LARGE FILING SEPERATOR SHEET

CASE NUMBER: 08-1227-EL-UNC
08-1228 "

FILE DATE: 11-17-08

SECTION: 2 of 4

NUMBER OF PAGES: 200

DESCRIPTION OF DOCUMENT: NEW case

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 Smart Saver and Summer Saver programs, which I will refer to as one program, the Smart Saver program. We'll talk about the Smart Saver Program and its objectives, your thoughts on improving the program, 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 Smart Saver Program's current objectives. How have these changed over time?

2. In your opinion, which objectives do you think are best being met or will be met?

3. Are there any program objectives that are not being addressed or not being addressed as well as possible 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?

4. Should the program objectives be changed in any way due to technology-based, market-based, or management based conditions? What objectives would you change? What program changes would you put into place as a result, and how would it affect the operations of the program?

Operational Efficiency

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?

6. Please review with us how the Smart Saver operates relative to your duties, that is, please walk us through the processes and procedures and key events that allow you do currently fulfill your duties.

7. Have any recent changes been made to your duties? If so, please tell us what changes were made and why they were made. What are the results of the change?

8. Describe the evolution of the Smart Saver Program. How has the program changed since it was it first started?

9. Do you have suggestions for improvements to the program that would increase participation rates or interest levels?

10. Do you have suggestions for improving or increasing energy impacts?

11. Do you have suggestion for the making the program operate more smoothly or effectively?

Program Design & Implementation

12. *(If not captured earlier)* Please explain how the interactions between the contractors, customers, and Summer Saver's management team work. Do you think these interactions or means of communication should be changed in any way? If so, how and why?

13. How do you determine which heat pumps and air conditioners are included in the program? How do you determine what efficiency levels should be placed in the program for heat pumps and central AC units? What should be changed about this selection process? Do you think this would result in more contractors and/or customers participating in the program?

14. Describe your quality control and tracking process.

15. Are key industry experts, trade professionals or peers used for assessing what the technologies or models should be included in the program? If so, how does this work?

16. Are key industry experts and trade professionals used in other advisory roles? If so how does this work and what kinds of support is obtained?

17. Describe Smart Saver's contractor program orientation training and development approach. Are contractors getting adequate program training and program information? What can be done that could help improve contractor effectiveness? Can we obtain training materials that are being used?

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

1. ❑ Yes 2. ❑ No 99. ❑ DK/NS

If no, 20b. What other products or equipment should be included and why?

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. Overall, what about the Smart Saver program works well and why?

22. What doesn't work well and why? Do you think this discourages participation or contractor interests?

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

24. In what ways can these operations or operational efficiencies be improved?

25. In what ways can the program attract more participants?

26. How do you make sure that the best information and practices are being used in Smart Saver operations?

27. *(If not collected above)* What market information, research or market assessments are you using to determine the best target markets and program opportunities, market barriers, delivery mechanisms and program approach?

28. If you had a magic wand, what one thing would you change and why?

29. Are their any other issues or topics you think we should know about and discuss for this evaluation?

Appendix B: Contractor Interview Instrument

Name: _____

Title: _____

Position description and general responsibilities:

_____

_____

_____

We are conducting this interview to obtain your opinions about and experiences with the Smart and Summer Saver programs, which I will refer to as one program, the Smart Saver program. We'll talk about your understanding of the Smart Saver Program and its objectives, your thoughts on improving the program, and the technologies the program covers. The interview will take about an hour to complete. May we begin?

Understanding the Program

We would like to ask you about your understanding of the Smart Saver program. We would like to start by first asking you to…

3. Please review for me how you are involved in the program and the steps you take in the participation process. Walk me though the typical steps you take to help a customer become eligible for this program and what you do to receive or help the customer receive the program incentive.

4. What kinds of problems or issues have come up in the Smart Saver program?

5. Have you heard of any customer complaints that are in any way associated with this program? Have callbacks increased due to the program technologies?

Program Design and Design Assistance

4. Do you feel that the proper technologies and equipment are being covered through the program?

5. Are the incentive levels appropriate? How do they impact the choice by the customers of the higher efficient equipment?

6. Are there other technologies or energy efficient systems that you think should be included in the program?

7. Are there components that are now included that you feel should not be included? What are they and why should they not be included?

8. Are the new changes going into effect in January going to significantly impact the program or your activity within the program? How?

Reasons for Participation in the Program

We would like to better understand why contractors become partners in the Smart Saver Program.

9. How long have you been a partner in the Smart Saver Program?

10. What are your primary reasons for participating in the program? Why do you continue to be a partner?.... *If prompts are needed...* Is this a wise business move for you, is it something you believe in professionally, is it that it provides a service to your customers, or other reasons?

