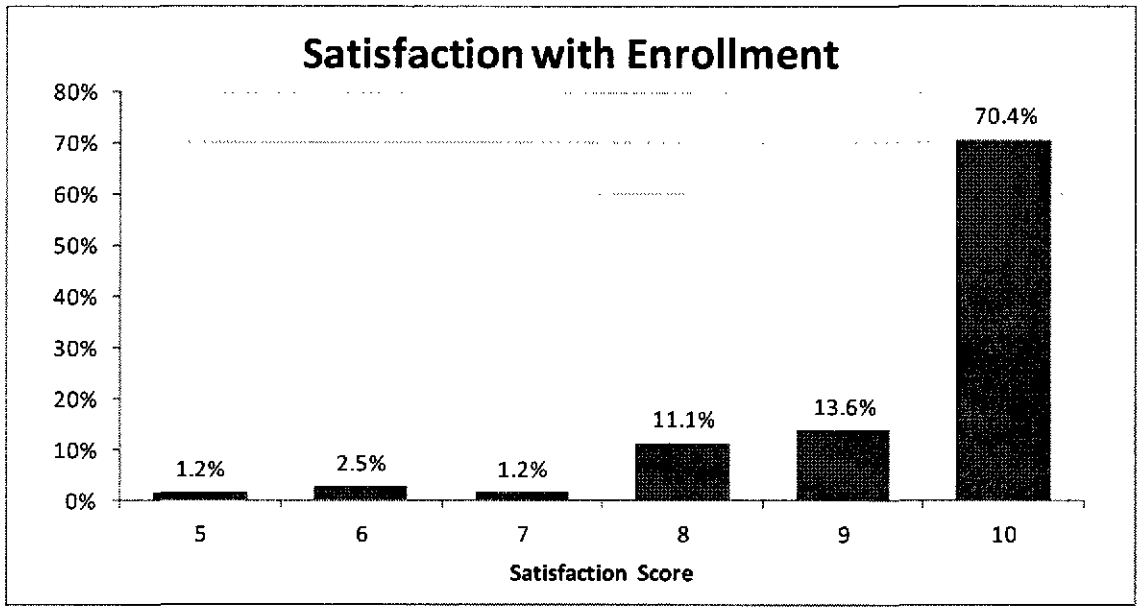


Figure 8. Satisfaction with Power Manager's Enrollment Process

No reasons were given by participants for reporting low (score of 8 or less) satisfaction scores with the program enrollment. These scores indicate that the customers who scored satisfaction low typically do not have a reason for that lower enrollment satisfaction score.

Overall program satisfaction scores for Power Manager are an average of 8.75 in Ohio. More than 65% of the survey respondents report a satisfaction score of 9 or 10 with the Power Manager program.

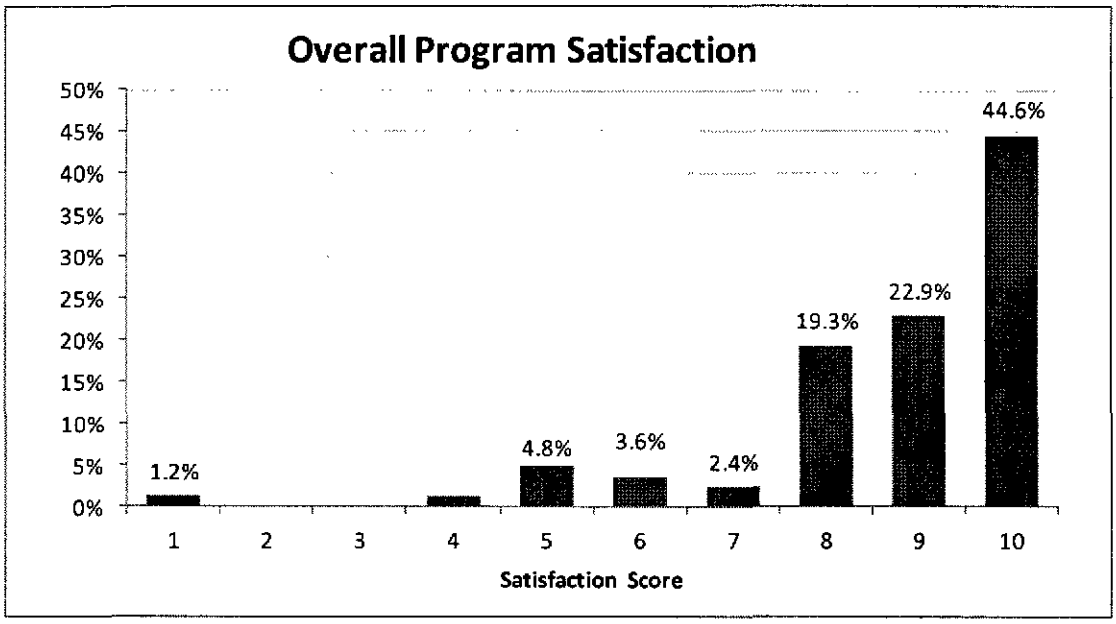


Figure 9. Overall Program Satisfaction

The following are the reasons for participants reporting low (score of 8 or less) satisfaction scores with the program overall.

- "The bill credits/incentives were not large enough." (N=6)
- "I am not sure I received the bill credits." (N=4)
- "I was uncomfortable when my Power Manager device was activated." (N=2)
- "I can't tell when it's been activated." (N=2)
- "I wish Duke Energy would notify us of events by email."

The majority of surveyed participants (89.3%) would recommend the Power Manager program to others. When a surveyed participant said they would not recommend the program, they offered the following reasons:

- "I am not sure there are any benefits."
- "I am indifferent to the program now."
- "Most of my friends would not be interested."
- "Bill credits are not worth the trouble."

- "Not enough impact."

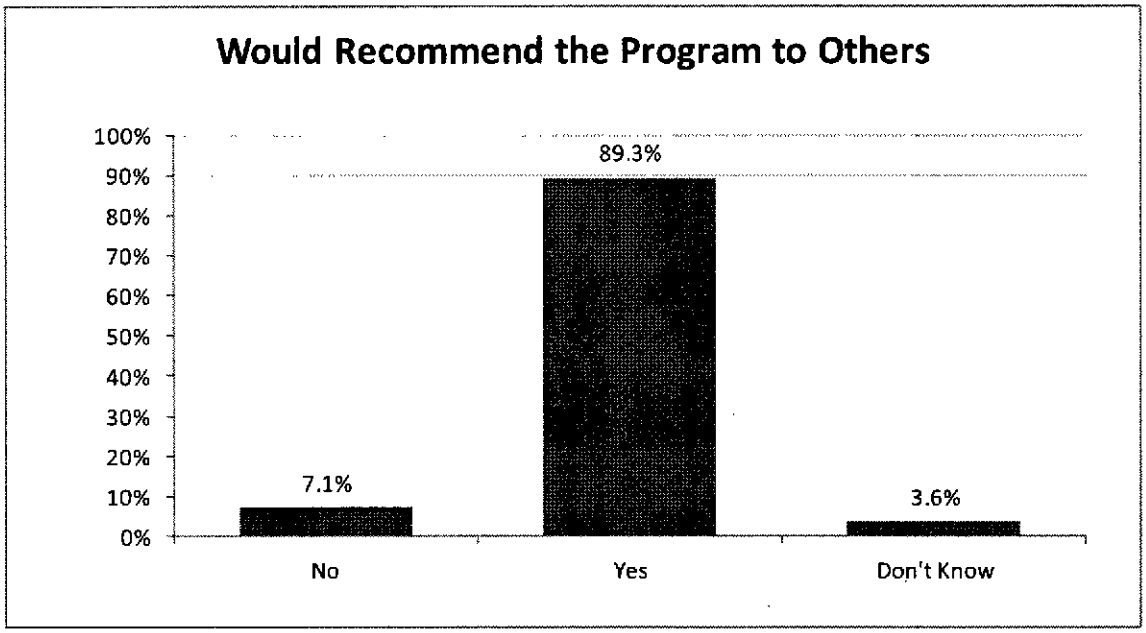


Figure 10. Percent of Participants that would Recommend the Program to Others

Awareness of Other Duke Energy Programs

We asked the surveyed participants if they were aware of any other Duke Energy programs. Fifty-seven (67.9%) of the participants were able to name a total of 78 other programs, and the most cited programs were the Home Energy House Call Program and the CFL Program.

	OH (n=84)	
	N	Percent
CFL Program	45	53.6%
Home Energy House Call	17	20.2%
Personalized Energy Report	4	4.8%
Smart $aver	0	-
Energy Star Homes	3	3.6%
Low Income Programs	2	2.4%
Home Energy Comparison Report	7	8.3%
Total	78	-

Note: Multiple responses were allowed

We then asked them what, if any, other kinds of programs or services they had heard of Duke Energy providing to help save customers money. Their responses are bulleted below:

- "Energy saving tips in the monthly bill." (N=6)
- "Energy Efficiency Kits." (N=3)

- "Energy saving tips on the Duke Energy Web Site." (N=2)
- "Smart meters." (N=2)
- "Hot water heater cycling."

Air Conditioner Practices

We asked the surveyed participants about their air conditioning use. First we asked if they used their air conditioner only on the hottest days of the cooling season, or if they used it frequently, most days, every day, or not at all. The Power Manager program in Ohio is successful in enrolling participants that routinely use their air conditioners on the hottest days, but also use their units most of the cooling season. The program is reaching and enrolling the customers that typically and routinely use their units on control days. None of the Ohio respondents indicated that they never use their air conditioner.

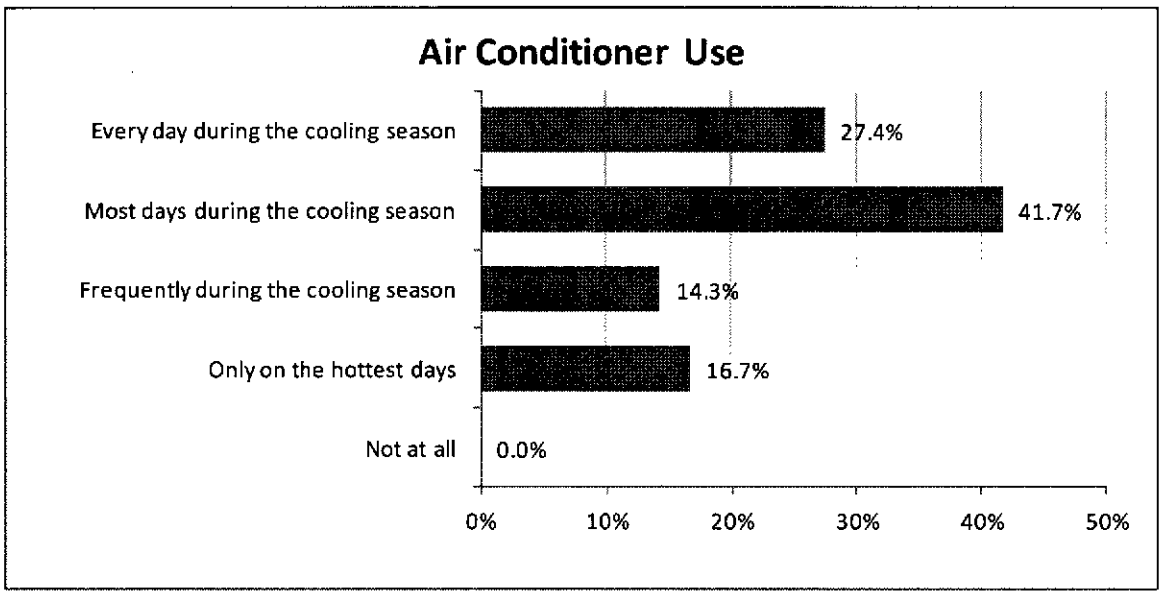


Figure 11. Air Conditioner Use of Power Manager Participants

We then asked the surveyed participants to estimate how many days they had their air conditioners on during the summer of 2011 previous to taking the survey. These results are presented in Figure 12.

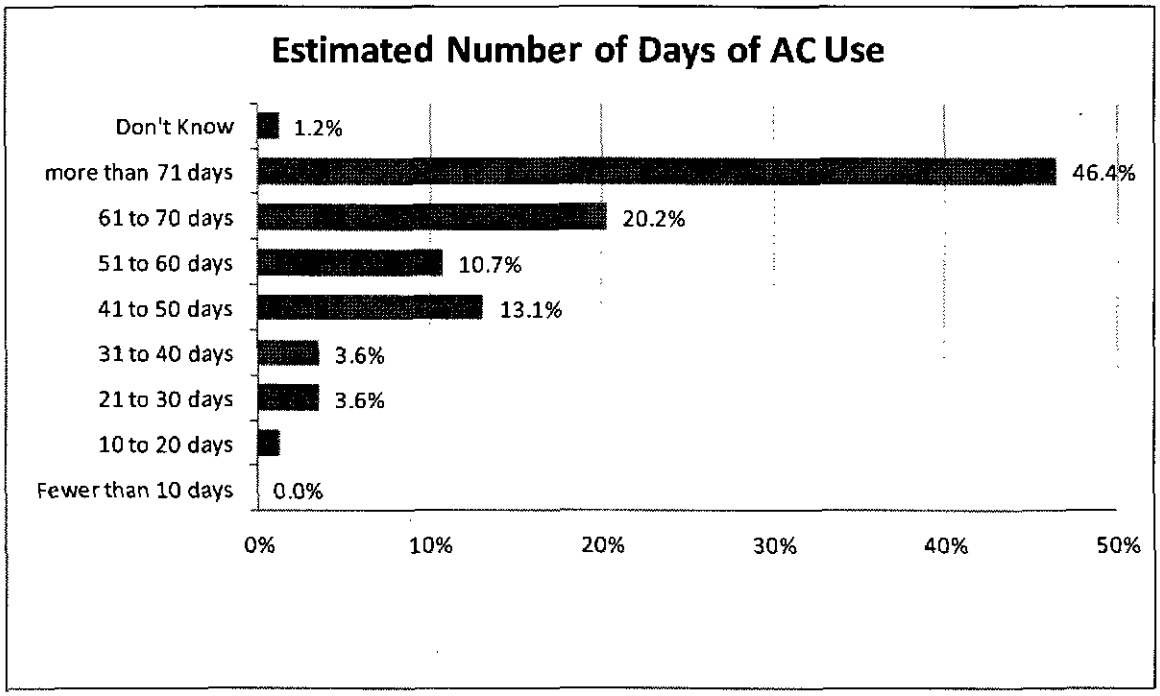


Figure 12. Estimated Number of Days of Air Conditioner Use, Summer 2011

Sixty percent of the Ohio participants that were surveyed reported that they had someone tune-up or repair their air conditioner in the time since they enrolled in the Power Manager program.

Table 16. Respondents Receiving AC Services (tune-up or repair) Since Enrolling in Power Manager

	OH	
	N	Percent
No	33	39.3%
Yes	51	60.7%
Don't Know	-	-

Forty-six of the surveyed participants in Ohio had their air conditioner serviced by an AC contractor, four participants noted that they had a friend service their AC, and one participant had his or her A/C services through People Working Cooperatively. About half of those respondents who had their AC serviced report that the performance of the AC unit did improve as a result, and about half the respondents report that the performance did not improve.

Table 17. Did the performance of your air conditioner improve after you had it serviced?

	OH	
	N	Percent
No	24	47.1%

Yes	23	45.1%
Don't Know	4	7.8%

Surveyed participants report that there is usually someone at the home and using the air conditioner on weekday summer afternoons in 73% of homes in Ohio.

Table 18. Is the air conditioner typically used to keep someone at home comfortable during weekday summer afternoons before 5 P.M.?

	OH	
	N	Percent
No	23	27.4%
Yes	61	72.6%

Table 19. Is the air conditioner typically used to keep someone at home comfortable during weekday summer afternoons after 5 P.M.?

	OH	
	N	Percent
No	0	-
Yes	84	100%

Outside Temperatures and Thermostat Settings

Surveyed Power Manager participants were asked to think about a hot and humid summer day, and then to tell us at what outside temperature they start to feel uncomfortably warm. The responses are presented in Figure 13. The median temperature range of discomfort is 85-87°F in Ohio.

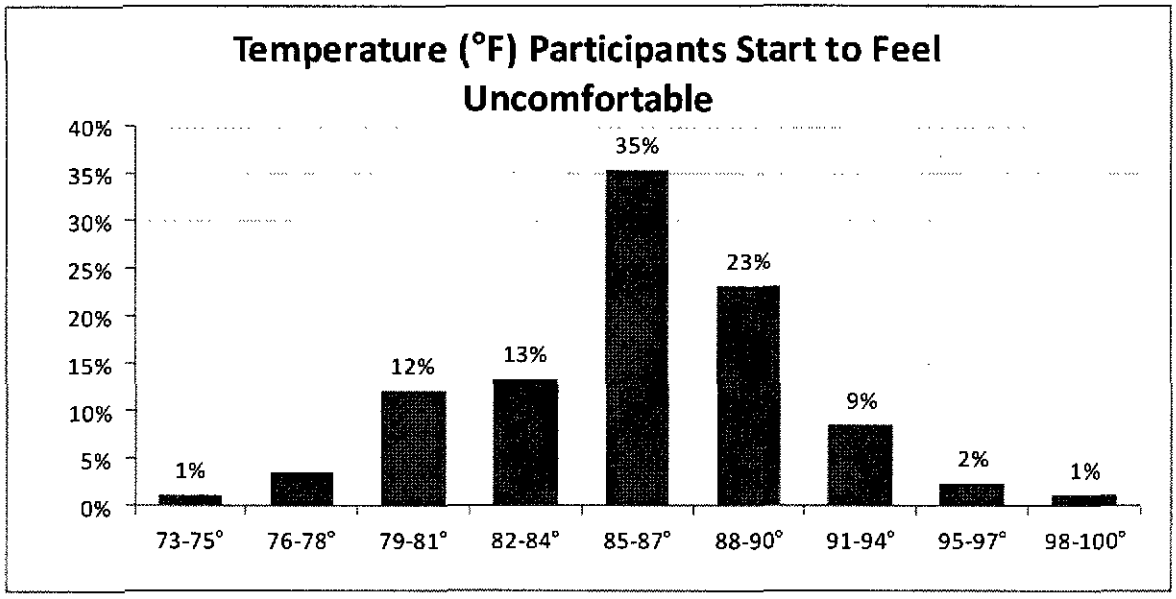


Figure 13. Outside Temperatures at Which Participants Feel Uncomfortably Warm

We then asked the surveyed participants at what outside temperature they tend to turn their air conditioners on. The median outside temperature range for which air conditioners are turned on is 82-84°F in Ohio (one range lower than their discomfort level). The frequency of responses are presented in Figure 14.

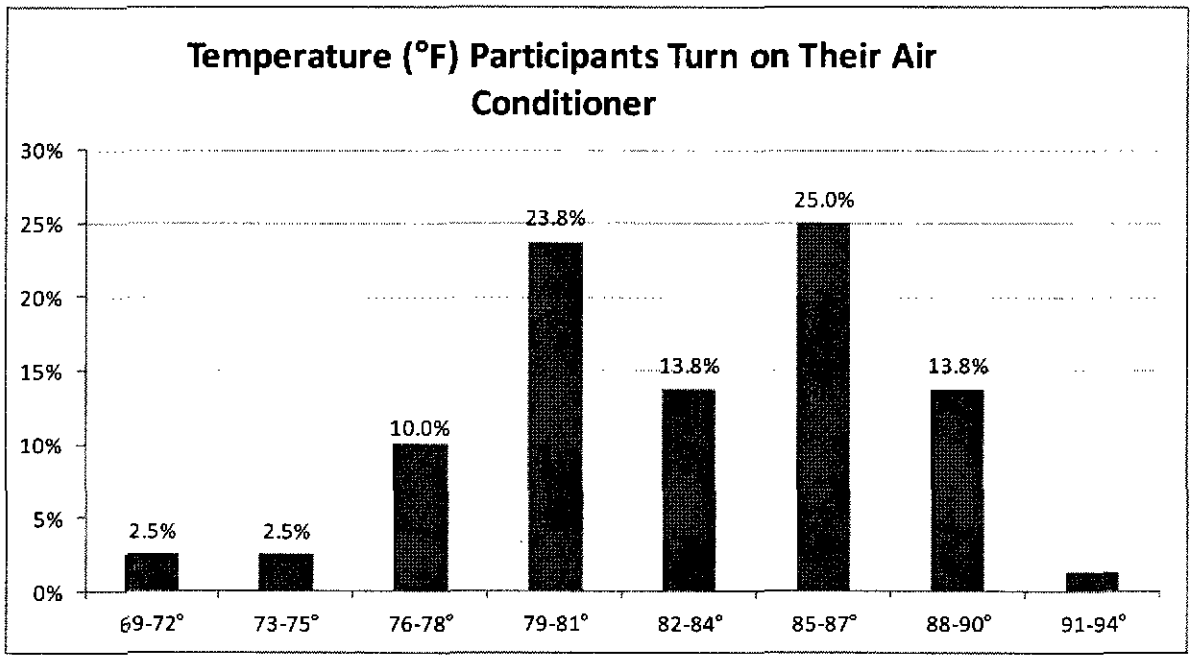


Figure 14. Outside Temperatures that Participants Turn On Their Air Conditioners

Comparing these two temperature points (of discomfort and when participants turn on their air conditioners) provides us with Figure 15, which shows that more than half of Ohio participants turn on their air conditioners before the temperature becomes uncomfortable, many (32.1%) turn it on when the weather becomes uncomfortable, and a few (11.5%) of them wait until the temperature is higher than when they begin to feel uncomfortable.