11. Has this program made a difference in your business? How?

12. How do you think Duke can get more contractors to participate in this program?

Program Participation Experiences

The next few questions ask about the process for submitting participation forms and obtaining the incentive payments.

13. Do you think the process could be streamlined in any way? How?

14. How long does it take between the time that you apply for your incentive, to the time that you and your customer receive the payments? Is this a reasonable amount of time? What should it be? Why?

15. Do you have the right amount of materials such as forms, information sheets, brochures or marketing materials that you need to effectively show and sell your Smart Saver heat pumps and air conditioners? What else do you need?

16. Overall, what about the Smart Saver Program do you think works well and why?

17. What changes would you suggest to improve the program?

18. Do you feel that communications between you and Duke's Smart Saver program staff is adequate? How might this be improved?

19. What benefits do you receive as a result of participating in Duke's Smart Saver Program or from selling Smart Saver items?

20. What do you think are the primary benefits to the people who buy an Smart Saver points, or are their other benefits that are important to a potential customer?

Market Impacts and Effects

21. How do you make customers aware of the Program?

22. Are customers more satisfied with this equipment? Why or why not?

23. Do you have fewer calls or more calls to correct problems with the Smart Saver appliances?

24. Do you market or sell the Smart Saver equipment differently than your other equipment? How?

25. Other than the energy efficient heat pumps and air conditioners, has the program influenced you to carry other energy efficient equipment that is not rebated through the program?

    a. *If yes*, what do you now carry?

    b. *If yes,* About how many of these units did you install/sell in the last year?

Heat Pump Questions

26. Has the program influenced your decision to market or sell more high efficiency heat pumps than you would have without the program?

    a. *If yes,* To what extent?

27. Of those Energy Efficient heat pumps that were rebated through the program, what percent of those customers do you think would have still gone with an energy efficient model if the Duke rebate were not available?

28. What percent of these customers do you think were in some way influenced by the rebate Duke offered?

29. What percent of your total high efficiency heat pump sales were rebated through the Duke program last year?

Central Air Conditioner Questions

30. Has the program influenced your decision to market or sell more high efficiency air conditioners than you would have without the program?

    a. *If yes,* To what extent?

31. Of those Energy Efficient central AC units that were rebated through the program, what percent of those customers do you think would have still gone with an energy efficient model if the Duke rebate were not available?

32. What percent of these customers do you think were in some way influenced by the rebate Duke offered?

33. What percent of your total high efficiency central AC sales were rebated through the Duke program last year?

We would like to know what your practices were before you became a partner in the program, and what you would offer your customers without the program.

39. There are no plans to terminate the program, but we would like to know how the program effects contractors. If the program were to be discontinued, would you still offer the same energy efficient equipment options?

40. If the program were not offered, how would you structure pricing differently to make up for the program loss?

41. In your opinion is the Smart Saver program still needed? Why?

Recommended Changes from the Participating Contractors

37. Are there any other changes that you would recommend to Duke Energy for their Program not already discussed?

38. If you had a magic wand to make any changes you wanted to these programs, what changes would you make to this program?

Appendix C: Participant Survey

Smart Saver Program

Participant Survey

Contact Module
SURVEY INTRODUCTION

If Smart Saver participant, then contact for survey. Use seven 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. (Sample size N =150-200)

SURVEY

Introduction

Note: Only read words in bold type.

Hello, my name is _____. I am calling on behalf of Duke Energy to conduct a customer survey about the Smart Saver Program. May I speak with _____ please?
If person talking, proceed. If person is called to the phone reintroduce.
If not home, 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
Call back 6:	Date: _____,	Time: _____ ❑AM or ❑PM
Call back 7:	Date: _____,	Time: _____ ❑AM or ❑PM

❑ Contact dropped after seventh attempt.

We are conducting this survey to obtain your opinions about the Smart Saver Program. We are not selling anything. The survey will take about 5-10 minutes and your answers will be confidential, and will help us to make improvements to the program to better serve others. May we begin the survey?

Note: If this is not a good time, ask if there is a better time to schedule a callback.

1. **Do you recall participating in the Smart Saver Program?**

1. ❑ Yes, *begin* → *Skip to Q3.*
2. ❑ No,
99. ❑ DK/NS

This program was provided through Duke Energy. In this program, you purchased a new energy efficient central air conditioner, heat pump, or furnace and received a rebate of $200 to $600 from Duke Energy's Smart Saver Program.

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.