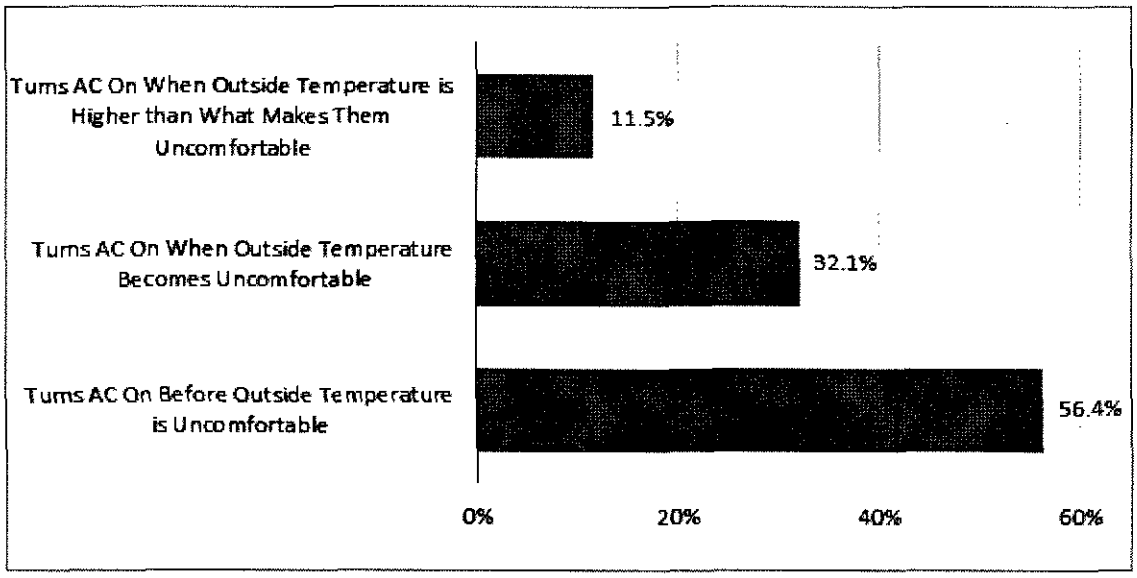


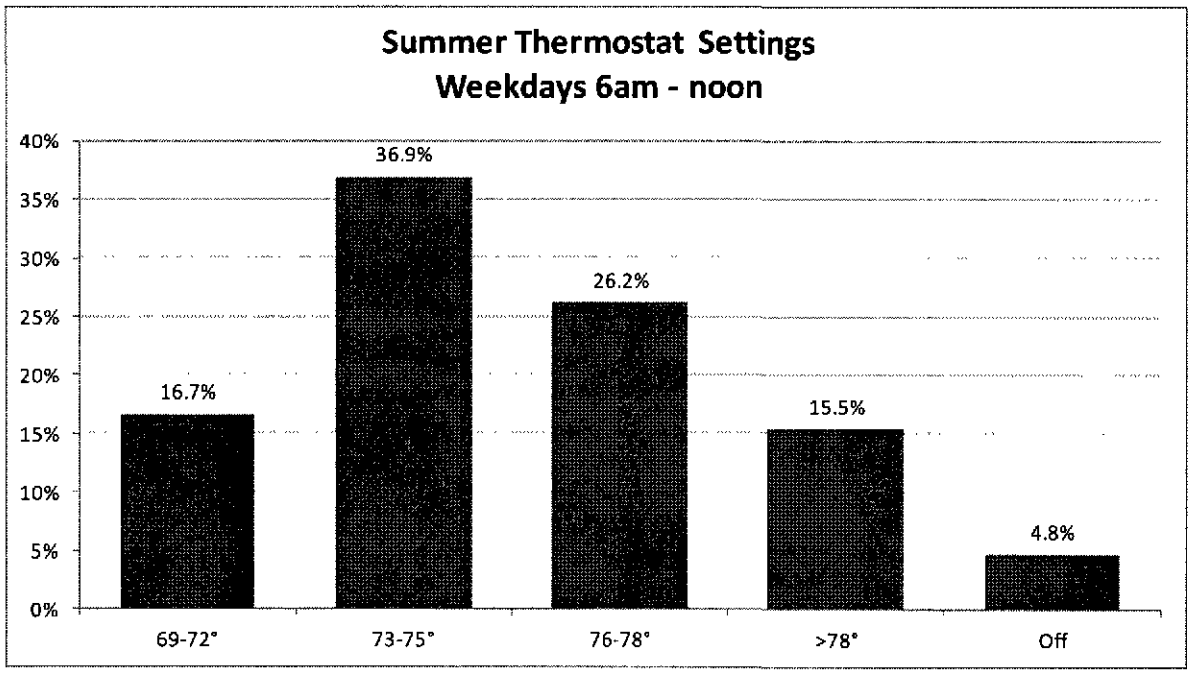
Figure 15. Percent of Participants Turning Their Air Conditioners When Temperatures Reach an Uncomfortable Level

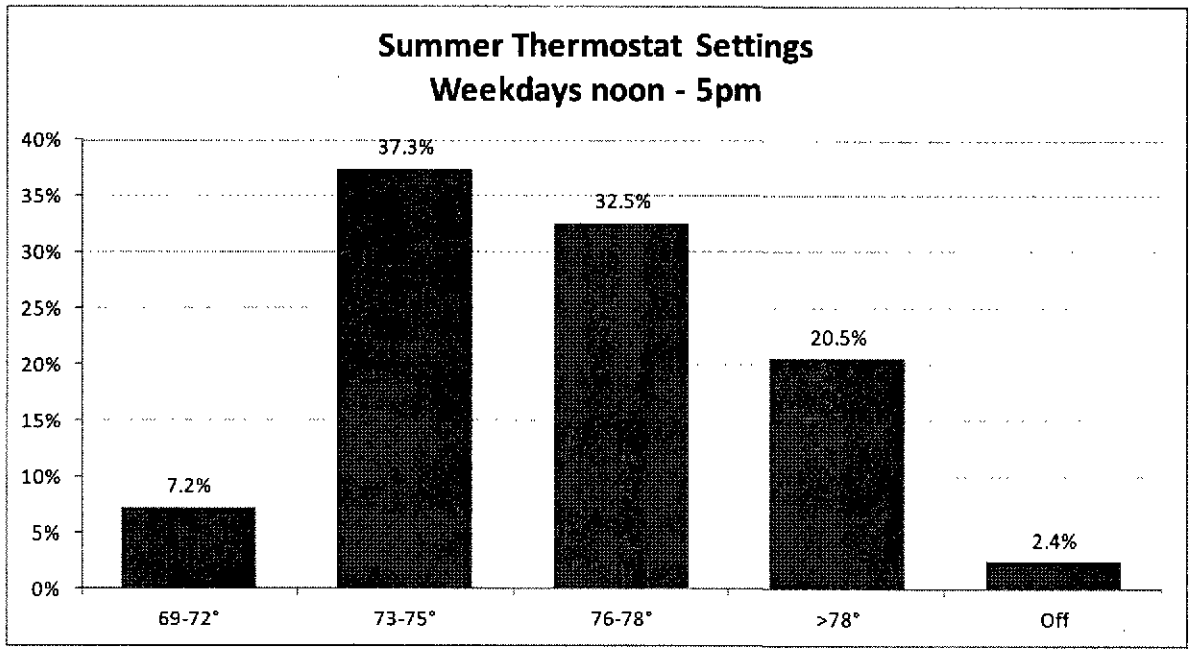
If the respondent indicated that the AC is turned on at a certain temperature through their programmed thermostat, we asked the participant if they set the thermostat seasonally or if they set it when the weather gets hot. The majority of respondents (83%) indicated that they adjusted the thermostat seasonally.

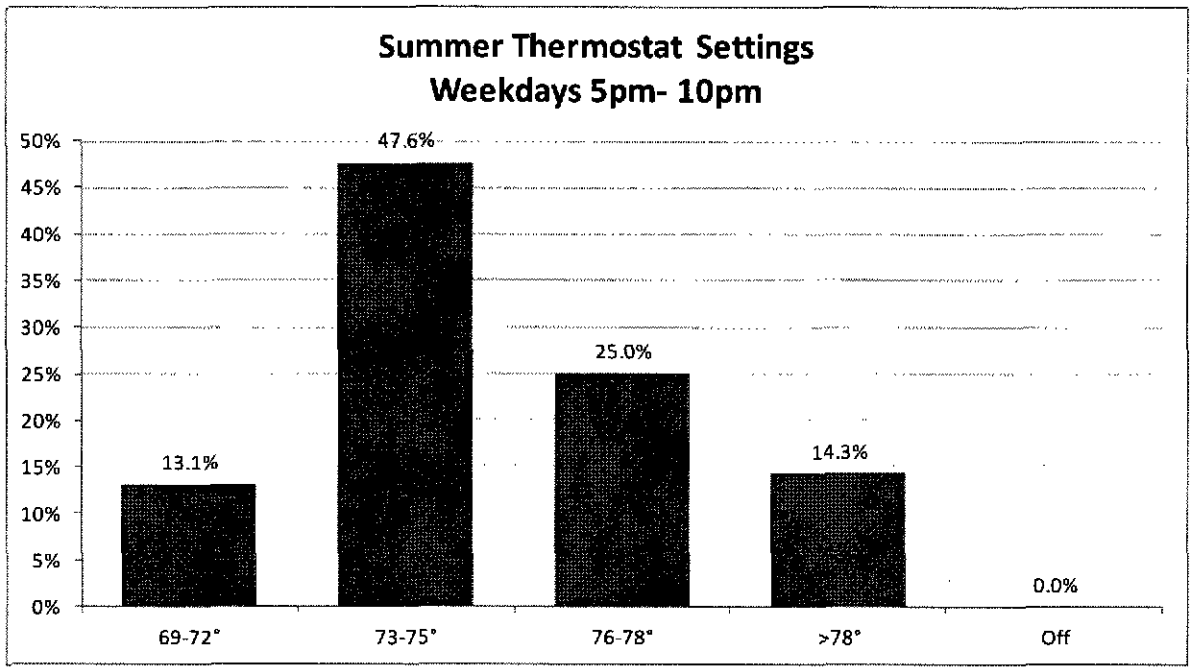
	OH	
	N	Percent
I program the thermostat seasonally	5	83.3%
When the weather gets hot	1	16.7%

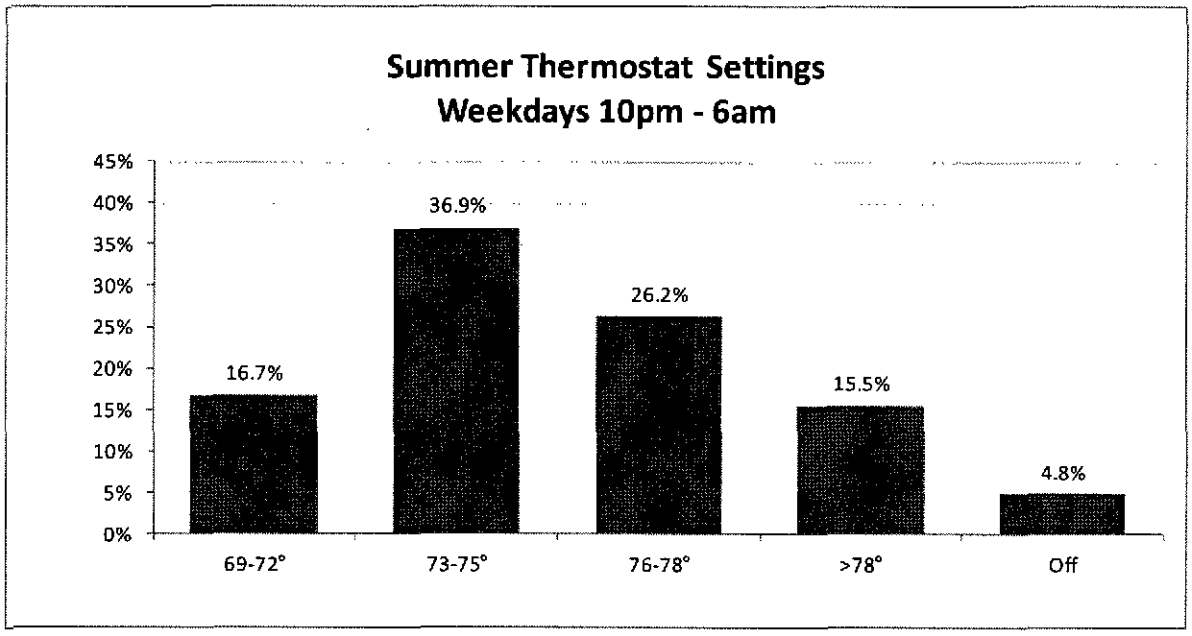
Thermostat Settings

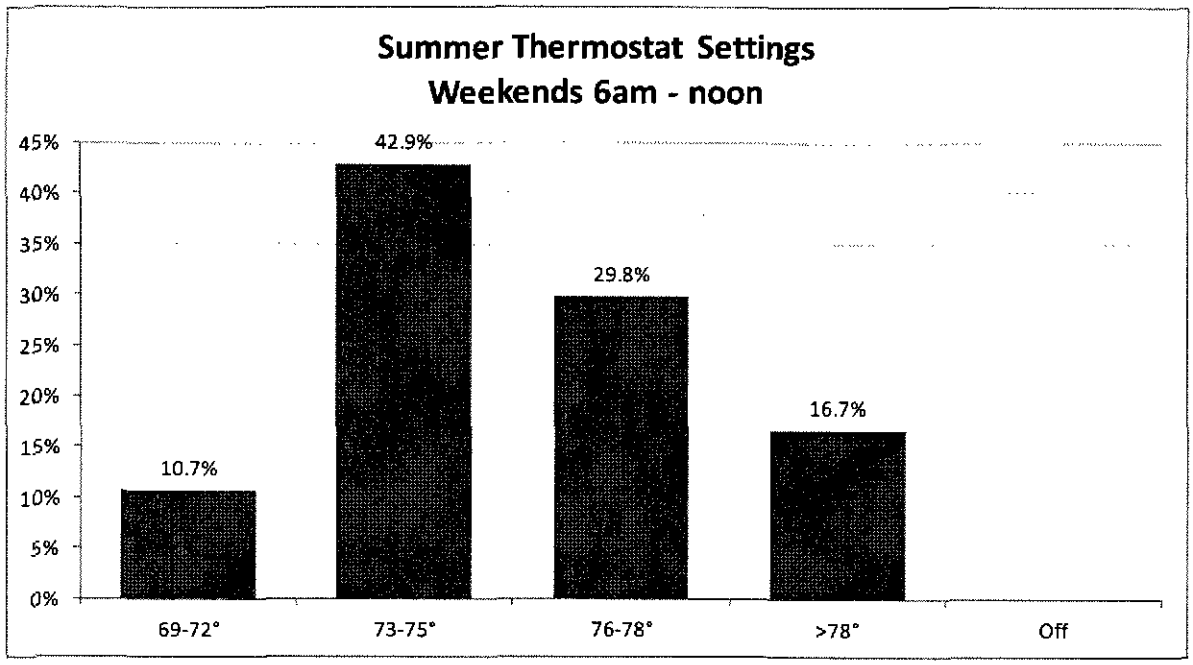
The following graphs present the frequencies of thermostat settings of the Ohio surveyed participants on weekdays and weekends at four time periods throughout the day (6am-12pm, 12pm-5pm, 5pm-10pm, and 10pm-6am). All eight of these graphs show that the most common thermostat setting over all days and time periods is 73-75°F.

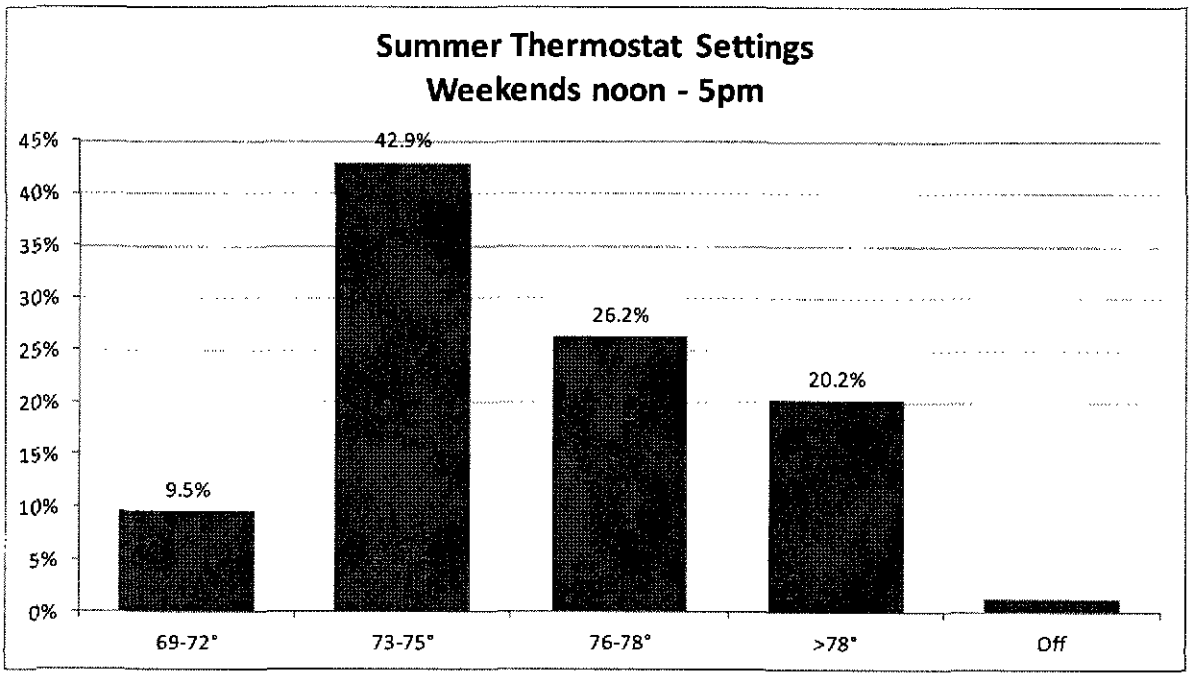

Summer Thermostat Settings
Weekdays 6am - noon
40%
35%
30%
25%
20%
15%
10%
5%
0%
16.7%
36.9%
26.2%
15.5%
4.8%
69-72°
73-75°
76-78°
>78°
Off

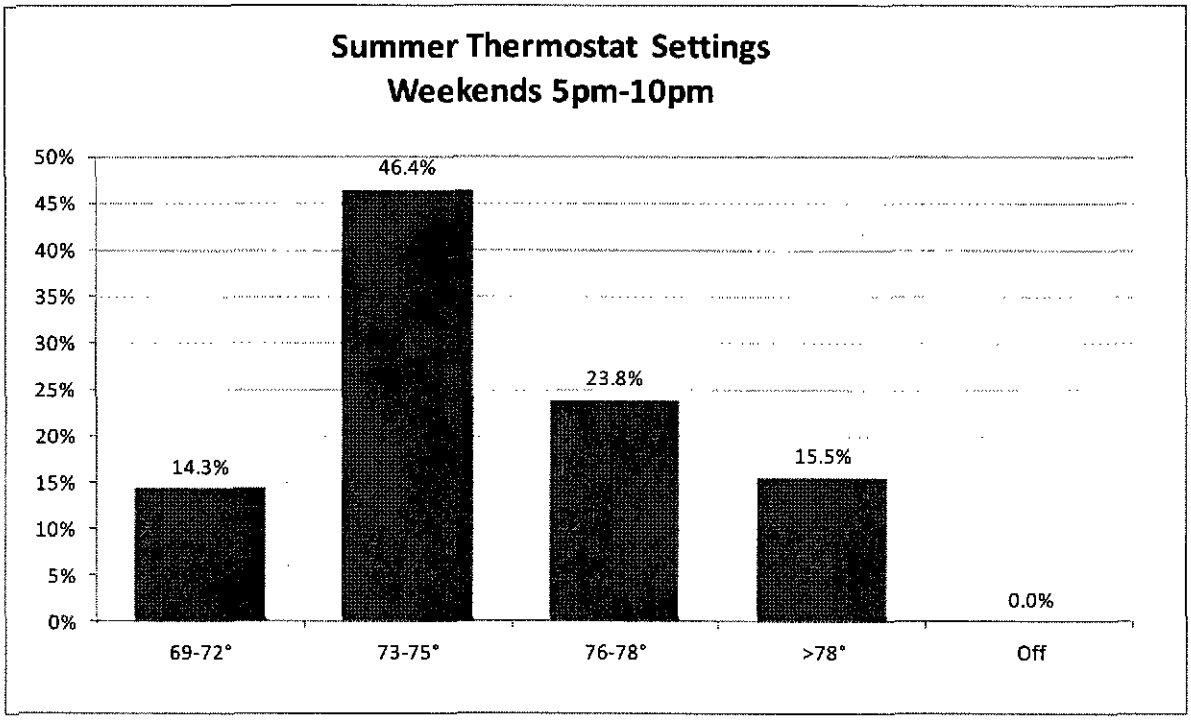

Summer Thermostat Settings
Weekdays noon - 5pm
40%
35%
30%
25%
20%
15%
10%
5%
0%
7.2%
37.3%
32.5%
20.5%
2.4%
69-72°
73-75°
76-78°
>78°
Off

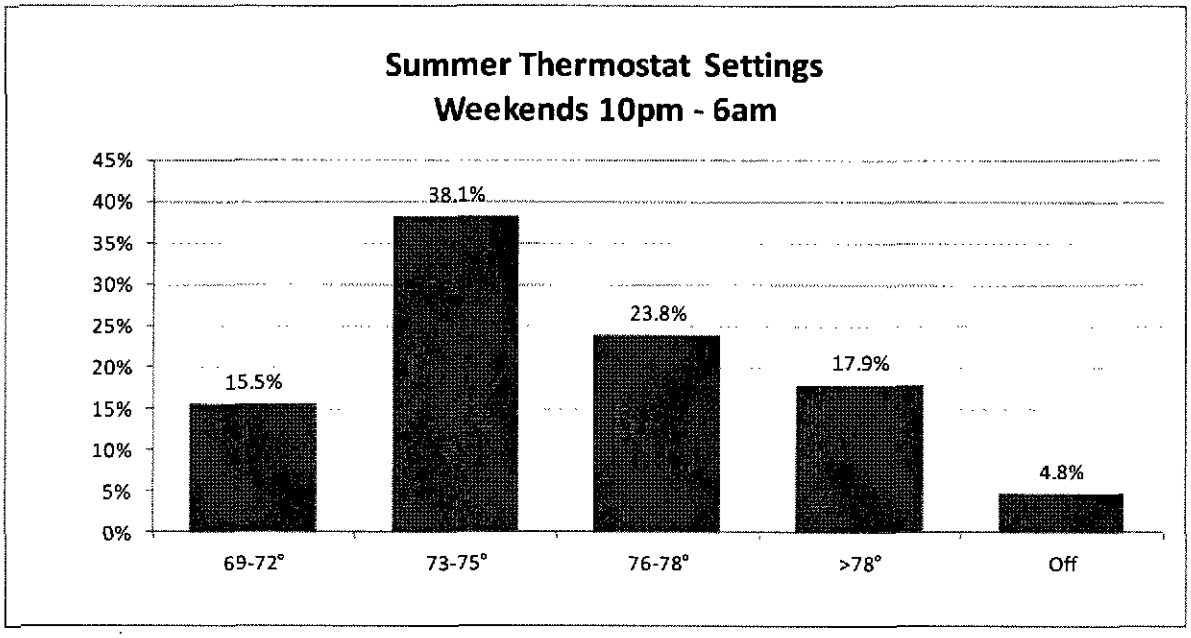

Summer Thermostat Settings
Weekdays 5pm- 10pm
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
13.1%
47.6%
25.0%
14.3%
0.0%
69-72°
73-75°
76-78°
>78°
Off


Summer Thermostat Settings
Weekdays 10pm - 6am
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
16.7%
36.9%
26.2%
15.5%
4.8%
69-72°
73-75°
76-78°
>78°
Off


Summer Thermostat Settings
Weekends 6am - noon
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
10.7%
42.9%
29.8%
16.7%
69-72°
73-75°
76-78°
>78°
Off


Summer Thermostat Settings
Weekends noon - 5pm
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
9.5%
42.9%
26.2%
20.2%
69-72°
73-75°
76-78°
>78°
Off





Most of the Power Manager participants leave their settings the same every day, from weekdays to weekends. Some Ohio respondents are likely to lower their AC temperature settings (using more energy) on weekends from 6 am-12 pm. There were a few participants reporting that they set their thermostats to higher temperature settings during the weekend.

Table 20. Changes in Thermostat Settings of Power Manager Participants

	OH		
Time period	Same every day	Lower AC temperature on weekends	Higher AC temperature on weekends
6am-12pm	94.0%	6.0%	0.0%
12pm-5pm	97.6%	2.4%	0.0%
5pm-10pm	98.8%	1.2%	0.0%
10pm-6am	98.8%	1.2%	0.0%

We found that there are two types of customers in the Power Manager participant group in Ohio: those that turn their air conditioners on to a set temperature and leave it at that temperature all day, every day (non-adjusters), and those that change the temperature settings (adjusters). Figure 16 below shows that 48.1% of the surveyed Power Manager participants are "non-adjusters".

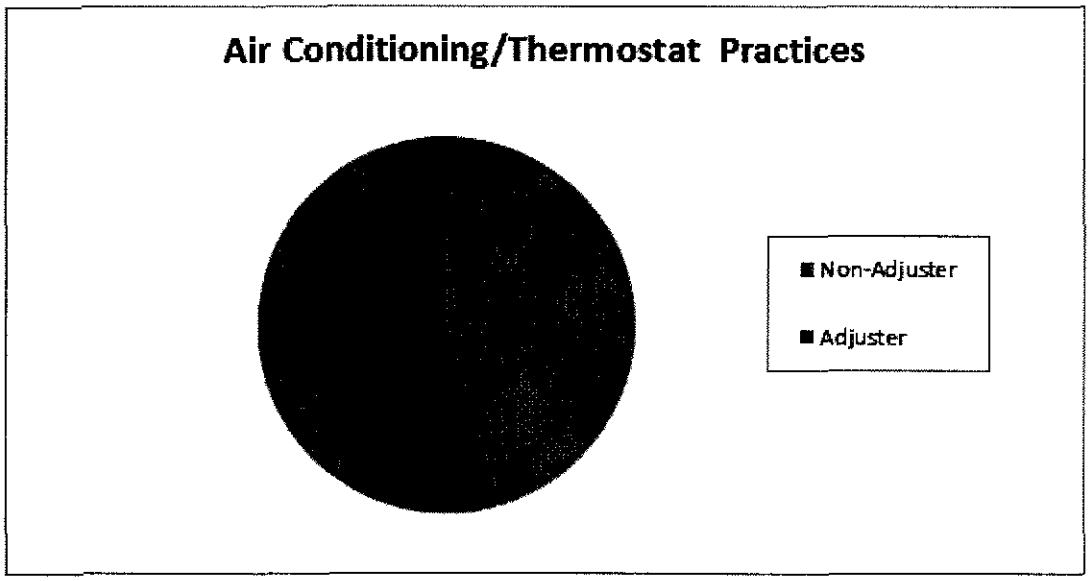


Figure 16. Thermostat Practices of Power Manager Participants

We split the surveyed participants into these two groups to calculate the outside temperature points at which they become uncomfortable and turn on their air conditioners. Table 21 presents these median temperature ranges.

Both adjusters and non-adjusters become uncomfortable when the outside temperature reaches 85-87°F, and will turn their air conditioners on when the outside temperature reaches 79-81°F.

Table 21. Temperature Points for Non-Adjusters and Adjusters

Non-Adjusters	OH
Median Temperature Range of Discomfort	85-87
Median Temperature to Turn AC On	79-81
Median Temperature of Thermostat	79-81

Adjusters	
Median Temperature Range of Discomfort	85-87
Median Temperature to Turn AC On	79-81

Satisfaction with Duke Energy

Overall satisfaction with Duke Energy is high. Ohio participants report an average satisfaction score of 8.2 on a ten-point scale. The frequency of responses is presented in Figure 17.

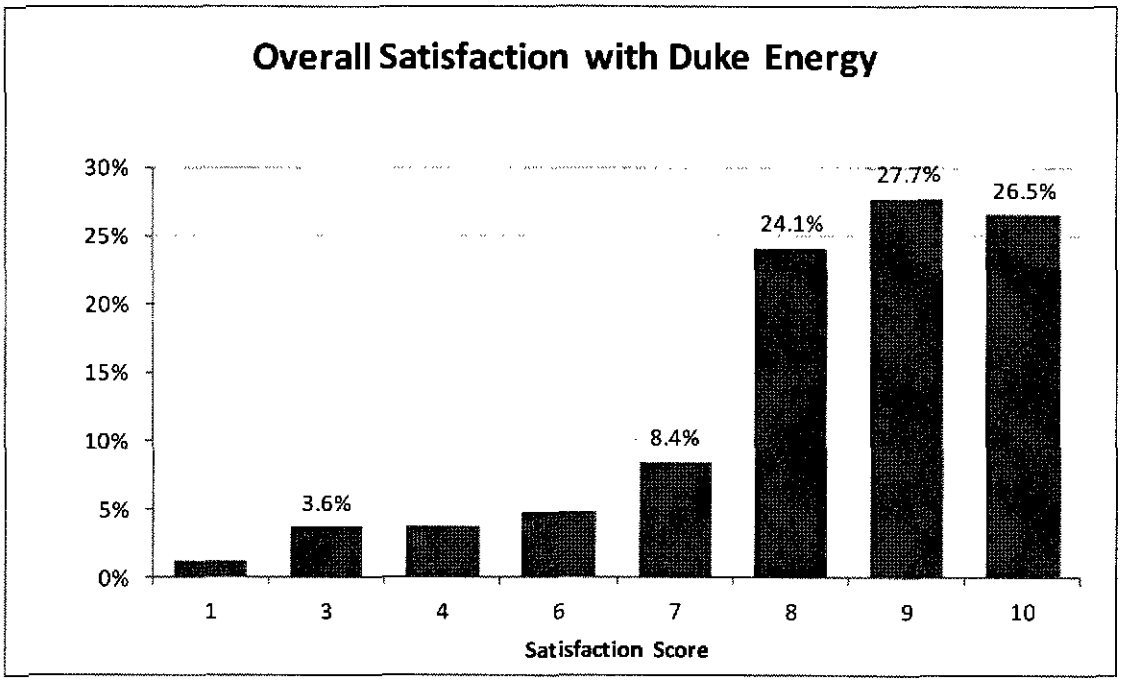


Figure 17. Overall Satisfaction with Duke Energy

Ohio surveyed participants that gave a satisfaction score lower than 9 were asked why they were less than satisfied with Duke Energy. Their responses are below.

Surveyed participants that scored their satisfaction with Duke Energy at 8:

- "Rates are too high." (N=10)
- "Too many power outages." (N=4)
- "Too long of a delay in restoring power" (N=3)
- "Duke Energy needs to improve their tree-trimming practices (N=3)
- "Duke Energy should promote more "green" initiatives" (N=2)

Section 3: Recency Surveys

In addition to the participant surveys reported above, TecMarket Works also conducted surveys of current Power Manager participants in order to better gauge their awareness of Power Manager events and their perception of discomfort caused by Power Manager curtailment events.

TecMarket Works conducted the recency surveys regarding each event during a 51-hour window beginning at 5 p.m. EST on the day that a curtailment event occurred and ending at 8 p.m. EST two days after the curtailment event. Calling hours were 10 a.m.- 8 p.m. EST. Following events occurring on July 12, July 20, July 21, July 29, and August 1, TecMarket Works surveyed a total of 111 participants in Ohio. The event survey protocol is located in Appendix C: Participant Recency Survey.

In order to control for customer perceptions and experiences not caused by Power Manager curtailment events, TecMarket Works also surveyed participants referencing days on which the heat index was high enough to trigger a curtailment event, but on which no curtailment event actually occurred. On and following the high temperature dates of July 11, July 28-29 and September 2, TecMarket Works surveyed at total of 53 participants in Ohio. The high temperature non-event survey is located in Appendix D: Participant Recency Survey for Non-Event Day Comparison.

Home Occupancy During Power Manager Activation

TecMarket Works then asked Event respondents whether they were home during the actual event timeframe (typically 2-5pm EST) and asked Non-Event survey respondents if they were home at 3pm EST on the date of the high temperature. The results in Figure 18 and Figure 19 show that roughly two-thirds of both event and non-event survey respondents were home during these times.

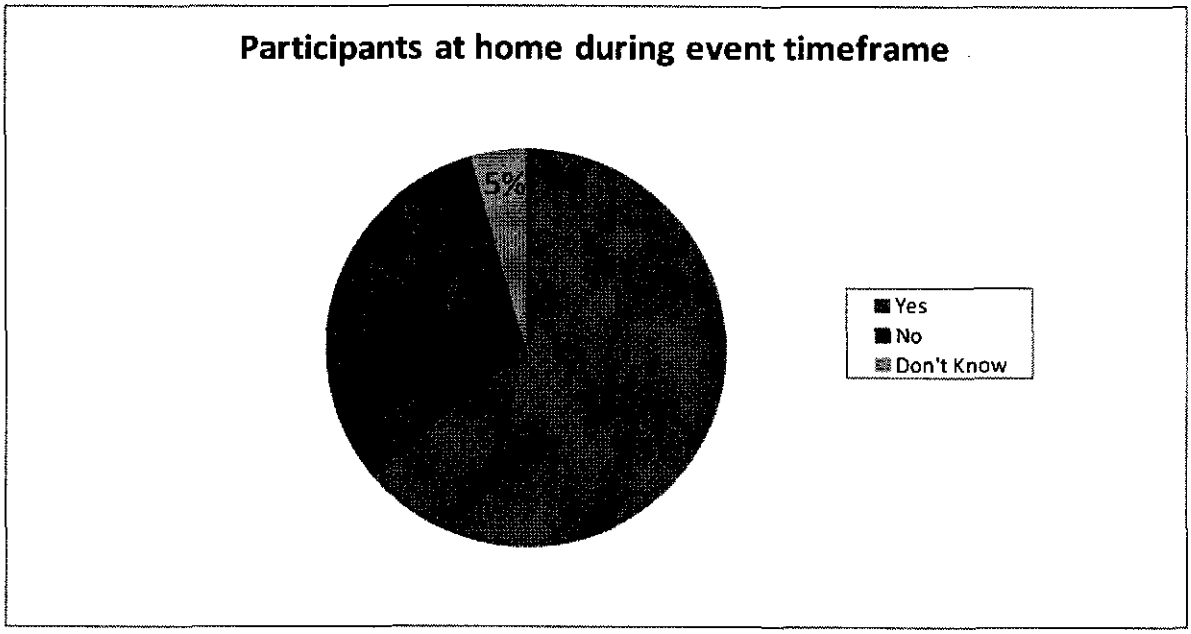


Figure 18. Event Participants at home during event timeframe. N=111

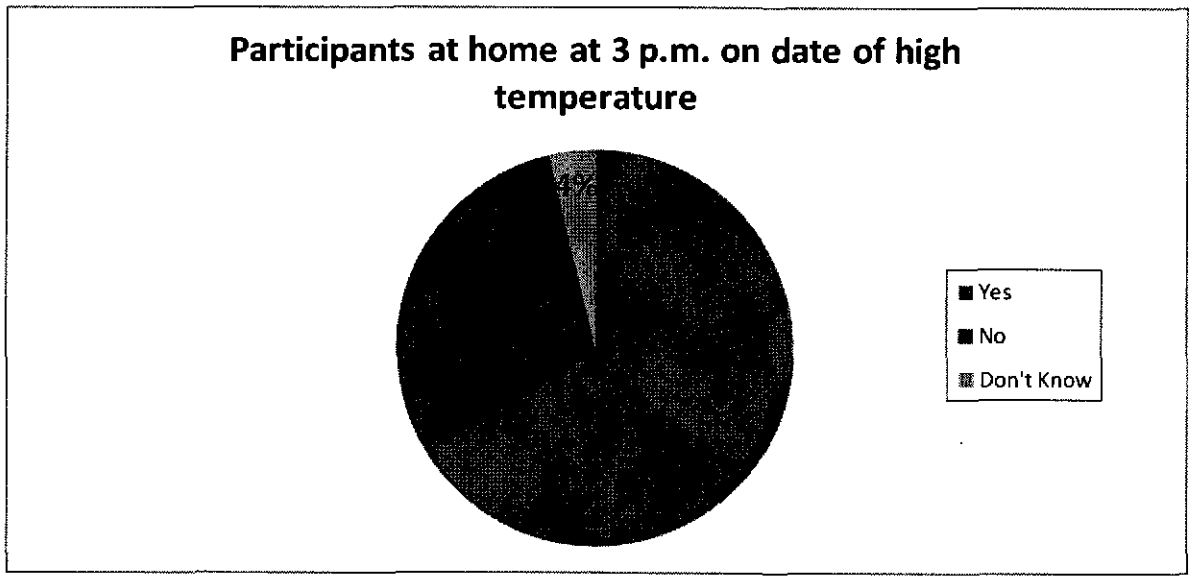


Figure 19. Non-Event participants at home at 3 p.m. on date of high temperature. N=53

Awareness of Device Activation

In order to gauge awareness of the Power Manager device activation, TecMarket Works first asked event and non-event participants if they were aware of a device activation occurring since they had joined the program. The results in Figure 20 show that a majority of event and non-event participants were unsure of whether or not an activation had occurred at some point since

their enrollment. Furthermore, the distribution of answers is nearly identical between event and non-event participants.

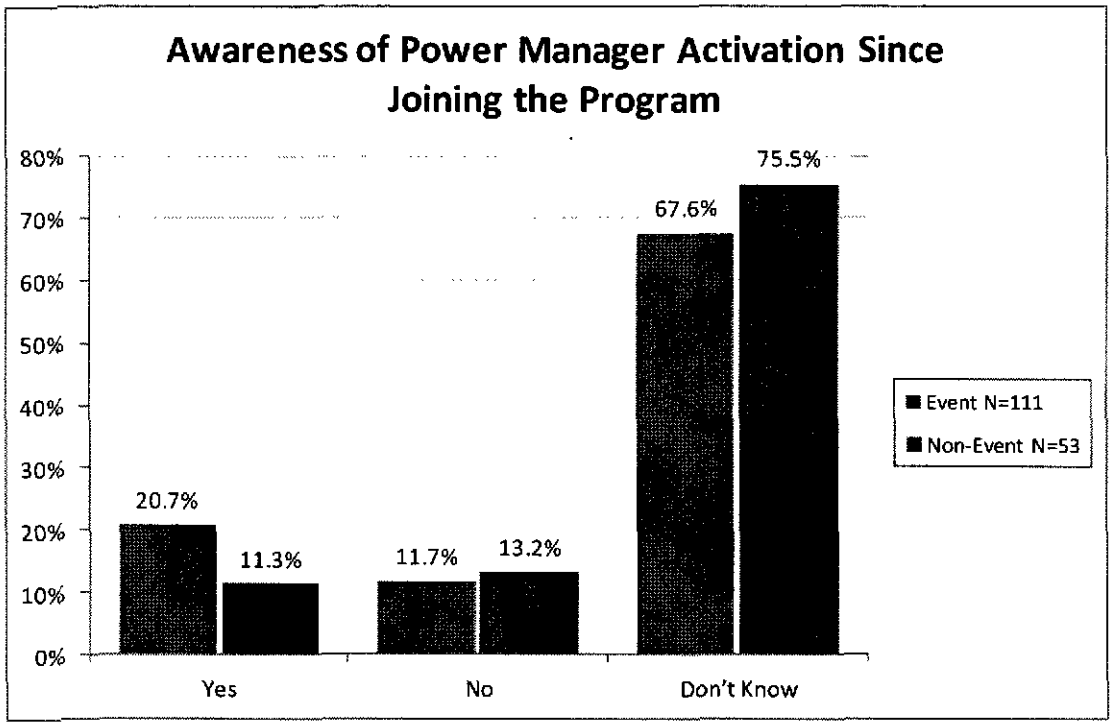


Figure 20. Awareness of Power Manager Activation Since Enrolling in the Program

TecMarket Works followed up the initial awareness question by asking participants an open-ended question as to how they knew that the Power Manager device had been activated. Eighty-three out of 111 event participants (74.8%) and 38 out of 53 non-event participants (71.7%) stated that they did not know how to tell if the Power Manager device had been activated. The responses from the remaining 28 event participants and 15 non-event participants in Table 22 below show that the shut-down of the A/C compressor and a rise in home temperature are the most cited reasons for awareness of a Power Manager device activation.