2. **What was the rebated appliance that you purchased?**

1. ❑ Heat Pump
2. ❑ Air Conditioner
3. ❑ Geothermal Heat Pump
4. ❑ Gas Furnace

If 4, **Was it a 90% AFUE or greater natural gas furnace combined with a new, qualifying AC or heat pump?**

1. ❑ Yes 2. ❑ No

3. **Please think back to the time when you were deciding to buy the energy saving** <rebated item>**, perhaps recalling things that occurred in your household shortly before and after your purchase. What factors motivated you to purchase energy saving** <rebated item>? *(do not read list, place a "1" next to the response that matches best)*

1. ____ Old equipment didn't work
2. ____ Old equipment working poorly
3. ____ The program's incentive
4. ____ The program's technical assistance
5. ____ Recommendation of someone else (*Probe*: **Who?**_____)
6. ____ Wanted to reduce energy costs
7. ____ The information provided by the Program

8. ____ Past experience with this program
9. ____ Because of past experience with another Duke Energy program
10. ____ Recommendation from friend/neighbor
11. ____ Recommendation from other utility program
    i. (*Probe*: **What program?** _____)
12. ____ Recommendation of dealer/retailer/contractor/builder
13. ____ Advertisement in newspaper (*Probe:* **For what program?** _____)
14. ____ Radio advertisement (*Probe:* **For what program?** _____)
15. ____ Other (SPECIFY) _____
16. ____ Don't know/don't remember/not sure (DK/NS)

If multiple responses: 2.a. **Were there any other reasons?** *(number responses above in the order they are provided - Repeat until 'no' response.)*

5. **Did you get this** <rebated item> **to replace an existing** <rebated item>**?**

1. ❑ Yes – *skip to question 8*
2. ❑ No
3. ❑ DK/NS – *skip to question 11*

6. **Is this** <rebated item> **the first you have ever had in your current home?**

1. ❑ Yes – *skip to question 11*
2. ❑ No
3. ❑ DK/NS – *skip to question 11*

7. **Did you get this** <rebated item> **because you wanted to add another/more** <rebated item> **to your home?**

1. ❑ Yes
2. ❑ No
3. ❑ Don't Know – *skip to question 11*

8. **About how old was the** <rebated item> **you replaced?**

1. ❑ Less than 5 years old
2. ❑ 5 to less than 10 years old
3. ❑ 10 to less than 20 years old
4. ❑ 20 years to less than 30 years old

5. ❑ 30 or more years old
99. ❑ Don't Know

9. **Was the old <rebated item> working or not working?**

1. ❑ Yes, working
2. ❑ No, not working – *skip to question 11*
3. ❑ Don't Know

10. **Was the old <rebated item> in good, fair, or poor working condition?**

1. ❑ Good
2. ❑ Fair
3. ❑ Poor
4. ❑ Don't Know

Free-Ridership Questions

11. **At the time that you first heard about the Smart Saver Rebate from Duke Energy, had you…?**

1. ❑ **Already been thinking about purchasing a new** <rebated item>
2. ❑ **Already begun collecting information about** <rebated item> **or**
3. ❑ **Already decided to buy the** <rebated item>**?**
4. ❑ Don't Know

12. Just to be sure I understand, did you already have specific plans to install a high-efficiency **<rebated item>** before you heard about Duke's program or their rebate?

1. ❑ Yes
2. ❑ No – *skip to question 14*
3. ❑ Don't Know – *skip to question 14*

13. **Did you have to make any changes to your existing plans in order to receive this rebate through the Smart Saver Program?**

1. ❑ Yes
2. ❑ No
3. ❑ Don't Know

14. **If the rebate from Duke Energy's Smart Saver Program had not been available, would you still have:**

14a. **Purchased a new** <rebated item>**?**

1. ❑ Yes
2. ❑ No – *skip to question 16*
3. ❑ Don't Know – *skip to question 16*

14b. **Purchased the same efficiency of** <rebated item>?