Table 22. Reasons for Awareness of Activation

	Percentage of times mentioned by...		
	Event Participants (N=28)	Non-Event Participants (N=15)	Difference
A/C shuts down	25.0%	60.0%	-35.0%
Home Temperature rises	46.4%	46.7%	-0.3%
The light on the meter is on	3.6%	-	3.6%
The light on the A/C unit flashes	17.9%	13.3%	4.6%
Bill Credits	14.3%	-	14,3%

Note: Multiple responses were allowed per participant

TecMarket Works then asked both event and non-event participants whether they were aware of their Power Manager device being activated in the last seven days. However, in the case of the non-event participants, such an activation had not occurred. The results are shown in Figure 21 and Figure 22.

In Figure 21, twenty-one percent of event respondents were aware of a Power Manager activation, while Figure 22 shows that 87 percent of non-event participants thought that no power manager activation had occurred, or were unsure of whether an activation had occurred or not. This data also suggests that the majority of all Power Manager participants in Ohio are unsure of whether a Power Manager event has recently occurred.

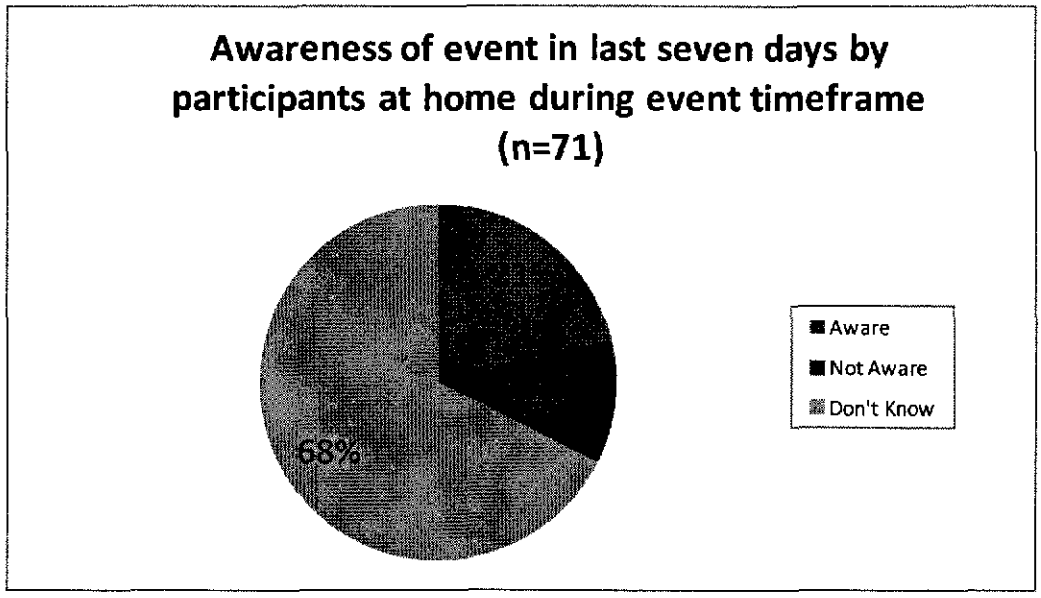


Figure 21. Awareness of activation in past seven days by event participants

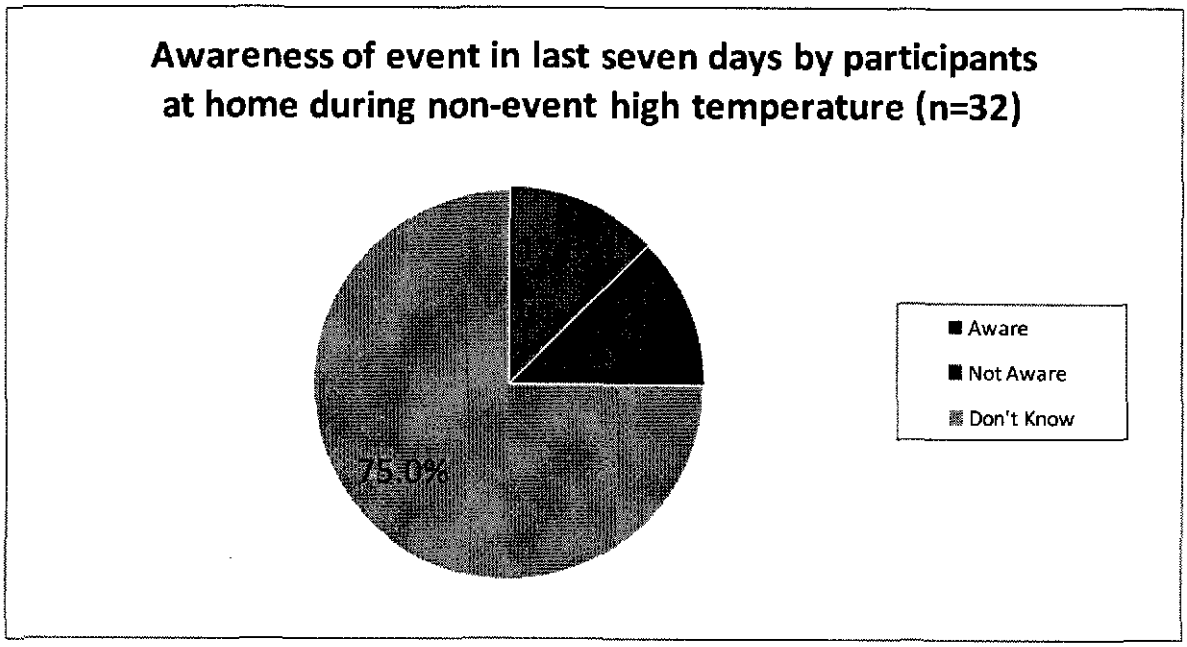


Figure 22. Awareness of event in last seven days by non-event participants.

TecMarket Works also asked event participants who were not at home during the event timeframe whether they were aware of the Power Manager device activation. As shown in Figure 23, eighty-one percent of event participants not a home stated either that they thought no activation had occurred or were unsure of whether an activation had occurred or not. This suggests that both participant groups ("at home" and "not at home" are equally likely to be unsure of a Power Manager activation occurring within the previous 51 hours.

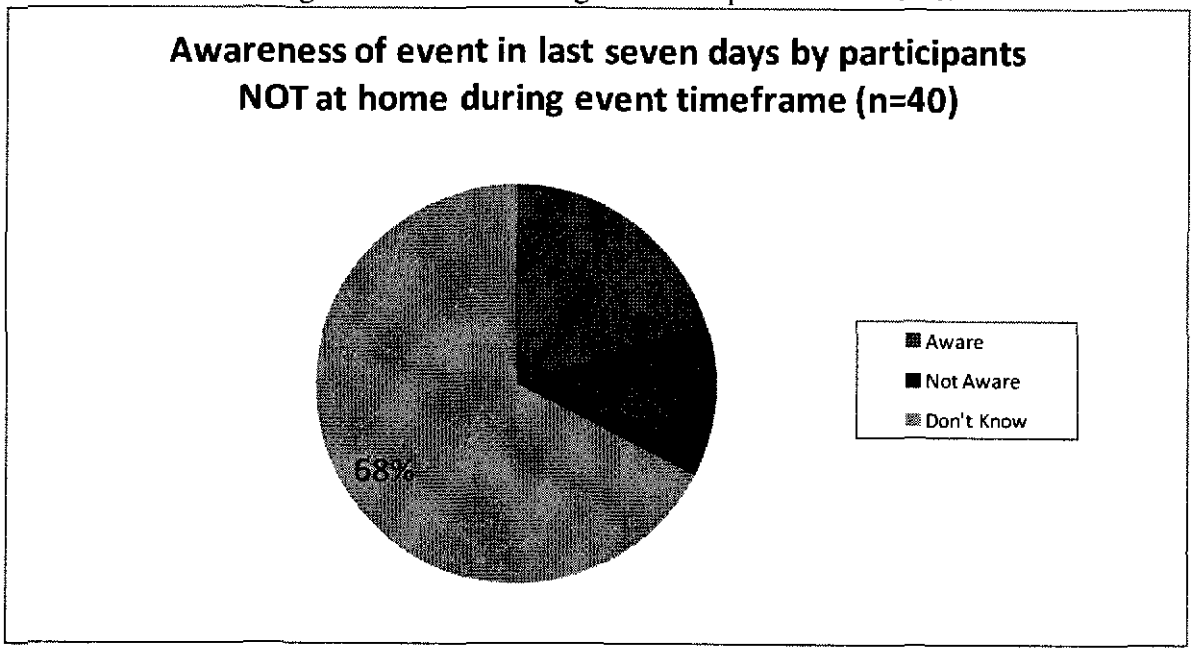


Figure 23. Awareness of event activation by event participants not at home.

Changes in Comfort and Comfort Drivers

The next part of the survey for both Event and Non-Event participants dealt with any perceived change in comfort being ascribed to a Power Manager activation and whether there were other drivers of that comfort change beyond the activation.

TecMarket Works then asked two comfort related questions to the 71 event participants and 35 non-event participants that indicated that they or a family member were home during the event or high temperature.

The first question asked for the participant to rate their level of comfort before the activation or time of high temperature on a 1-to-10 scale with one being very uncomfortable and ten being very comfortable. TecMarket Works then asked participants to rate their comfort level during the event or time of high temperature using the same scale. Table 23 below shows that the majority of both Event and Non-Event survey respondent indicated no change in their comfort level during the Power Manager activation or time of high temperature.

Table 23. Comfort perception percentages by customers at home during an event

		Event (N=71)	Non-Event (N=35)
Participants at home who noticed any change in comfort	N	12	6
	%	16.9%	17.1%

For the participants that did notice a change, Table 24 shows the mean ratings for before and during the event or high temperature as well as the high, low and mean difference for event and non-event participants.

Table 24. Rating differences for Events and Non-Events by customers at home during an event

	Event (N=12)	Non-Event (N=6)
Mean of pre-event comfort rating	9.0	8.83
Mean of rating during event or high temperature	5.75	7
Mean difference of ratings	3.25	1.83
Highest difference	9	4
Lowest difference	1	1

Participant Perceptions Relative to Comfort Change

TecMarket Works asked participants who noted a change in comfort during the event or non-event timeline an open-ended question as to what they believe caused the change in comfort. The responses are shown below in Figure 24.

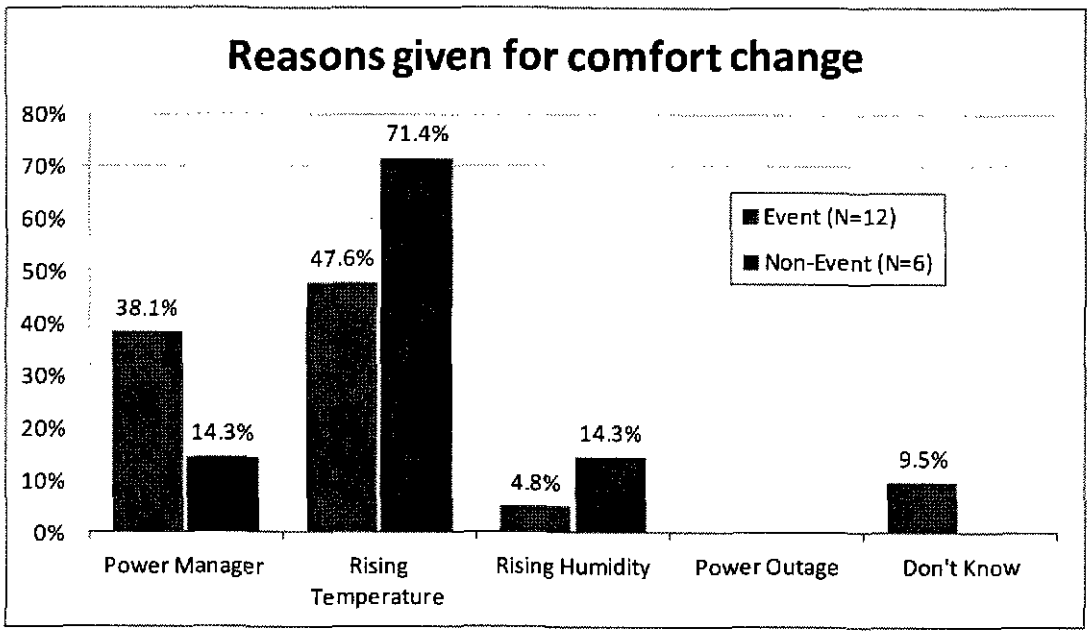


Figure 24. Reasons for comfort change

Figure 24 shows that most event and non-event participants attribute their change in comfort to rising temperature, however, only a small percentage attribute the change to high humidity.

Also of note is the fact that a minority of both the event and non-event participants cited Power Manager as contributing to their change in comfort. One out of six (14%) non-event participants did cite Power Manager for their change in comfort even though there was no device activation on the day in question.

Power outage was not mentioned a contributing factor to comfort change by any respondents.

This data – along with the data from Figure 22 showing that only 12.5% of event participants were aware of an event occurring in the past seven days – suggests there is uncertainty among many participants as to how Power Manager affects their air conditioner and home comfort level. That is, many participants may be unaware that the Power Manager device is causing the changes they feel in comfort. In addition, some participants may be attributing a change in comfort to participation in Power Manager when that change is in fact being caused by other factors.

Behaviors During Event Activation

TecMarket Works asked several questions regarding behavior associated with a Power Manager device activation.

Thermostat Adjustments

Participants who indicated that they or a family member had been home during the time of the event or high temperature non-event day were asked if they had adjusted their thermostat during that time.

Three event participants stated that they adjusted the thermostat: one from 75 degrees to 73 degrees, one from 78 to 74 degrees, and one from 76 to 74 degrees, for a mean change of 2.7 degrees during the device activation.

Two non-event participants stated that they had adjusted their thermostats: one from 73 degrees to 62 degrees, and one from 76 degrees to 75 degrees.

Use of Fans and Other Ways to Keep Cool

Participants who indicated that they or a family member had been home during the time of the event or high temperature period were then asked if they had turned on any fans during that time period. The results are shown in Table 25.

Table 25. Did you or your family turn on a fan during event or high temperature?

	Event (N=71)	Non-Event (N=35)
Yes	25.4%	22.9%
No	70.4%	77.1%
Don't Know	4.2%	-

Participants were then asked an open-ended question as to whether they did anything else to keep cool during the timeframe of the Power Manager device activation or high temperature. Sixty-five out of 71 event participants (91.5%) and all of the non-event participants stated that they either did nothing else or nothing at all in response to the device activation or high temperature. The other responses are included in Table 26.

Table 26. Activities Event participants took to cool down (N=71)

Moved to a cooler part of the house	2.8%
Sat still	2.8%
Opened windows	1.4%
Didn't use the stove	1.4%

No event or non-event participants indicated that they had used any room air conditioners to keep cool or to compensate for the Power Manager device activation.

Age of Air-Conditioner and Change in Comfort Levels During Event

TecMarket Works asked participants for the age of their air conditioner. The distributions are shown below in Figure 25.

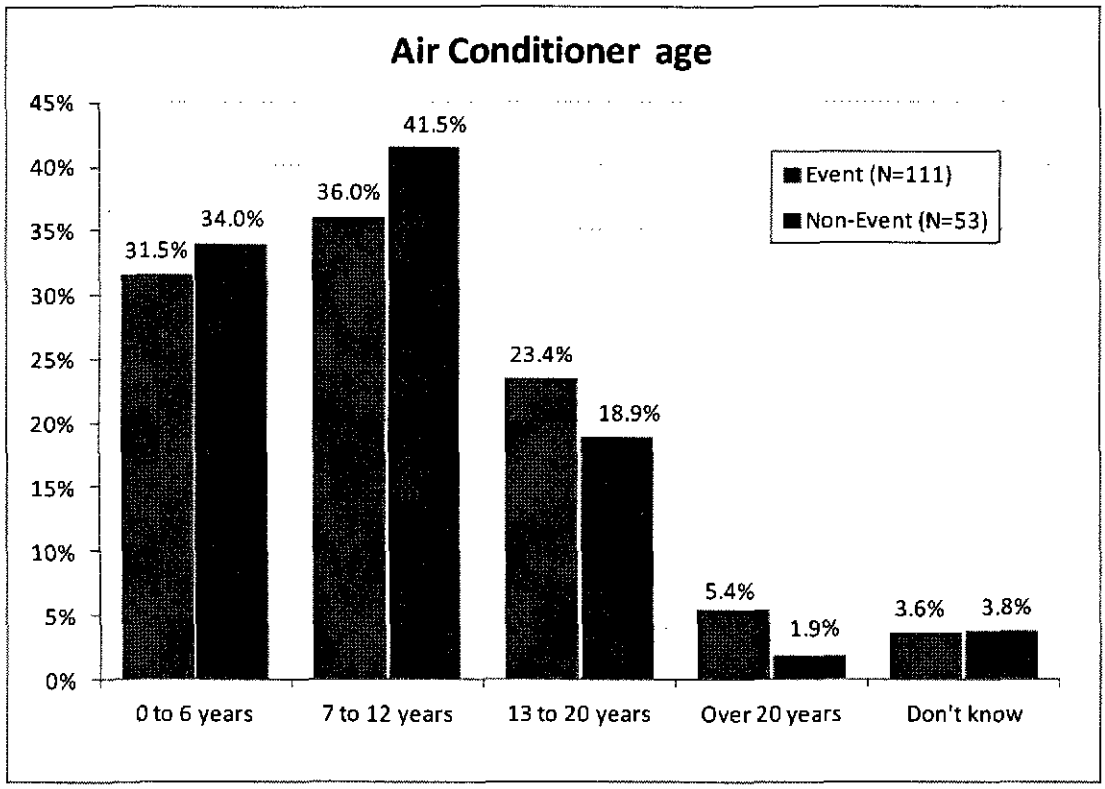


Figure 25. Air Conditioner age

These distributions are similar between Event and Non-Event participants with the majority of air conditioners 12 years old or less for both groups. Cross-tabulating air conditioner age with comfort ratings yields the following line chart (Figure 26).

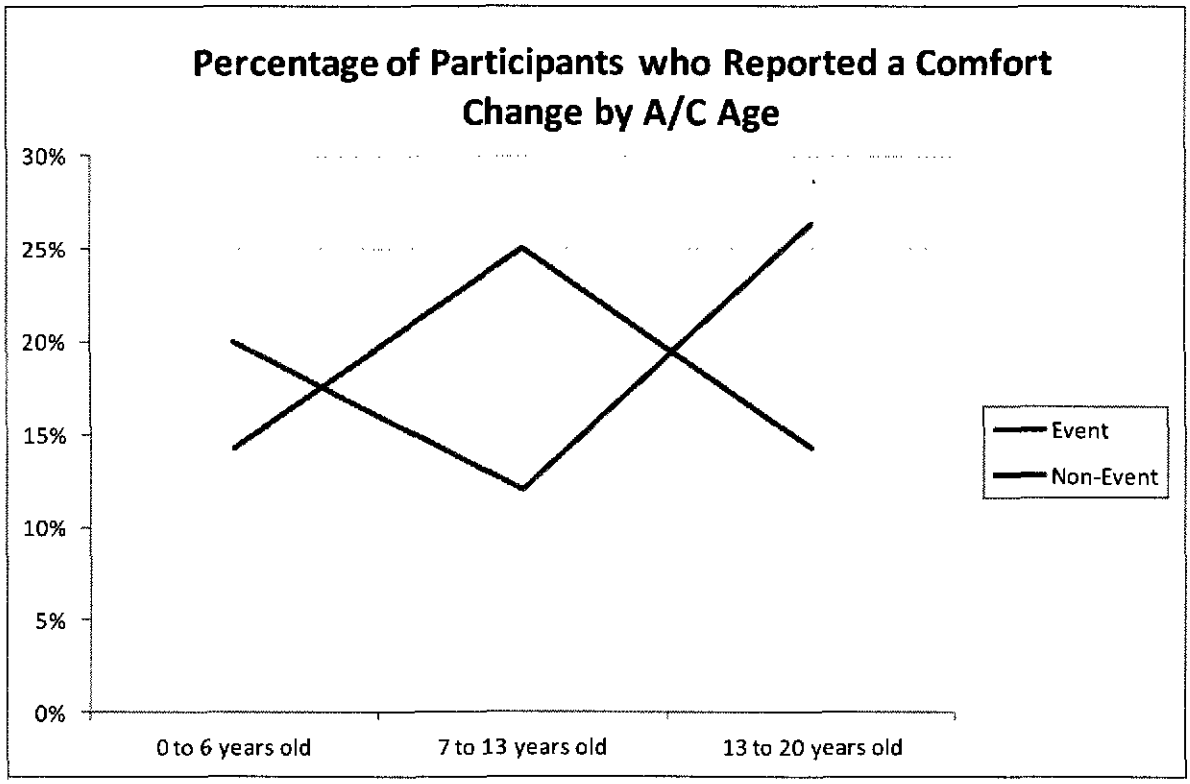


Figure 26. Comfort change vs. Air conditioner age

In Figure 26 the lines cross twice and there is no clear difference in the direction of the lines between Event and Non-Event participants.