1. ❑ Yes
2. ❑ No
3. ❑ Don't Know

14c. **Purchased the** <rebated item> **at the same time that you did?**

1. ❑ Yes – *skip to question 15*
2. ❑ No
3. ❑ Don't Know – *skip to question 15*

14d. **Purchased the** <rebated item> **earlier than you did, or later?**

1. ❑ Earlier
2. ❑ Same Time
3. ❑ Later
4. ❑ Don't Know – *skip to question 15*

14e. **How much <earlier/later>?**

1. _____ years and/or _____months
2. ❑ Don't Know

15. **If the rebate from the Smart Saver Program had not been available, would you have done anything else differently?**

1. ❑ Yes
2. ❑ No
3. ❑ Don't Know

15a. **What would you have done differently?**

_____

_____

16. **On a 0 to 10 scale, with 0 being not at all likely and 10 being very likely, how likely is it that you would have bought a less efficient** <rebated item> **if you had not received any rebate from the program?**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

I'm going to read several statements about how you came to choose your <rebated item>. **On a scale of 0 to 10, where 0 is strongly disagree and 10 is strongly agree, how much do you agree with this statement?**

17. **If I had not had any assistance from the program, I would have paid the additional** <$200-$600> **to buy the** <rebated item> **on my own?**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

18. **The rebate from the Duke Energy Smart Saver Program was a critical factor in my decision to purchase the high efficiency/energy efficient product.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

19. **I would have bought a** <rebated item> **within** [a year/2 years] **of when I did even without the rebate from the Duke Energy Smart Saver Program.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

20. **The rebate from the Duke Energy Smart Saver Program was not necessary to cause me to purchase the higher efficiency product when I bought my new** <rebated item>.

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

Consistency Check & Resolution

21 will be asked only for those respondents who have a clear inconsistency between responses (i.e., all but one of the questions are at one end of the spectrum for free ridership while one question is at the other spectrum.) An algorithm will be provided after pretesting. The question responses that will be used to trigger 21 are:

- 14a (only for efficiency enhancement measures)

- 14b (only for incremental efficiency measures)
- 16
- 18
- 19
- 20

21. **Let me make sure I understand you. Earlier, you said <inconsistency prompted by excel function>, but that differs from some of your other responses. Please tell me in your own words what influence, if any, the program had on your decision to purchase and install the** <rebated item> **at the time you did?**

_____
_____
_____
_____

Based on response, correct any above entries.

Spillover Questions

22. **Since you participated in the Smart Saver Program, have you purchased and installed any other type of high efficiency equipment or made energy efficiency improvements in your home or at any other locations?**

1. ☐ Yes, only at this home
2. ☐ Yes, only at other locations
3. ☐ Yes, at both home and other locations
4. ☐ No
5. ☐ Don't Know

23. **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: _____

24. *For each type listed in 23 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.

25a. **My experience with the Smart Saver Program in** <2006, 2007, 2008> **influenced my decision to install** <item type 1> **on my own.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

25b. **My experience with the Smart Saver Program in** <2006, 2007, 2008> **influenced my decision to install** <item type 2> **on my own.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

25c. **My experience with the Smart Saver Program in** <2006, 2007, 2008> **influenced my decision to install** <item type 3> **on my own.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

25d. **My experience with the Smart Saver Program in** <2006, 2007, 2008> **influenced my decision to install** <item type 4> **on my own.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

26. **What other actions, if any, have you taken in your home to save energy and reduce utility bills as a result of what you learned in this program?**

Response:1 _____

Response:2 _____

Response:3 _____

Response:4 _____

Now I am going to ask you some general satisfaction statements. On a scale from 1-10, with 0 indicating that you strongly disagree, and 10 indicating that you strongly agree, please rate the following statements.

27. **The program's rebate form was easy to understand and complete.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

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

_____

28. **I received the rebate in a timely manner.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

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

_____

29. **The interactions and communications I had with Duke Energy staff was 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?**_____

_____

30. **The program rebates covered enough equipment and efficiency options.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

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

_____

31. **The** <rebated item> **has been performing well.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

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

_____

32. **The** <rebated item> **is energy efficient.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

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

_____

33. **The** <rebated item> **was installed properly.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

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

_____

34. **The** <rebated item> **was installed by a skilled and experienced installer.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

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

_____

35. **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?**_____

_____

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 Smart Saver 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: _____

Appendix D

APPENDIX C

Power Manager Impact Evaluation Study

Duke Energy Indiana
Duke Energy Kentucky

2007 Event Year

Impact Modeling/Metering
conducted by Duke Energy staff/contractors

Report Compilation and Review
conducted by Integral Analytics

Table of Contents

Independent Review and Assessment of the 2007 Duke Energy Kentucky Power Manager Impact Estimates

Dr Michael Ozog, Vice President, Integral Analytics

In September/ October, 2007, I reviewed the enclosed text, findings, datasets, conclusions and load reduction estimates related to the Duke Energy Kentucky Power Manager program. The objective of this review was to provide an expert and independent third party assessment of the reliability and validity of the load reduction estimates and overall evaluation activities and findings contained within this report. Given that the Power Manager program evaluation efforts significantly depend on Duke Energy meters, staff, sampling and operations, this third party review and assessment is an important exercise to glean not only an independent perspective on the evaluation effort and load reduction estimates, but to also offer possible improvements and recommendations for subsequent evaluation activities.