Because of the small sample size of those participants who were home at the time of the event or high temperature and experienced a change in comfort (N=12 and N=6 for event and non-event participants respectively) it is impossible to determine with any certainty whether or not air conditioner age plays a role in participants' comfort change during a Power Manager event.

The finding from the full participant survey that 60 percent of participants reported having their air conditioner tuned or serviced since enrolling in the program suggests that regular maintenance is being performed on the air conditioners.

Curtailment kWh Option and Change in Comfort Levels During Event

In Ohio, Power Manager participants have the option to sign up for either of two levels of curtailment: 1 kWh or 1.5 kWh. The larger option offers a higher bill credit to the participant, but also requires a longer "cycle" or activation period and a longer time period that the participant would be without the A/C compressor running during event activation.

TecMarket Works surveyed both 1 kWh and 1.5 kWh option participants:

- Nine event respondents were signed up for the 1.5kWh option and four of those respondents reported being home during an event. Of those four respondents, one (25%) reported a change in comfort.

- Six non-event respondents were signed up for the 1.5kWh option and three of those respondents reported being home at the time of high temperature. Of those three respondents, one (30%) found a change in comfort.

Curtailment options do not appear to effect comfort levels of participants in Ohio.

Recency Respondents Satisfaction

Overall satisfaction with Duke Energy for recency survey respondents is high at 8.2 on a 1-to-10 scale with 1 being not at all satisfied and 10 being very satisfied. Event respondents overall satisfaction mean is 8.25 while the mean for non-event respondents is 8.26. The distribution of ratings is shown in Figure 27 below.

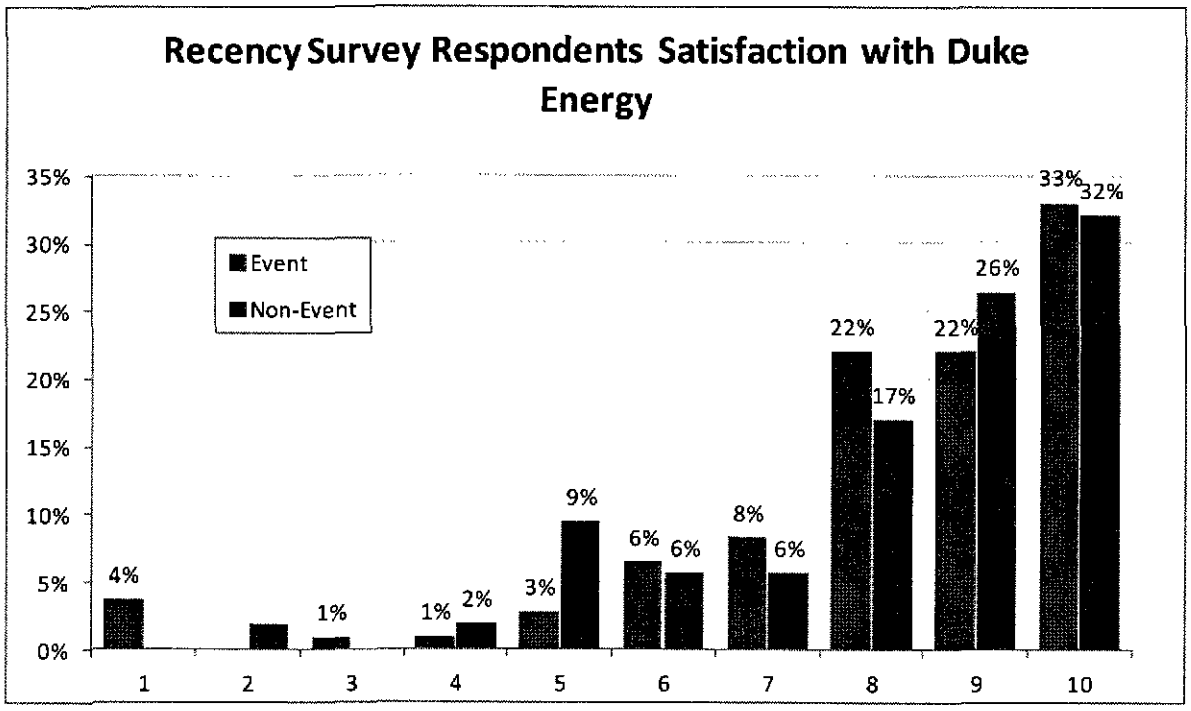


Figure 27. Distribution of Recency Survey Satisfaction Ratings

Recency Participant Population

Recency survey participants were also asked how many people lived in their home and how many were regularly home on a weekday afternoon. The distributions are shown below in Figure 28 and Figure 29.

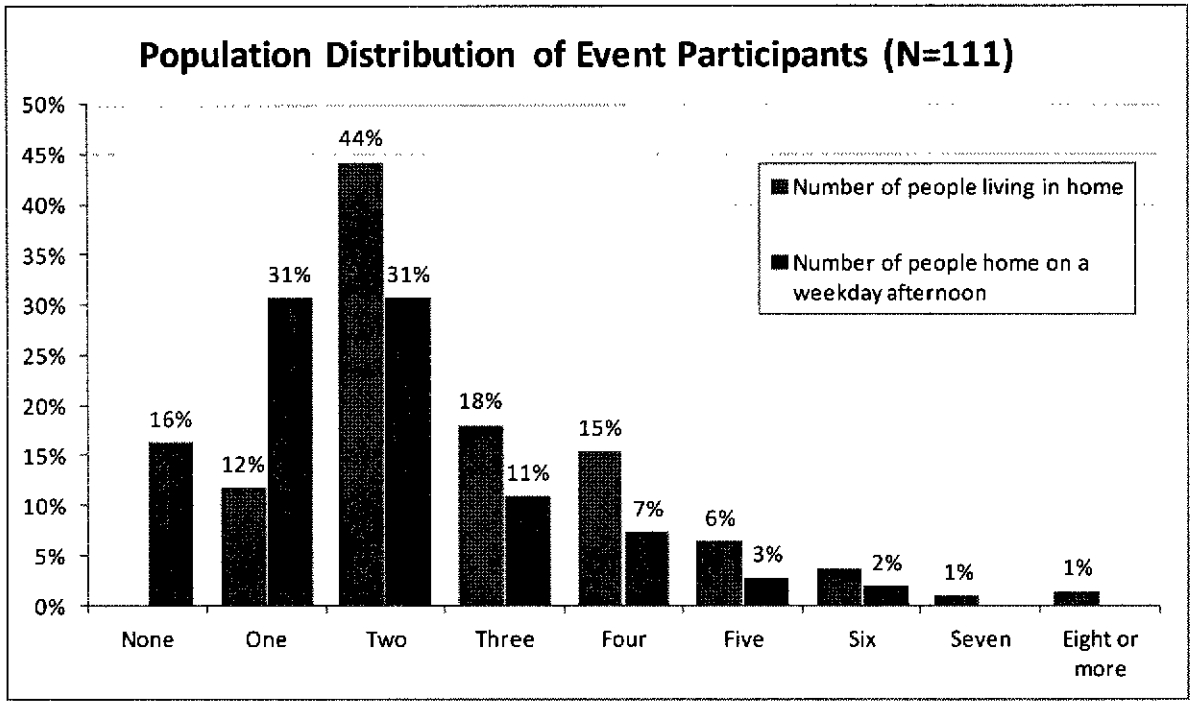


Figure 28. Population distribution of Event participants

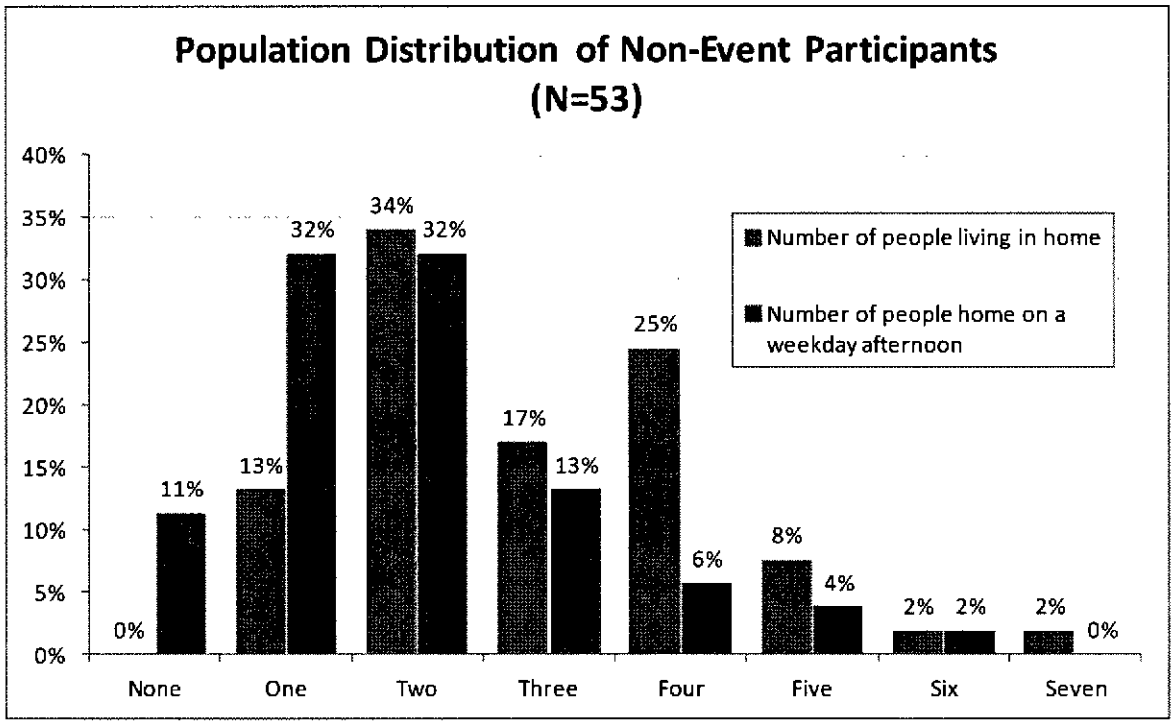


Figure 29. Population distribution of Non-Event Participants

Section 4: Comfort Values and Heat Index or Temperature

No Correlation: Temperature or Heat Index and Comfort Levels
There is no statistical relationship between a surveyed participants' awareness of an event occurring and an event actually occurring. That is, if an event occurs and a customer was surveyed, they were no more likely to correctly answer if there was an event or not than someone who did not experience a control event.

In addition, there is no correlation (Pearson Correlation = -0.047 and is not statistically significant) between a surveyed participant's comfort level and the temperature setting on the day in question before the event or the day prior to the high temperature day (for participants surveyed about non-event days), regardless if there was an event or not. This indicates that people are comfortable in their homes with their temperature settings before the event. Further, there is no significant correlation (Pearson Correlation = -0.246 and is statistically significant at the 0.05 level) between a surveyed participant's comfort level and the temperature setting during the event or high temperature period.

This suggests that the customers are comfortable in their homes, at the temperature setting they have their thermostats set at. Looking at reported comfort levels during the event or high temperature day again reveals no correlation (0.178 and -0.335, respectively, the latter with statistical significance at the 0.01 level). Finally, looking at reported change in comfort levels compared to the high temperature and the heat index for the day in question reveals no correlation (-.165 and .179, respectively, with neither being statistically significant).

This suggests that the customers are comfortable in their home with their air conditioners on, and do not experience any significant change in comfort regardless if there is a control event or what the high temperature or heat index of the day is.

Appendix A: Program Manager Interview Instrument

Name: _____

Title: _____

Position description and general responsibilities:

_____

_____

_____

We are conducting this interview to obtain your opinions about and experiences with the Power Manager program. We'll talk about the Power Manager Program and its objectives and your thoughts on improving the program. The interview will take about one hour to complete. Your responses during this interview will be kept confidential May we begin?

Program Objectives & Operations

1. Please explain how the Power Manager program works: Walk us through the participatory steps starting with a customer who knows nothing about the program.

    - Outreach and Marketing
    - Enrollment
    - Event Call
    - Response
    - Payment

2. Please describe your role and scope of responsibility in detail. When did you take on this role?

3. Do you feel that you have enough support and resources to adequately manage this program? If not, what else is needed?

4. In your own words, please briefly describe the Power Manager Program's objectives. Any other objectives?

5. Have these objectives changed in the last year or so, and if so how? Why?

6. In your opinion, how well are objectives being met?

7. Are there any new external influences on the program since the objectives were developed, that might be affecting program operations? If yes, is there anything the program can do to

address those influences? Or, do you think the objectives should be adjusted to reflect the new influences?

8. Do you think the materials and information presented to the residential customer about the Power Manager program provides a complete enough picture for them to understand the potential importance of the program to them and their participatory benefits of the program?

9. Do you think the incentives offered through the Power Manager program are adequate enough to entice the residential customer to enroll in the program? Why or why not? What can be improved in the area of incentives or enticements?

10. Are there any changes to the incentives or marketing that could possibly increase participation in the program? What would happen if the incentives were decreased or increased, how would this impact your ability to acquire power reductions?

11. What kinds of marketing, outreach and customer contact approaches do you use to make your customers aware of the program? Are there any changes to the program marketing that you think would increase participation?

Program Design & Implementation

12. How does Duke determine the best target markets or customer segments to focus on?

13. Are there any market information, research or market assessments that you are using to identify market barriers, and to develop more effective operational mechanisms?

14. How do you track, manage, and monitor or evaluate customer involvement?

15. What is the quality control, tracking and accounting process for determining how well control strategies work?

16. (for post-season interview) Please tell me about the events that were called in 2011. How many events were called? Why were they called?

17. (for post-season interview) How were the events called? What did you learn from the event call process? Where there any surprises with the process? What could be done to improve the way the events are called in the future?

18. (for post-season interview) Did you achieve the load shift you needed? How do you know this?

19. (for post-season interview) How well did the payment process operate? Did the program staff come across any issues or problems with payment? How were they resolved?

Overall Power Manager Management

20. (summer interview) During the last process evaluation of Power Manager, Duke Energy was in the process of addressing some problems in communication with the switches and failure rates. Can you describe this so that we understand it well? Are you experiencing the same problems in 2011? What is being done to deal with this issue? Do you have any suggestions for improving this in addition to the approaches being taken?

21. (summer interview) The last process evaluation of Power Manager, included a number of recommendations for Duke Energy to consider. I'd like to go over these and find out if Duke has adopted those recommendations or, if not, why Duke decided against them.

    •Add staff to help with the administrative needs during control season. It is critical to ensure that program operations run efficiently in the eyes of the participants during those times, and that all customer concerns during events are addressed promptly.
    •In program planning, estimate the number of economic events separately from emergency events should be considered.
    •Consider leapfrogging the Cannon switch technology in favor of a switch that allows two-way communication, or one that can be integrated with a smart grid
    (for the analytical team members:)
    •A potential alternative approach for future impact evaluations is to use the data from the M&V (and possibly the operability) sample to directly estimate impacts via statistical models. This approach could use a time-series, cross-sectional analysis where the dependent variable is the actual AC load (or run time), and the independent variables include weather conditions, time of day, day of week, and the Power Manager® control event. In essence, this would produce an overall duty-cycle model, and the coefficient on the Power Manager® control event variable(s) would estimate the actual load impacts during those events. This assumption is based on the panel sample being representative of the program population.

22. Describe the use of any internal or outside program advisors, technical groups or organizations that have in the past or are currently helping you think through the program's approach or methods. How often do you use these resources? What do you use them for?

23. In what ways do you think the Power Manager Program's operations could be improved?

24. Do you have any suggestions for how program participation can be increased?

25. If you could change any part of the program what would you change first?

26. What would you say are the program's biggest successes?

27. We've covered a lot of areas today, but are there any other issues or topics you think we should know about and discuss for this evaluation?

28. Do you have any questions for me, about this interview or this process evaluation?

Thank you for your time…

Appendix B: Participant Survey Instrument

Use five attempts at different times of the day and different days before dropping from contact list. Call times are from 10:00 a.m. to 8:00 p.m. EST or 9-7 CST Monday through Saturday. No calls on Sunday.

SURVEY

Introduction

Note: Only read words in bold type.

Introduction

Hello, my name is _____, and I'm calling on behalf of Duke Energy. According to our information, you presently participate in Duke Energy's Power Manager® Program. This program allows Duke Energy to cycle your air conditioner when there is a critical need for electricity in the region. This survey will take about 15 minutes to complete, and the information you provide will be confidential and will help to improve the program.

1. **Are you aware of your participation in the Power Manager® program?**

❑ Yes ❑ No ❑ DK

If no, **May I please speak to the person who would be most familiar with your household's participation in the Power Manager® program?**

If not available, try to schedule a callback time. If transferred, begin survey from beginning (Introduction).

Participation Drivers

We would like to collect some information on why you agreed to participate in the program and how you heard about it.

2. **Were you involved in the decision to participate in Duke Energy's Power Manager® Program?**

❑ Yes ❑ No ❑ DK

If no, skip to question 5.

3. **Do you recall how you first heard about the program?**

❑ Yes ❑ No ❑ DK

If yes, 3a. **How did you hear about the Power Manager® Program?**

a) ❑ utility bill insert
b) ❑ direct mail offer from Duke Energy
c) ❑ utility website
d) ❑ Word-of-mouth (friend/neighbor/landlord)
e) ❑ Newspapers
f) ❑ Social network: _____
g) ❑ Don't know
h) ❑ Other: _____

4. **To the best of your ability, could you please tell me what the promoted benefits of the program were?**

a) ❑ _____
b) ❑ Don't Know.

5. **What was the main reason why you chose to participate in the program?**

a) ❑ For the bill credits
b) ❑ Helping Duke avoid power shortages/outages
c) ❑ To save energy
d) ❑ To save money (through lower utility bills)
e) ❑ To help the environment
   a. Please explain: (to reduce carbon or GHG, etc…) _____
f) ❑ I don't use the air conditioner much
g) ❑ I'm usually not home when the events are supposed to occur
h) ❑ Don't know
i) ❑ Other: _____

5a. **Do you recall reading this benefit in the program brochure or materials sent to you?**

❑ Yes ❑ No ❑ DK
❑ Did not get brochure ❑ Do not remember brochure

6. **What were your other reasons for choosing to participate in this program?**

a) ❑ For the bill credits
b) ❑ Helping Duke avoid power shortages/outages
c) ❑ To save energy (through lower utility bills)
d) ❑ To save money
e) ❑ To help the environment
   a. Please explain: (to reduce carbon or GHG, etc…) _____
f) ❑ I don't use the air conditioner much

g) ❑ I'm usually not home when the events are supposed to occur
h) ❑ Don't know
i) ❑ Other: _____
j) ❑ No other reasons.

6a. **Do you recall reading anything about this benefit in the program brochure or materials sent to you?**

❑ Yes ❑ No ❑ DK
❑ Did not get brochure ❑ Do not remember brochure

7. **Generally speaking, how important are environmental issues to you? Would you say they are...**

a. ❑ **Very Important**
b. ❑ **Important**
c. ❑ **Neither Important Nor Not Important**
d. ❑ **Not Important, or**
e. ❑ **Not At All Important**

8. **How important are climate change issues to you? Would you say they are...**

a. ❑ **Very Important**
b. ❑ **Important**
c. ❑ **Neither Important Nor Not Important**
d. ❑ **Not Important, or**
e. ❑ **Not At All Important**

9. **How important is reducing air pollution to you? Would you say it is...**

a. ❑ **Very Important**
b. ❑ **Important**
c. ❑ **Neither Important Nor Not Important**
d. ❑ **Not Important, or**
e. ❑ **Not At All Important**

10. **How important is the need to reduce the rate of building new power plants? Would you say it is...**

a. Very Important
b. Important
c. Neither Important Nor Not Important
d. Not Important
e. Not At All Important

11. **Are you a member of any groups or clubs that have environmental missions?**

❑ Yes ❑ No ❑ DK

If yes, 11a. **Which ones?**

a) ❑ List: _____
b) ❑ Don't know

Understanding the Program

12. **Before you enrolled in the program, you received program information from Duke Energy that described how the program works. Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", how satisfied were you with this information in helping you to understand how the program works?**

1 2 3 4 5 6 7 8 9 10

If 8 or below, 12b. **Why were you less than satisfied with this information?**

_____

❑ DK

13. **How often per year did Duke Energy say it would activate the Power Manager® device on your air conditioner?**

_____

❑ DK

14. **What's your best estimate of how many dollars you will receive in yearly bill credits from Duke Energy for participating in the Power Manager® program?**

a) ❑ $____
b) ❑ Don't know

15. **According to our information are currently a participant in this program. Have you receive any bill credits this year from Duke Energy for participating in this program?**

❑ Yes ❑ No ❑ DK

16. **Is anything unclear to you about how the program works?**

❑ Yes ❑ No ❑ DK

If yes, 16a. **What is unclear to you?**

_____

❑ DK

17. **Did you ever call or email Duke Energy to find out more about the Power Manager® Program?**

❑ Yes ❑ No ❑ DK

If no, skip to question 18.

If yes, 17a. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", how satisfied were you with the ease of reaching a Duke Energy representative?**

1 2 3 4 5 6 7 8 9 10

If 8 or below, 17b. **Why were you less than satisfied?**

_____

17c. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", how satisfied were you with how the person responded to your questions?**

1 2 3 4 5 6 7 8 9 10

If 8 or below, 17d. **Why were you less than satisfied with this information?**

a) ❑ Didn't respond to my questions/ concerns
b) ❑ Unable to answer/address my questions/concerns
c) ❑ Not professional/courteous
d) ❑ Other: _____
e) ❑ Don't know

Program Experience

18. **Has Duke Energy activated the Power Manager® device since you joined the program?** *[If they ask what this means, respond with: "Duke Energy has the ability to send a signal to activate the device to cycle your central air conditioner on and off during an event." Repeat the question.*

❑ Yes ❑ No ❑ DK

19. **How do you know when the device has been activated?**

a) ❑ A/C shuts down

b) ❑ Home temperature rises
c) ❑ The light on the meter is on
d) ❑ Light on AC unit flashes
e) ❑ Bill credits
f) ❑ Lower bill
g) ❑ Other: _____
h) ❑ Don't know

20. **About how many times did Duke Energy activate your Power Manager® device so far in 2011?**

a) ❑ _____
b) ❑ Don't know

21. **Were you or any members of your household home when Duke Energy activated your Power Manager® device this past summer?**

❑ Yes ❑ No ❑ DK

If no or don't know, skip to question 28.

22. **During this activation, using a scale of 1 to 10 where 1 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort before the control event?**

1 2 3 4 5 6 7 8 9 10

a) ❑ DK

23. **Using the same scale of 1 to 10 where 1 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort during the control event?**

1 2 3 4 5 6 7 8 9 10

a) ❑ DK

If score from Q23 is lower than score from Q22:

24. **What do you feel caused your decrease in comfort?**

Select all that apply:

a) ❑ Power Manager
b) ❑ Rising Temperature
c) ❑ Rising Humidity
d) ❑ Power Outage

e) ❑ Other: _____
f) ❑ Don't Know

25. **When Duke Energy activated your Power Manager® device, did you or any other members of your household adjust the settings on your thermostat?**

❑ Yes ❑ No ❑ DK

If yes, 25a. **What temperature was it originally at, and what temperature did you set it to during the control event?**

Original temperature setting: _____ degrees F
❑ DK
Adjusted temperature setting: _____ degrees F
❑ DK

26. **Thinking about this summer, how many times do you think the activation of the Power Manager® program affected your level of comfort?**

a) ❑ _____
b) ❑ Don't know

27. **When Duke Energy activated your Power Manager® device, did you or any other members of your household turn on any fans to keep cool?**

❑ Yes ❑ No ❑ DK

27a. **What else did you or other members of your household do to keep cool?**

a) ❑ Continued normal activities/ Didn't do anything different
b) ❑ Turned on room/window air conditioners
c) ❑ Closed blinds/shades
d) ❑ Moved to a cooler part of the house
e) ❑ Left the house and went somewhere cool
f) ❑ Wore less clothing
g) ❑ Drank more water/cool drinks
h) ❑ Turned on fans
i) ❑ Opened windows
j) ❑ Other: _____
k) ❑ Don't know

28. **When Duke Energy activates your Power Manager® device, it usually does so on summertime afternoons. Is someone usually home on weekday afternoons during the summertime?**

❑ Yes ❑ No ❑ DK

29. **Why do you think Duke Energy activates your Power Manager® device on summertime weekdays during the afternoon as opposed to other times of the day or year?**

a) ❑ _____
b) ❑ Don't know

Overall Program Satisfaction

30. **Using a scale of 1 to 10 where 10 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", how satisfied were you with the process of enrolling in the program?**

1 2 3 4 5 6 7 8 9 10

If 8 or below, 30b. **Why were you dissatisfied with this enrollment process?**

a) ❑ _____
b) ❑ Don't Know

31. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", how satisfied are you with the Power Manager® program in general?**

1 2 3 4 5 6 7 8 9 10

If 8 or below, 31b. **Why were you less than satisfied with Power Manager®?**

a) ❑ They activated my Power Manager® device more often than I would like
b) ❑ The bill credits/incentives were not large enough
c) ❑ I was uncomfortable when my Power Manager® device was activated
d) ❑ Other: _____
e) ❑ Don't Know

31c. **Were there any other reasons you were less than satisfied with Power Manager®?**

a) ❑ They activated my Power Manager® device more often than I would like
b) ❑ The bill credits/incentives were not large enough
c) ❑ I was uncomfortable when my Power Manager® device was activated
d) ❑ Other: _____
e) ❑ Don't Know
f) ❑ No

32. **Would you recommend this program to a friend, neighbor, or co-worker?**

❑ Yes ❑ No ❑ DK

If no, 32b. **Why not?**

a) ❑ _____
b) ❑ Don't Know

33. **What, if any, Duke Energy programs or services have you heard of that help customers save energy? Any others?**

a) ❑ Smart Saver (other than CFL)
b) ❑ Personalized Energy Report
c) ❑ Home Energy House Call
d) ❑ Home Energy Comparison Report
e) ❑ CFL Program
f) ❑ Energy Star Homes
g) ❑ Low Income, Weatherization, or Low Income Weatherization
h) ❑ K12, NEED, or "Get Energy Smart"
i) ❑ Other: _____
j) ❑ Don't Know

Air Conditioning Practices

Now I'm going to ask you some questions about your air conditioning use.

34. **How often do you use your central air conditioner? Would you say you use it ...**

a) ❑ **Not at all**
b) ❑ **Only on the hottest days**
c) ❑ **Frequently during the cooling season**
d) ❑ **Most days during the cooling season**
e) ❑ **Everyday during the cooling season**
f) ❑ **Don't know**

If b-e, 34a. **About how many days would you estimate that you had your air conditioner on so far this summer?**

a) ❑ Fewer than 10 days
b) ❑ 10 to 20 days
c) ❑ 21 to 30 days
d) ❑ 31 to 40 days
e) ❑ 41 to 50 days
f) ❑ 51 to 60 days

g) ❑ 61 to 70 days
h) ❑ more than 71 days
i) ❑ every day
j) ❑ Don't know

35. **Have you had your air conditioner tuned-up or serviced since you enrolled in the Power Manager® program?**

❑ Yes ❑ No ❑ DK

If yes, 35a. **Did the performance of your air conditioner improve after you had it serviced?**

❑ Yes ❑ No ❑ DK

35b. **Who serviced your air conditioner?**

a) ❑ Air conditioning contractor
b) ❑ Duke Energy
c) ❑ Electrician
d) ❑ Other: _____
e) ❑ Don't Know

36. **Is the air conditioner typically used to keep someone at home comfortable during weekday summer afternoons before 5 P.M.?**

❑ Yes ❑ No ❑ DK

37. **Is the air conditioner typically used to keep someone at home comfortable during summer weekdays after 5 P.M.?**

❑ Yes ❑ No ❑ DK

38. **When you think of a typical hot and humid summer day, at what outside temperature do you tend to feel uncomfortably warm?**

a) ❑ < 65 degrees
b) ❑ 65-68 degrees
c) ❑ 69-72 degrees
d) ❑ 73-75 degrees
e) ❑ 76-78 degrees
f) ❑ 79-81 degrees
g) ❑ 82-84 degrees
h) ❑ 85-87 degrees
i) ❑ 88-90 degrees
j) ❑ 91-94 degrees
k) ❑ 95-97 degrees

l) ❑ 98-100 degrees
m) ❑ > 100 degrees
n) ❑ Don't Know

39. **At what outside temperature do you tend to turn on the air conditioner?**

a) ❑ < 65 degrees
b) ❑ 65-68 degrees
c) ❑ 69-72 degrees
d) ❑ 73-75 degrees
e) ❑ 76-78 degrees
f) ❑ 79-81 degrees
g) ❑ 82-84 degrees
h) ❑ 85-87 degrees
i) ❑ 88-90 degrees
j) ❑ 91-94 degrees
k) ❑ 95-97 degrees
l) ❑ 98-100 degrees
m) ❑ > 100 degrees
n) ❑ It's programmed into the thermostat.
o) ❑ Don't Know

If n, 39a. **Do you set your thermostat seasonally or when the weather gets hot?**

i. ❑ I program the thermostat seasonally
ii. ❑ When the weather gets hot
iii. ❑ Other: _____

40. **I am going to read a list of time periods. For each time period, please tell me the temperature that your thermostat is typically set to on a hot summer weekday when you are using the air conditioner, or if it is turned off.**

40a. **On a hot weekday morning from 6 am to noon.**

p) ❑ < 65 degrees
q) ❑ 65-68 degrees
r) ❑ 69-72 degrees
s) ❑ 73-75 degrees
t) ❑ 76-78 degrees
u) ❑ >78 degrees
v) ❑ No change from an average summer week day
w) ❑ OFF

40b. **On a hot weekday afternoon from noon to 5 pm**

a) ❑ < 65 degrees
b) ❑ 65-68 degrees
c) ❑ 69-72 degrees
d) ❑ 73-75 degrees
e) ❑ 76-78 degrees
f) ❑ >78 degrees
g) ❑ No change from an average summer week day
h) ❑ OFF

40c. **On a hot weekday evening from 5 pm to 10pm.**

a) ❑ < 65 degrees
b) ❑ 65-68 degrees
c) ❑ 69-72 degrees
d) ❑ 73-75 degrees
e) ❑ 76-78 degrees
f) ❑ >78 degrees
g) ❑ No change from an average summer week day
h) ❑ OFF

40d. **During a hot weekday night from 10pm to 6am.**

a) ❑ < 65 degrees
b) ❑ 65-68 degrees
c) ❑ 69-72 degrees
d) ❑ 73-75 degrees
e) ❑ 76-78 degrees
f) ❑ >78 degrees
g) ❑ No change from an average summer week day
h) ❑ OFF

41. **I would now like to know the thermostat temperature setting for those same time periods but on a hot summer weekend.**

41a. **On a hot weekend morning from 6 am to noon.**

a) ❑ < 65 degrees
b) ❑ 65-68 degrees
c) ❑ 69-72 degrees
d) ❑ 73-75 degrees
e) ❑ 76-78 degrees
f) ❑ >78 degrees
g) ❑ No change from an average summer weekend day
h) ❑ OFF

41b. **On a hot weekend afternoon from noon to 5 pm**

a) ❑ < 65 degrees
b) ❑ 65-68 degrees
c) ❑ 69-72 degrees
d) ❑ 73-75 degrees
e) ❑ 76-78 degrees
f) ❑ >78 degrees
g) ❑ No change from an average summer weekend day
h) ❑ OFF

41c. **On a hot weekend evening from 5 pm to 10pm.**

a) ❑ < 65 degrees
b) ❑ 65-68 degrees
c) ❑ 69-72 degrees
d) ❑ 73-75 degrees
e) ❑ 76-78 degrees
f) ❑ >78 degrees
g) ❑ No change from an average summer weekend day
h) ❑ OFF

41d. **During a hot weekend night from 10pm to 6am.**

a) ❑ < 65 degrees
b) ❑ 65-68 degrees
c) ❑ 69-72 degrees
d) ❑ 73-75 degrees
e) ❑ 76-78 degrees
f) ❑ >78 degrees
g) ❑ No change from an average summer weekend day
h) ❑ OFF

42. **How old is your air conditioner?**

a) ❑ 0 to 6 years old
b) ❑ 7 to 12 years old
c) ❑ 13 to 20 years old
d) ❑ over 20 years old
e) ❑ Don't Know

43. **Duke Energy is always looking for other ways to help their customers. If Duke were to offer a program that cycles other equipment at your home such as an electric water heater, would you be interested in participating??**

❑ Yes ❑ No ❑ DK

44. **Are there any programs or services that you think Duke Energy should provide to its residential customers that are currently not provided?**

❑ Yes ❑ No ❑ DK

If yes, 44b. **What services or types of programs?**

_____

45. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", What is your overall satisfaction with Duke Energy?**

1 2 3 4 5 6 7 8 9 10

a) ❑ Don't Know

If 8 or below, 45b. **Why were you less than satisfied with Duke Energy?**

_____

46. **Did you experience any power outage issues on any of the days that Duke Energy activated your Power Manager® device?**

❑ Yes ❑ No ❑ DK

Demographics

Finally, we have two short demographic questions.

47. **How many people live in this home?**

a) ❑ 1
b) ❑ 2
c) ❑ 3
d) ❑ 4
e) ❑ 5
f) ❑ 6

g) ❑ 7
h) ❑ 8 or more

48. **How many persons are usually home on a weekday afternoon?**

a) ❑ 1
b) ❑ 2
c) ❑ 3
d) ❑ 4
e) ❑ 5
f) ❑ 6
g) ❑ 7
h) ❑ 8 or more

Thank you for your time and feedback today! *Politely end call.*

Appendix C: Participant Recency Survey

Use three attempts at different times of the day within 51 hours of event notification before dropping contact from the contact list. Call times are from 10:00 a.m. to 8:00 p.m. EST or 9-7 CST Monday through Saturday. No calls on Sunday. For example, if a control event occurs on a Monday, calling hours for that particular event would be:

- *Monday 5pm-8pm Eastern (4-7 Central)*
- *Tuesday 10am-8pm Eastern (9-7 Central)*
- *Wednesday 10am-8pm Eastern (9-7 Central)*

SURVEY

Note: Only read words in bold type.

Introduction

Hello, my name is _____, and I'm calling on behalf of Duke Energy. According to our information, you presently participate in Duke Energy's Power Manager® Program. This program allows Duke Energy to cycle your air conditioner when there is a critical need for electricity in the region. This is a short survey that will take about 5 minutes to complete, and the information you provide will be confidential and will help to improve the program.

1. **Are you aware of your participation in the Power Manager® program?**

❑ Yes ❑ No ❑ DK

If no, **May I please speak to the person who would be most familiar with your household's participation in the Power Manager® program?**

If not available, try to schedule a callback time within the 51 hour time-frame for the particular event. If transferred, begin survey from beginning (Introduction).

2. **Has Duke Energy activated the Power Manager® device since you joined the program?**
[If they ask what this means, respond with: "Duke Energy has the ability to send a signal to activate the device to cycle your central air conditioner on and off during an event." Repeat the question.]

❑ Yes ❑ No ❑ DK

3. **How do you know when the device has been activated?**

a) ❑ A/C shuts down
b) ❑ Home temperature rises
c) ❑ The light on the meter is on
d) ❑ Light on AC unit flashes
e) ❑ Bill credits
f) ❑ Lower bill
g) ❑ Other: _____
h) ❑ Don't know

4. **Has your device been activated within the last 7 days?**

❑ Yes ❑ No ❑ DK

Your Power Manager device was recently activated on <*date*> starting at <*start time*> and ending at <*end time*>.

5. **At what temperature was your thermostat set to during the time of the event?**

a) ❑ < 65 degrees
b) ❑ 65-68 degrees
c) ❑ 69-72 degrees
d) ❑ 73-75 degrees
e) ❑ 76-78 degrees
f) ❑ 79-81 degrees
g) ❑ 82-84 degrees
h) ❑ 85-87 degrees
i) ❑ 88-90 degrees
j) ❑ 91-94 degrees
k) ❑ 95-97 degrees
l) ❑ 98-100 degrees
m) ❑ > 100 degrees
n) ❑ It's programmed into the thermostat.
o) ❑ Thermostat was turned off
p) ❑ Air conditioner was turned off
q) ❑ DK

6. **Were you or any members of your household home when Duke Energy activated your Power Manager® device at that time?**

❑ Yes ❑ No ❑ DK

If no or don't know, skip to question 13.

7. During this recent activation, using a scale of 1 to 10 where 1 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort before the control event?

1 2 3 4 5 6 7 8 9 10

a) ❑ DK

8. Using the same scale of 1 to 10 where 1 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort during the control event?

1 2 3 4 5 6 7 8 9 10

a) ❑ DK

If score from Q8 is lower than score from Q7:

9. What do you feel caused your decrease in comfort?

Select all that apply:

a) ❑ Power Manager
b) ❑ Rising Temperature
c) ❑ Rising Humidity
d) ❑ Power Outage
e) ❑ Other: _____
f) ❑ Don't Know

10. **When Duke Energy activated your Power Manager® device** <today, yesterday, or two days ago>**, did you or any other members of your household adjust the settings on your thermostat?**

❑ Yes ❑ No ❑ DK

If yes, 10a. **What temperature was it originally at, and what temperature did you set it to during the control event?**

Original temperature setting: _____ degrees F
❑ DK
Adjusted temperature setting: _____ degrees F
❑ DK

11. **When Duke Energy activated your Power Manager® device, did you or any other members of your household turn on any fans to keep cool?**

❑ Yes ❑ No ❑ DK

12. **What else did you or other members of your household do to keep cool?**

a) ❑ Continued normal activities/ Didn't do anything different
b) ❑ Turned on room/window air conditioners
c) ❑ Closed blinds/shades
d) ❑ Moved to a cooler part of the house
e) ❑ Left the house and went somewhere cool
f) ❑ Wore less clothing
g) ❑ Drank more water/cool drinks
h) ❑ Turned on fans
i) ❑ Opened windows
j) ❑ Other: _____
k) ❑ Don't know

Now I'm going to ask you some questions about your air conditioning use.

13. **How often do you use your central air conditioner? Would you say you use it ...**

a) ❑ **Not at all**
b) ❑ **Only on the hottest days**
c) ❑ **Frequently during the cooling season**
d) ❑ **Most days during the cooling season**
e) ❑ **Everyday during the cooling season**
f) ❑ **Don't know**

14. **When you think of a typical hot and humid summer day, at what outside temperature do you tend to feel uncomfortably warm?**

a) ❑ < 65 degrees
b) ❑ 65-68 degrees
c) ❑ 69-72 degrees
d) ❑ 73-75 degrees
e) ❑ 76-78 degrees
f) ❑ 79-81 degrees
g) ❑ 82-84 degrees
h) ❑ 85-87 degrees
i) ❑ 88-90 degrees
j) ❑ 91-94 degrees
k) ❑ 95-97 degrees

l) ❑ 98-100 degrees
m) ❑ > 100 degrees
n) ❑ Don't know

15. **At what outside temperature do you tend to turn on the air conditioner?**

a) ❑ < 65 degrees
b) ❑ 65-68 degrees
c) ❑ 69-72 degrees
d) ❑ 73-75 degrees
e) ❑ 76-78 degrees
f) ❑ 79-81 degrees
g) ❑ 82-84 degrees
h) ❑ 85-87 degrees
i) ❑ 88-90 degrees
j) ❑ 91-94 degrees
k) ❑ 95-97 degrees
l) ❑ 98-100 degrees
m) ❑ > 100 degrees
n) ❑ It's programmed into the thermostat.
o) ❑ Don't know

16. **How old is your air conditioner?**

a) ❑ 0 to 6 years old
b) ❑ 7 to 12 years old
c) ❑ 13 to 20 years old
d) ❑ over 20 years old
e) ❑ Don't Know

17. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", What is your overall satisfaction with the Power Manager® program?**

1 2 3 4 5 6 7 8 9 10

If 8 or below, 17b. **Why are you less than satisfied with Power Manager®?**

a) ❑ They activated my Power Manager® device more often than I would like
b) ❑ The bill credits/incentives were not large enough
c) ❑ I was uncomfortable when my Power Manager® device was activated
d) ❑ Other: _____
e) ❑ Don't Know

18. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", What is your overall satisfaction with Duke Energy?**

1 2 3 4 5 6 7 8 9 10

If 8 or below, 18b. **Why are you less than satisfied with Duke Energy?**

_____

19. **Did you experience any power outage issues on the day of the event?**

❑ Yes ❑ No ❑ DK

Finally, we have two short demographic questions.

20. **How many people live in this home?**

a) ❑ 1
b) ❑ 2
c) ❑ 3
d) ❑ 4
e) ❑ 5
f) ❑ 6
g) ❑ 7
h) ❑ 8 or more

21. **How many persons are usually home on a weekday afternoon?**

a) ❑ 0
b) ❑ 1
c) ❑ 2
d) ❑ 3
e) ❑ 4
f) ❑ 5
g) ❑ 6
h) ❑ 7
i) ❑ 8 or more

Thank you for your time and feedback today! *Politely end call.*

Appendix D: Participant Recency Survey for Non-Event Day Comparison

Use three attempts at different times of the day within 51 hours of weather exceeding 90°F and no Power Manager event being called. Call times are from 10:00 a.m. to 8:00 p.m. EST or 9-7 CST Monday through Saturday. No calls on Sunday. For example, if a high temperature/no event day occurs on a Monday, calling hours for that particular non-event would be:

- *Monday 5pm-8pm Eastern (4-7 Central)*
- *Tuesday 10am-8pm Eastern (9-7 Central)*
- *Wednesday 10am-8pm Eastern (9-7 Central)*

SURVEY

Note: Only read words in bold type.

Introduction

Hello, my name is _____, and I'm calling on behalf of Duke Energy. According to our information, you presently participate in Duke Energy's Power Manager® Program. This program allows Duke Energy to cycle your air conditioner when there is a critical need for electricity in the region. This is a short survey that will take about 5 minutes to complete, and the information you provide will be confidential and will help to improve the program.

1. **Are you aware of your participation in the Power Manager® program?**

❑ Yes ❑ No ❑ DK

If no, **May I please speak to the person who would be most familiar with your household's participation in the Power Manager® program?**

If not available, try to schedule a callback time within the 51 hour time-frame for the particular event. If transferred, begin survey from beginning (Introduction).

2. **Has Duke Energy activated the Power Manager® device since you joined the program?** *[If they ask what this means, respond with: "Duke Energy has the ability to send a signal to activate the device to cycle your central air conditioner on and off during an event." Repeat the question.]*

❑ Yes ❑ No ❑ DK

3. **How do you know when the device has been activated?**

i) ❑ A/C shuts down
j) ❑ Home temperature rises
k) ❑ The light on the meter is on
l) ❑ Light on AC unit flashes
m) ❑ Bill credits
n) ❑ Lower bill
o) ❑ Other: _____
p) ❑ Don't know

4. **Has your device been activated within the last 7 days?**

❑ Yes ❑ No ❑ DK

5. **At what temperature was your thermostat set to at 3pm on** <day of high temperature>**?**

r) ❑ < 65 degrees
s) ❑ 65-68 degrees
t) ❑ 69-72 degrees
u) ❑ 73-75 degrees
v) ❑ 76-78 degrees
w) ❑ 79-81 degrees
x) ❑ 82-84 degrees
y) ❑ 85-87 degrees
z) ❑ 88-90 degrees
aa) ❑ 91-94 degrees
bb) ❑ 95-97 degrees
cc) ❑ 98-100 degrees
dd) ❑ > 100 degrees
ee) ❑ It's programmed into the thermostat.
ff) ❑ Thermostat was turned off
gg) ❑ Air conditioner was turned off
hh) ❑ DK

6. **Were you or any members of your household home at that time?**

❑ Yes ❑ No ❑ DK

If no or don't know, skip to question 13.

7. **Using a scale of 1 to 10 where 1 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort on** <day before high temperature>**?**

1 2 3 4 5 6 7 8 9 10

b) ❑ DK

8. **Using the same scale of 1 to 10 where 1 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort on** <day of high temperature>?

1 2 3 4 5 6 7 8 9 10

b) ❑ DK

If score from Q8 is lower than score from Q7:

9. **What do you feel caused your decrease in comfort?**

Select all that apply:

g) ❑ Power Manager
h) ❑ Rising Temperature
i) ❑ Rising Humidity
j) ❑ Power Outage
k) ❑ Other: _____
l) ❑ Don't Know

10. **On** <day of high temperature>, **did you or any other members of your household adjust the settings on your thermostat?**

❑ Yes ❑ No ❑ DK

If yes, 10a. **What temperature was it originally at, and what temperature did you set it to during the control event?**

Original temperature setting: _____ degrees F
❑ DK
Adjusted temperature setting: _____ degrees F
❑ DK

11. **Did you or any other members of your household turn on any fans to keep cool?**

❑ Yes ❑ No ❑ DK

12. **What else did you or other members of your household do to keep cool?**

l) ❑ Continued normal activities/ Didn't do anything different
m) ❑ Turned on room/window air conditioners
n) ❑ Closed blinds/shades
o) ❑ Moved to a cooler part of the house
p) ❑ Left the house and went somewhere cool
q) ❑ Wore less clothing
r) ❑ Drank more water/cool drinks
s) ❑ Turned on fans
t) ❑ Opened windows
u) ❑ Other: _____
v) ❑ Don't know

Now I'm going to ask you some questions about your air conditioning use.

13. **How often do you use your central air conditioner? Would you say you use it ...**

g) ❑ **Not at all**
h) ❑ **Only on the hottest days**
i) ❑ **Frequently during the cooling season**
j) ❑ **Most days during the cooling season**
k) ❑ **Everyday during the cooling season**
l) ❑ **Don't know**

14. **When you think of a typical hot and humid summer day, at what outside temperature do you tend to feel uncomfortably warm?**

o) ❑ < 65 degrees
p) ❑ 65-68 degrees
q) ❑ 69-72 degrees
r) ❑ 73-75 degrees
s) ❑ 76-78 degrees
t) ❑ 79-81 degrees
u) ❑ 82-84 degrees
v) ❑ 85-87 degrees
w) ❑ 88-90 degrees
x) ❑ 91-94 degrees
y) ❑ 95-97 degrees
z) ❑ 98-100 degrees
aa) ❑ > 100 degrees
bb) ❑ Don't know

15. **At what outside temperature do you tend to turn on the air conditioner?**

p) ❑ < 65 degrees
q) ❑ 65-68 degrees
r) ❑ 69-72 degrees
s) ❑ 73-75 degrees
t) ❑ 76-78 degrees
u) ❑ 79-81 degrees
v) ❑ 82-84 degrees
w) ❑ 85-87 degrees
x) ❑ 88-90 degrees
y) ❑ 91-94 degrees
z) ❑ 95-97 degrees
aa) ❑ 98-100 degrees
bb) ❑ > 100 degrees
cc) ❑ It's programmed into the thermostat.
dd) ❑ Don't know

16. **How old is your air conditioner?**

f) ❑ 0 to 6 years old
g) ❑ 7 to 12 years old
h) ❑ 13 to 20 years old
i) ❑ over 20 years old
j) ❑ Don't Know

17. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", What is your overall satisfaction with the Power Manager® program?**

1 2 3 4 5 6 7 8 9 10

If 8 or below, 17b. **Why are you less than satisfied with Power Manager®?**

f) ❑ They activated my Power Manager® device more often than I would like
g) ❑ The bill credits/incentives were not large enough
h) ❑ I was uncomfortable when my Power Manager® device was activated
i) ❑ Other: _____
j) ❑ Don't Know

18. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", What is your overall satisfaction with Duke Energy?**

1 2 3 4 5 6 7 8 9 10

If 8 or below, 18b. **Why are you less than satisfied with Duke Energy?**

19. **Did you experience any power outage issues on** <day of high temperature>**?**

❑ Yes ❑ No ❑ DK

Finally, we have two short demographic questions.

20. **How many people live in this home?**

i) ❑ 1
j) ❑ 2
k) ❑ 3
l) ❑ 4
m) ❑ 5
n) ❑ 6
o) ❑ 7
p) ❑ 8 or more

21. **How many persons are usually home on a weekday afternoon?**

j) ❑ 0
k) ❑ 1
l) ❑ 2
m) ❑ 3
n) ❑ 4
o) ❑ 5
p) ❑ 6
q) ❑ 7
r) ❑ 8 or more

Thank you for your time and feedback today! *Politely end call.*

Impact Evaluation and Review of the 2011 Power Manager® Program in Ohio

Final Report

Prepared for
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139 East Fourth Street
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February 19, 2012

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Table of Contents

Executive Summary

Summary of Findings

The approach used by Duke Energy for estimating the effect of the Power Manager program is very reasonable and defensible. One particularly noteworthy feature is that they use an extensive history to estimate the model, rather than relying on only a handful of days as is common in many utilities which use less rigorous approaches (i.e., approaches that compare average usages from a pre-event period, for example, rather than conducting a multivariate regression model, as Duke Energy is doing).

Overall, based on our review, Duke Energy's impact evaluation is a very complete and innovative approach, and should result in accurate estimates of event impacts and the summer load reduction capacity under peak normal weather conditions, as summarized in Table 15 on page 18.

Recommendation

- The behavior of some Cannon switches to deviate substantially from the shed times expected for the Target Cycle method is worrisome since it increases the uncertainty of the program impacts. While this is beyond the control of Duke Energy, we encourage Duke Energy to continue to work with Cooper Power Systems (Cannon) staff to determine the cause and extent of this issue.
    - See section titled "PM Load Control Strategies", specifically "Table 6. Percentage of Cannon Switches for Each Shed Pattern" on page 12.

Introduction and Purpose of Study

This document presents the evaluation report for Duke Energy's Power Manager Program as it was administered in Ohio.

The evaluation was conducted by Duke Energy and the TecMarket Works evaluation team. Duke Energy conducted the impact analysis, and Integral Analytics (a TecMarket Works subcontractor) conducted the review of the methodology and results.

Summary Overview

This document presents a review of the impact evaluation for the Power Manager (PM) program conducted by Duke Energy as it was administered in Ohio.

Summary of the Evaluation

Power Manager is a voluntary residential program, available to homeowners with central air conditioning (AC). On days where energy demand and/or energy costs are expected to be high, Power Manager participants have agreed to allow Duke Energy to cycle their air conditioning off for a period of time.

The impact evaluation conducted by Duke Energy developed an air conditioner (AC) duty cycle model based on information from a sample of PM participants in Ohio and Kentucky. This duty cycle was then used to simulate the expected natural duty cycle during the PM event days and under peak normal weather conditions for different PM program options and load control technologies to produce estimates of the potential load reduction. These estimates were then de-rated by the results of various operability studies to give estimates of the realized load reductions.

Evaluation Objectives

The purpose of this evaluation was two-fold. The first objective is to summarize the actual kW and expected peak normal kW impacts determined by Duke Energy for 2011. The second objective is to determine if the approach used by Duke Energy in estimating these impacts is consistent with commonly accepted evaluation principles.

Description of Program

Power Manager is a voluntary residential program, available to homeowners with central air conditioning (AC). On days where energy demand and/or energy costs are expected to be high, Duke Energy has permission from Power Manager participants to cycle their air conditioning off for a period of time.

There are two requirements that must be met for a customer to be eligible to participate in Power Manager. First, they need to own and live in their single family home. Second, they need to have a functional central air conditioner with an outside compressor that can be controlled. When customers enroll, Duke Energy installs a switch that allows the AC unit to be cycled off and on in response to signals sent over Duke Energy's paging system.

The Power Manager program allows customers to select which load reduction target they would be willing to provide, either 1.0 kW or 1.5 kW. During an event, customers in the 1.5 kW option would have their air conditioner cycled off for a few minutes longer in each half hour than the 1.0 kW customers. Events may be called on non-holiday weekdays during the months of May through September.

Within Duke Energy Ohio's portfolio, Power Manager is currently the only residential demand response program[1]. The Power Manager program plays a key role in capacity planning; every year, Power Manager provides an estimate as to how much capacity it can provide during the summer season, and this information is taken into account by the capacity planners.

Program Participation

Program	Participation Count for 2011
Power Manager Ohio	EOM Sept. 2011 – 37,612

[1] Not including pilot programs.

Methodology

Overview of the Evaluation Approach

The impact evaluation for the Power Manager (PM) program was conducted by Duke Energy staff. The complete evaluation included M&V sample from Duke Energy territory in the states of Ohio, Indiana, Kentucky, North Carolina, and South Carolina. The results presented in this report include a review by Integral Analytics of the impact evaluation methodology and results.

The impact evaluation developed an air conditioner (AC) duty cycle model based on information from a sample of PM participants in Ohio and Kentucky. This duty cycle was then used to simulate the expected natural duty cycle during the PM event days for estimates of event load reduction impacts and under peak normal weather conditions for different PM program options and load control technologies to produce estimates of the potential load reduction on a peak normal day. These estimates were then de-rated by the results of various operability studies to give estimates of the realized load reductions. Table 1 below summarizes the resulting estimated actual and the peak normal weather load impacts at the switch level for customers in Ohio.

Table 1. Ohio Load Impacts

Control Strategy	2011 Impacts	Peak Normal Weather Impacts
Target Cycle (TC) 1.5	1.24	1.40
Target Cycle (TC) 1.0	1.11	1.24

The approach used by Duke Energy staff is nearly identical to the approach used in the prior evaluations reviewed by the TecMarket team. Noteworthy additions include:

- The discovery that many Cannon switches deviate substantially from the shed times expected for the Target Cycle method, shedding more like an "inverted" pattern. This results in a significant difference between the Target Cycle shed and the actual shed. The reported estimated impacts incorporate this inverted shed.
- It appears that the peak normal impacts now include an adjustment for line losses. This is a commendable approach and is rarely done in other evaluations.

This general approach is well established in the industry and the actual analysis was very thorough and well thought out. The resulting impact estimates are reasonable and accurate. A potential alternative approach for future impact evaluations is to use the data from the M&V and the operability sample to directly estimate impacts via statistical models. This approach could use a time-series, cross-sectional analysis where the dependent variable is the actual AC load (or run-time), and the independent variables include weather conditions, time of day, day of week, and the PM control event. In essence, this would produce an overall duty-cycle model, and the coefficient on the PM control event variable(s) would estimate the actual load impacts during those events. This approach is very similar to the approach used by Duke Energy, but it reduces the need to model event days separately. It is not certain that the results would necessarily be

more accurate, however it is a more efficient use of the data. In addition, the statistical significance of the estimated impacts are directly calculated.

Data collection methods, sample sizes, and sampling methodology

The 2011 Power Manager M&V sample in the Midwest consists of 144 households with 156 air conditioner (AC) units. This includes 56 households from Ohio, 16 households from Kentucky, and 72 households from Indiana, closely reflecting the relative numbers of PM participants in each state in February, 2011. The 2011 Ohio and Kentucky M&V sample is representative of the PM population within the two states and is designed to target at 10% relative precision at 90% confidence level. The OH/KY sample includes 47 new households randomly selected from the PM population in February, 2011, and 25 holdovers from the 2010 M&V sample that were randomly selected in either 2009 or 2010. The 2011 Indiana M&V sample has 39 new households randomly selected from the PM population in February, 2011, and 33 holdovers from the 2010 M&V sample that were randomly selected in either 2009 or 2010. The resulting stratification of PM M&V samples is shown in Table 2.

Table 2. M&V Sample Stratification

	Midwest		Indiana		Southeast	
	High	Low	High	Low	High	Low
Sample allocation	38	34	37	35	74	69
Population weight	34.7%	65.3%	34.7%	65.3%	37.3%	62.7%

Hourly run-time of AC units in the M&V samples was collected during the summer months of 2011 (May through September). This was accomplished with Cannon load control devices, which record hourly run-time (in minutes) of the AC unit to which they are attached. Three rounds of data collection from M&V Cannon devices were conducted in June, July, and October. In addition to hourly run-time, the Cannon device scan data includes hourly shed minutes and the contents of many device registers. Information about the AC unit is also recorded, including amp ratings for both the AC compressor and fan.

Households in the M&V samples were equipped with load research interval meters, and 15-minute premise interval usage (kWh) was collected for 2011 summer months.

Number of completes and sample disposition for each data collection effort

See "Table 2. M&V Sample Stratification" above.

Expected and achieved precision

The 2011 Ohio and Kentucky M&V sample is representative of the PM population within the two states and is designed to target at 10% relative precision at 90% confidence level.

The final sample sizes for OH & KY were adequate to produce estimates at 20% relative precision at 90% confidence level.

Description of baseline assumptions, methods and data sources

The baseline is developed from the duty-cycle of the sampled AC units based upon the observed AC usage during non-holiday, non-weekend, and non-control days.

Description of measures and selection of methods by measure(s) or market(s)

The PM program is an AC cycling program, so the only measure in question is the AC units.

Use of TRM values and explanation if TRM values not used

The analysis provides estimate of the savings that were achieved by participating households, thus there was no need to use TRM values.

Threats to validity, sources of bias and how those were addressed

The approach used in the evaluation relied upon actual measurement of AC usage, and is therefore not subject to any reporting or self-selection bias.

Evaluation Findings

Validation of AC Duty Cycle Data

Hourly air conditioner (AC) run-time collected from Cannon M&V devices is compared to corresponding premise interval kWh to verify that it accurately reflects the operations of the attached AC unit. The validation process is accomplished through a sequence of computer programs that: 1) convert the hourly AC run-time data into hourly duty cycle; 2) display time series plots of premise kWh and duty cycle with control over time resolution enabling visual comparison of plot detail; 3) calculate cross-correlation between hourly kWh and hourly duty cycle and display cross-plots of kWh versus duty cycle. Each run-time data file collected for an AC in the 2011 M&V sample is reviewed in this fashion, and the AC duty cycle is added to the model database when hourly premise kWh provides adequate confirmation.

For 5 ACs in the Midwest sample and 4 ACs in the Southeast sample, Duke Energy could not obtain the 2011 data needed to apply validation procedures. Reasons for this include customers leaving the PM program (3), no interval kWh (1), unable to retrieve scan data (5). In the validation process, run-time data was rejected for 4 ACs in the Indiana sample and 9 ACs in the Southeast sample. These cases appear to be due to sensitivity issues, where the AC is reported to have no run-time or to be always running. The remaining sample is statistically significant and provides better insight into AC usage profiles. Overall, hourly duty cycle data was added to the model database for 147 ACs from the Midwest sample and 165 ACs from the Southeast sample. The final sample sizes for OH & KY, IN, and the Southeast are still adequate to produce estimates at 20% relative precision at 90% confidence level. Table 3 summarizes the 2011 M&V sample.

Table 3. M&V Sample

	Midwest			Southeast	
	Ohio	Indiana	Kentucky	North Carolina	South Carolina
Households	56	72	16	104	39
Total AC Units	156			178	
Missing data	5			4	
Invalid Data	4			9	
Final AC Sample	147			165	
Duty Cycle Models (see below)	136			136	

AC Duty Cycle Models

Impact estimates during PM load control periods are based upon models developed for the natural duty cycle of M&V AC units. These models are developed from 2011 duty cycle data described above, and similar duty cycle data from the two prior summers (2009, 2010) for AC units that are holdovers from previous M&V samples. Weekends and holidays are not used in the models, and hours during load control and for the remainder of the day are not used. Duke

Energy staff was able to develop duty cycle models for AC units at 136 households in the Midwest M&V sample, and for AC units at 136 households in the Southeast M&V sample.

Natural duty cycle models are specified and estimated individually for M&V AC units to better capture the unique dependence of duty cycle on the temperature and humidity characteristics of each AC unit. A limited dependent variable model specification is adopted for hourly duty cycle, the independent variable in the models. Candidate specifications for dependent variables in the models include temperature averaged over the prior 2-hour, 4-hour, and 6-hour intervals, and a weighted temperature average with declining weights over the previous six hours. Candidate specifications also include similar sets of averages based on temperature-humidity index (THI) and heat index (16-element polynomial). Models are estimated with the SAS procedure QLIM[2]. The dependent variable specification selected for an AC unit is based on fit diagnostics from hourly model fits over the typical load control hours, 2:00–6:00 PM. For the selected model, distinct parameters are estimated in each hour of interest, resulting in a set of hourly natural duty cycle fits for each M&V AC.

PM Load Control Strategies

The PM program employs two generic types of load control devices which require somewhat different treatment for load impact evaluation. The newer switch types – Cannon LCR 4700 in OH, KY, NC, and SC, and the Cannon LCR 5200 in Indiana – operate with an adaptive control strategy called Target Cycle (TC). For each hour of load control, the Target Cycle switch calculates a unique shed time (or percentage) based on characteristics of the attached AC unit. The older switch type – CSE in Indiana and KY and Comverge in NC and SC – uses traditional fixed cycling control, where all devices on the same program shed the same amount of time during the control period. In the Midwest, the principal PM program options are 1.5 kW and 1.0 kW, and Target Cycle switches are configured with these load reduction targets constrained by the maximum shed time of 24 minutes per 30-minute control period. Fixed Cycling (FC) devices in the Midwest limit the AC run-time to 7.5 minutes (1.5 kW) or 15 minutes (1.0 kW) of each 30-minute control period. Equivalently, PM CSE devices in the Midwest are operated with fixed cycling percentages of 75% (FC 75%) for 1.5 kW, or 50% (FC 50%) for 1.0 kW. The third program option in the Midwest is 0.5 kW. Due to the limited number of participants on this option, we scale the impact estimate for it based on the results for 1.0 kW. Different program options are not offered in the Southeast. Cannon devices in NC and SC are configured with a load reduction target of 1.3 kW (TC 1.3) constrained by the maximum shed time of 22.5 minutes per 30-minute control period, and Comverge fixed cycling devices limit the AC run-time to 5 minutes of each 15-minute control period. Equivalently, PM Comverge devices in the Southeast are operated with a fixed cycling percentage of 67% (FC 67%). Another control strategy is full shed of the AC. The AC is completely turned off during the control periods. This strategy is only commonly employed in the Southeast for emergency load shed events. Table 4 summarizes PM load control technology and strategy used in different states.

[2] QLIM: qualitative and limited dependent variable model.

Table 4. PM Load Control Devices and Strategies

Device	Period	Strategy					
		OH		IN / KY		NC / SC	
	(min)	1.5 kW	1.0 kW	1.5 kW	1.0 kW	Cycling	Full Shed
Cannon	30	TC 1.5	TC 1.0	TC 1.5	TC 1.0	TC 1.3	FC 100%
CSE	30			FC 75%	FC 50%		
Comverge	15					FC 67%	FC 100%

The Target Cycle control strategy puts more functionality in the switch itself. Rated amps of the attached AC unit is entered into the switch at installation, and used to determine connected load for the unit. The switch also records hourly duty cycle of attached AC unit and builds a profile (historical profile) of the expected hourly duty cycle under weather conditions typical for load control. The historical profile can be scaled (globally) by adjusters included in the commands sent to switches for load control. The connected load and adjusted historical profile are used to calculate hourly cycling percentages for the attached AC unit expected to achieve the appropriate load reduction target (1.5 kW, 1.3 kW, or 1.0 kW).

Factors that determine Target Cycle shed percentages for M&V AC units during control periods are known, except for contents of hourly historical profile registers on those days. Values in these registers change frequently during the summer as they are updated with the AC hourly run-time on "saved" days, which are selected with weather conditions sufficiently close to a typical load control day. Hourly run-time profiles on 2011 control days for M&V AC units are determined from the contents at the start of the 2011 control season (when available), and the unit run-time on 2011 saved days.

Various factors contribute to small deviations of the switch shed minutes recorded hourly in the switch data log during PM load control hours from the expected Target Cycle shed times calculated with switch register values for the amp parameter, the hourly historical profile, and the load reduction target. Such factors include limited precision of switch processor arithmetic, and occasional hours with proper shed in only one of two 30-minute shed periods. Note that in our operability shed analysis, hours with zero shed time are incorporated into the operability shed factor and do not contribute to the shed adjustment results. By analysis of Cannon switch shed times during 2011 PM load control hours for Target Cycle switches from the operability samples in NC/SC and IN, and the special group collected in OH/KY, we have estimated average shed deviation in different states and for different program types. These results given in Table 5 are used to adjust Target Cycle shed percentages in the load impact simulation model.

Table 5. Target Cycle shed adjustment

State	Program	Shed deviation (min /hr)	Shed deviation (%)
NC / SC	TC 1.3 kW	-0.99	-1.66
IN	TC 1.5 kW	0.11	0.18
IN	TC 1.0 kW	1.14	1.90
OH / KY	TC 1.5 kW	-0.79	-1.32
OH / KY	TC 1.0 kW	-0.10	-0.16

Analysis of Cannon switch shed times during 2011 PM load control hours for operability samples in NC/SC and IN, and for a special group collected in OH/KY, has identified many Cannon switches that deviate substantially from the shed times expected for the Target Cycle method. Instead, these switches appear to shed more like an "inverted" pattern, relative to the pattern expected, defined as follows:

$$Inverted\ shed\ \% = 100 - 0.5 * Target\ Cycle\ shed\ \%$$

Table 6 gives our estimates of the proportion of Cannon switches that shed according to the inverted pattern. These proportions are used to determine the overall shed per switch attributable to Cannon switches in different states and for different program options. Results are given in Table 6. These results are used to adjust shed percentages for the inverted pattern in the load impact simulation model.

Table 6. Percentage of Cannon Switches for Each Shed Pattern

State	Target KW	Target Cycle shed	Inverted shed
OH/KY	1.5	58.5%	41.5%
OH/KY	1.0	75.2%	24.8%
IN	1.5	30.1%	69.9%
IN	1.0	22.2%	77.8%
NC/SC	1.3	60.5%	39.5%

For LCR 4700 switches in OH/KY and NC/SC, newer switches with higher serial numbers shed according to the inverted pattern. For LCR 5200 switches in Indiana, it is the older switches with lower serial numbers that shed according to the inverted pattern. This issue is currently being researched by Cooper Power Systems (Cannon) staff.

The inverted pattern is characterized in terms of the Target Cycle shed time, and it is reasonable to expect similar deviations for these switches. By analysis of Cannon switch shed times during 2011 PM load control hours for switches following the inverted shed pattern from the operability samples in NC/SC and IN, and the special group collected in OH/KY, we have estimated average shed deviation for the inverted pattern in different states and for different program types. Results are given in Table 7. These results are used to adjust shed percentages for the inverted pattern in the load impact simulation model.

Table 7. Shed adjustment for the inverted pattern

State	Program	Shed deviation (min /hr)	Shed deviation (%)
NC / SC	1.3 kW	-1.25	-2.09
IN	1.5 kW	-3.35	-5.59
IN	1.0 kW	-2.19	-3.65
OH / KY	1.5 kW	-0.09	-0.15
OH / KY	1.0 kW	-0.41	-0.69

AC Connected Load

Connected load is the average power demand (kW) of a running AC unit over a full cycle. It determines the load reduction (kWh) achieved when AC run-time is reduced. Connected load is specified for M&V AC units through the basic engineering formulas:

*Apparent Power (kVA) = (Compressor Amps + Fan Amps) * 230 Volts / 1000*

*Connected Load (kW) = Power Factor * Apparent Power*

Rated amps for the compressor (FLA) and fan (RLA) are typically listed on the AC faceplate.

Power factor in this formula is actually different for different AC units, and even varies somewhat for different cycles of the same unit, increasing at high temperature and humidity. Duke Energy has analyzed synchronous AC run-time and premise interval kWh collected for the M&V samples to determine an appropriate overall power factor within each sample. Results are 0.84 for the Midwest M&V sample, and 0.8 for the Southeast M&V sample. These power factor values are used to calculate connected loads for impact evaluation.

Simulation Method for PM Impact Evaluation

Simulation with M&V natural duty cycle models is used to determine average load reduction per household within high and low M&V strata during each hour of load control and for each PM cycling strategy. These strata results are combined with the population weights given in Table 2 to estimate average load reduction per household in the PM population (Midwest or Southeast). The potential load impacts estimated in this manner represent the load reduction which would be achieved if all switches controlled as expected. Impact results for PM load control in the Midwest are obtained by simulation with the Midwest M&V sample, and impact results for the PM load control in the Southeast are obtained by simulation with the Southeast M&V sample.

The simulation procedure is very similar for the three basic PM control strategies: Target Cycle, Fixed Cycling, and Full Shed. In a fixed cycling or full shed (100% cycling) simulation, the same specified shed percentage is applied to all ACs to evaluate load impact for a particular program option. Program options available in each state and the corresponding shed percentages are shown in Table 4. In a Target Cycle simulation for a particular program option, or load reduction target, and during a specified hour (and day) of load control, a customized shed percentage is calculated for each AC unit from information specific to that unit. The appropriate adjustment is applied to this shed percentage. The resulting unit-specific shed percentages remain fixed in all simulated realizations for that load reduction target and load control hour.

Load reduction corresponding to the inverted shed pattern is also calculated in a Target Cycle simulation. A unit-specific shed percentage for the inverted pattern is determined from the relationship to the Target Cycle shed percentage given in the section "PM Load Control Strategies" and the appropriate adjustment from Table 7. The same set of simulated duty cycles for an AC are used to evaluate load reduction with both the Target Cycle shed percentage and the inverted pattern shed percentage calculated for that AC.

A single realization in the simulation is generated by a random draw of residuals for each of the M&V natural duty cycle model fits, which are evaluated at the temperature and humidity of the control hour (and day). This gives a set of simulated natural duty cycles appropriate for the control hour. Load reduction for each M&V AC is calculated as follows:

Duty cycle reduction = MAX[Duty cycle - (1 – Shed percentage), 0]

*Load reduction = Connected load * Duty cycle reduction*

For households with multiple ACs, realized load reduction is aggregated to the household level by summing load reduction from all household ACs. These realized load reductions are averaged within the strata to produce single realizations of average load reduction per household within both high and low strata. These two sample averages constitute the result from one pass through the simulation corresponding to one draw of model residuals.

Two thousand passes through the simulation are performed to adequately capture the variation in average load reduction within strata that is consistent with our duty cycle models and M&V sample sizes. The results accumulate into distributions of sample averages for both high and low strata. The grand means of these distributions are the most significant output from a simulation run. They are the estimates of average load reduction per household in the high and low strata for the specified control hour and cycling strategy. The spread of these distributions (e.g., variance) characterizes the uncertainty in the load reduction estimates, and is very much affected by our M&V sample sizes.

Load Impact Results

Load impacts described in this section are computed with population estimates of load reduction per switch, rather than load reduction per household. Simulation results are converted to load reduction per switch using the factors 1.057 switches per household for Ohio and Kentucky results, 1.063 switches per household for Indiana results, and 1.178 switches per household for Southeast results. Population estimates of load reduction per household are divided by these factors to get corresponding population estimates of load reduction per switch. The estimates of switches per household are determined from the Midwest and Southeast M&V samples.

Table 8 through Table 10 illustrate the calculation of the load reduction on a PM event day in a state with 3 different load control technologies. Load impact from CSE devices are developed in Table 8, load impact from Cannon devices are developed in Table 9, and Table 10 gives the total PM load impact in the state. In Table 8, columns labeled shed kW/switch are the results of simulation runs, scaled as described above, for both 75% cycling (1.5 kW program) and 50% cycling (1.0 kW program) and for hours 16-18 on June 8, 2011. Potential load impacts for CSE

devices (next to last column) are calculated from switch counts for each program option in the state on the event day. De-rated load impacts in the last column of Table 8 are the product of the potential impact with the de-rating factor (54.1%) applicable to Kentucky CSE devices. The appropriate de-rating factors for each switch technology are determined by separate operability studies. Table 9 for Cannon devices is structured in the same way as Table 8. The columns with shed kW/switch in Table 9 contain results from Target Cycle simulations, and the higher de-rating factor appropriate for Cannon devices (93.1%) is used to calculate de-rated impacts. Table 10 shows the PM hourly impact results in KY on June 8, 2011, which are obtained by adding corresponding hours in the last columns of Table 8 and Table 9.

PM load control devices do not start shedding load in unison at the top of the first control hour. Instead, each load control device computes a random time delay which determines when the first shed period begins for that device. For the population as a whole, this reduces the shed minutes in the first hour of a load control event by a factor that depends on the load control technology and program option. For CSE devices, these loss factors are 0.1875 for the 1.5 kW program with 75% shed percentage, and 0.125 for the 1.0 kW program with 50% shed percentage. Potential and de-rated impacts for hour 16 in Table 8 are reduced accordingly. Duke Energy approximated the reduction in shed minutes for Target Cycle 1.5 kW and 1.0 kW programs with these same factors, and the potential and de-rated impacts for hour 16 in Table 9 are similarly reduced.

Table 8. KY CSE Impact Results on 6/8/2011

									De-rate 54.1%
		Option 1.5 kW			Option 1.0 kW			Total	
Date	Hour (EDT)	shed kW/switch FC 75%	Switch Count	Potential Impact (MW)	shed kW/switch FC 50%	Switch Count	Potential Impact (MW)	Potential Impact (MW)	De-rated Impact (MW)
			1439			1243			
6/8/2011	16	1.53		2.39	0.86		1.07	3.27	1.77
	17	1.60		2.50	0.91		1.13	3.43	1.86
	18	1.63		2.54	0.94		1.17	3.51	1.90

Table 9. KY Cannon Impact Results on 6/8/2011

									De-rate 93.1%
		Option 1.5 kW			Option 1.0 kW			Total	
Date	Hour (EDT)	shed kW/switch FC 75%	Switch Count	Potential Impact (MW)	shed kW/switch FC 50%	Switch Count	Potential Impact (MW)	Potential Impact (MW)	De-rated Impact (MW)
			2974			3910			
6/8/2011	16	1.24		3.55	1.04		4.07	7.75	7.22
	17	1.29		3.70	1.05		4.11	7.94	7.39
	18	1.3		3.72	1.04		4.07	7.93	7.39

Table 10. KY PM Impact Results on 6/8/2011

Date	Hour	De-rated Impact (MW)
6/8/2011	16	9.0
	17	9.3
	18	9.3

PM hourly impact results have been computed as illustrated by Table 8 through Table 10 for all 2011 load control days in all states. Results for OH, KY, and IN are given in Table 12 and results for NC and SC are given in Table 13. Both Cannon and CSE load control devices are also installed in Indiana, so load impact results there are computed in the same way as for KY. Only Cannon devices are installed in OH, so these load impact results are computed similarly to Table 9 above. In NC and SC, older fixed cycling Comverge switches are installed along with newer Cannon devices, so load impact results are computed similarly to Table 8 through Table 10. But PM offers a single program in NC and SC, with fixed cycling at 67% and a Target Cycle load reduction target of 1.3 kW, so the calculations corresponding to Table 8 and Table 9 are simplified.

Table 11 shows de-rating factors used for the 2011 impact evaluation. The factors for Cannon in OH and KY were determined by an operability study conducted in 2010. The CSE factor in KY was determined by an operability study conducted in 2009. The factors for CSE in Indiana and Comverge in the Southeast were determined by operability studies conducted in 2010. Cannon factors in Indiana and the Southeast were determined by operability studies conducted in 2011.

Table 11. De-rating Factors for Impact Evaluation

Switch Type	OH	KY	IN	NC / SC
Cannon	0.931	0.931	0.803	0.945
CSE		0.541	0.396	
Comverge				0.399

Table 12. 2011 PM Impact Results for OH, KY, and IN

Event Date	Hour	PM Impact (MW)			Midwest Total
		OH	KY	IN	
5/31/2011	15	15.5	8.3	25.0	48.8
	16	16.3	9.2	29.9	55.4
	17		2.0	13.6	15.6
6/7/2011	15	15.3	8.4	27.7	51.4
	16	16.4	9.2	31.5	57.1
	17	16.9	9.6	35.0	61.6
6/8/2011	16	15.4	9.0	18.6	42.9
	17	15.6	9.3	20.7	45.5
	18	15.5	9.3	21.4	46.2
7/12/2011	16	17.2	10.3		27.5
	17	17.5	10.6		28.1

7/20/2011	16	17.1	10.2	33.0	60.3
	17	17.3	10.4	35.7	63.4
7/21/2011	16	16.9	10.6	45.0	72.5
	17	17.5	11.0	49.3	77.9
	18	17.9	11.3	49.4	78.7
7/29/2011	16	16.9	10.4		27.3
	17	17.4	10.7		28.1
8/1/2011	15	14.1			14.1
	16	14.8	8.9	35.5	59.2
	17	15.6	9.4	38.7	63.8
9/1/2011	16	16.1	9.5	39.1	64.6
	17	17.3	10.3	43.1	70.7
	18	18.2	10.9	45.1	74.2

PM load control was activated in OH and KY on 9 days during the summer of 2011, including both CSE and Cannon devices on all days. PM load control was activated in Indiana on 7 days during summer 2011, including Cannon devices on all days and CSE devices on all days except for June 8. Table 12 gives hourly impact results in OH, KY, and IN for each control day. The last column of Table 12 gives total PM impact in the Midwest. The highest hourly impact in the Midwest was 78.7 MW in hour 18 (5:00 – 6:00 pm EDT) on July 21, not adjusted for line losses.

Table 13. PM Impact Results for NC and SC

Event Date	Hour	PM Impact (MW)		Southeast Total
		NC	SC	
6/21/2011	16	63.6	26.4	90.0
	17	67.9	28.3	96.3
7/11/2011	16	62.3	25.7	88.0
	17	67.1	27.8	94.9
	18	69.3	28.7	97.9
7/13/2011	16	69.2	28.8	98.0
	17	67.2	28.0	95.2
	18	63.2	26.2	89.4
7/20/2011	16	68.9	28.4	97.3
	17	72.0	29.7	101.7
7/21/2011	16	73.5	30.4	103.9
	17	76.5	31.7	108.3
7/29/2011	16	71.2	29.3	102.7
	17	73.7	30.3	106.9
8/2/2011	17	75.0	30.6	101.8
	18	76.5	31.3	105.0
8/25/2011	16	126.4	43.3	169.7

PM cycling events were activated in NC and SC on 8 days during the summer of 2011. Both Cannon and Comverge devices were controlled on all days. Table 13 gives hourly impact results in NC and SC for each control day. The last column of Table 13 gives total PM impact in the Southeast. The highest hourly impact for cycling events in the Southeast was 108.3 MW in hour 17 (4:00 – 5:00 pm EDT) on July 21. A full shed test event was activated on August 25 from 3:00 to 4:00 pm in NC and SC and the total impact was 169.7 MW not adjusted for line losses and 183.3 MW after adjusting for line losses.

Table 14 gives estimated load reduction per switch under peak normal weather conditions for different PM program options and load control technologies. **Table 15 shows the summer monthly load reduction adjusted for line losses under peak normal weather conditions for each state.** Table 16 shows the peak normal weather conditions used to calculate the results in Table 14. The system peak is assumed to occur in the hour 5:00 – 6:00 pm EDT in the Midwest (identified as hour 18 in this report). The system peak in the Southeast is assumed to occur in the hour 4:00 – 5:00 pm EDT (identified as hour 17 in this report).

Table 14. Shed kW/switch with Peak Normal Weather

Switch Type	Control Strategy	Potential Impact			De-rated Impact		
		OH/KY	IN	NC/SC	OH/KY	IN	NC/SC
Cannon	TC 1.5	1.50	1.37		1.40	1.10	
	TC 1.0	1.33	1.48		1.24	1.19	
	TC 1.3			1.18			1.12
	Full Shed			2.22			2.10
CSE	FC 75%	1.77	1.74		0.96	0.69	
	FC 50%	1.05	1.00		0.57	0.40	
Comverge	FC 67%			1.29			0.51
	Full Shed			2.22			0.89

Table 15. Monthly Peak Normal Weather Load Reduction De-rated Impact by State adjusted for Line Losses for Cycling and Full Shed

State	Control Strategy	June	July	August	September
Ohio	**Cycling**	**48.9**	**48.8**	**49.4**	**50.5**
Kentucky	Cycling	11.8	12.2	12.1	12.1
Indiana	Cycling	42.8	43	43	43.6
Carolinas	Cycling	110.9	112.9	113.7	115
Carolinas	Full Shed	224.2	226.7	227.6	229.2

Table 16. Peak Normal Weather

Hour	OH / KY		IN		NC / SC	
	Temp	Dewpt	Temp	Dewpt	Temp	Dewpt
11	85.3	71.8	84.9	73.9	89.0	69.0
12	87.6	71.9	87.6	74.4	91.0	69.0
13	89.9	71.9	89.9	74.8	92.0	68.0
14	92.0	71.5	91.2	74.9	94.0	68.0
15	93.1	70.7	91.9	74.5	93.0	69.0
16	93.9	70.5	91.5	74.2	95.0	67.0
17	92.5	70.0	90.8	74.0	95.0	66.0
18	92.4	69.5	89.5	73.5	95.0	67.0