Overall, I found the 2007 Duke Energy Kentucky load reduction estimates to be reasonable and accurate. The sampling protocols, coverage of load research meters across the service territory, paging and operational testing, duty cycle modeling, regression methods and load reduction estimations were satisfactory and reasonable. Sufficient sample sizes were employed to yield the desired precision and accuracy in load reduction forecasts, and considerable attention was afforded to correcting the switch, operating and paging problems previously identified in the 2006 Duke Energy Kentucky Power Manager evaluation study. The past year's efforts and attention to quality control and assessment appear to have increased the load reduction capability and reliability of the program significantly. As such, I am confident that the average household load reduction forecast of 1.04 KW is a reasonable and accurate load impact for the program, given this 2007 group of customers. This level of impacts is comparable to impacts I have found for similar programs in other areas of the country.

For future evaluations, I recommend the following possible improvements or enhancements to help improve program effectiveness and load reduction forecast precision. First, it would be useful to migrate load research meters from current year sample to new homes for the 2008 season. This sample migration will insure that any potential sampling bias is mitigated and does not confound the load reduction impact estimates. Second, continued, and perhaps expanded use of, supplementary logger and instantaneous demand measures are relatively inexpensive ways to boost sampling power and improve load reduction forecasts at a reasonable cost. Third, expanded use of a "nested" sample of logger and interval end-use meters to better understand the relationship between duty cycle and air conditioner load. In all cases, additional sample points would be desirable, though not required.

And finally, the approach used in this analysis relied upon the average duty cycle (per unit) to estimate run time. This is a reasonable assumption. However, there may be significant benefits to developing statistical models that relate the individual run-time to such things as the time of day, day of week, month, and weather, or other influential

variables. This approach may produce more meaningful estimates of the program effect. Therefore, future analysis should look into using more advanced statistical methods to estimate of the impacts of the Power Manger program.

DR. MICHAEL OZOG

AREAS OF QUALIFICATION

Econometrics, energy economics, energy policy modeling, program evaluation

EMPLOYMENT HISTORY

- Integral Analytics, Fort Collins, CO 2007-present
- Senior Consultant, Summit Blue Consulting, LLC, Boulder, CO, 2002-2007
- Senior Associate, Stratus Consulting Inc., Boulder, CO, 2001-2002
- Senior Consultant, E Source, Boulder, CO, 2000

EDUCATION

- Boston College, PhD, Economics, 1991
- Pennsylvania State University, MS, Mineral Economics, 1985
- Massachusetts Institute of Technology, BS in Geology, 1982

PROFESSIONAL EXPERIENCE

At Integral Analytics (IA), Dr. Ozog is the leader of economic evaluation practice, which develops innovative statistical analysis techniques which can be used by the energy industry to understand and predict the behavior and preferences of their customer's. Dr. Ozog is also responsible for the support and improvement of IA's existing product base, including DSMore.

While at Summit Blue, Dr. Ozog was leading the quantitative research efforts into the impacts of energy efficiency programs, demand response and innovative pricing. He evaluated Sacramento Municipal Utility District's mass-market DR programs, Idaho Power Company's load management programs, and Com Ed/Chicago Cooperative Real Time Pricing program. A list of his recent projects includes:

- Multi-year evaluation of the Community Energy Cooperative's Energy-Smart Pricing Plan (ESPP). ESPP is a large-scale residential real-time pricing program in the Chicago area that uses market-based hourly electricity prices.

- Multi-year evaluation of PSE&G's residential and small commercial direct load control programs

- Multi-year valuation of KCP&L's residential air conditional load control program.

- Multi-year evaluation of Idaho Power Company's (IPCo) Residential Air-Conditioning Cycling Pilot Program.

- Evaluation of IPCo's Irrigation Peak Clip program, a program which uses switches to curtain irrigation during peak demand periods.

- Evaluation of Louisville Gas & Electric Company (LG&E) residential direct load control program for water heating and air conditioning.

- Evaluation of California Working Group 2 (WG2) demand response. The WG2 evaluation investigated the demand impacts associated with industrial demand response programs.

- A multi-year impact Evaluation of Sacramento Municipal Utility District's (SMUD's) PowerStat and PowerChoice programs.

- Multi-utility evaluation of New Hampshire's Home Energy Solutions (HES). The HES program is a residential retrofit program that is implemented by all electric utilities in New Hampshire (i.e., Granite State, New Hampshire Electric Cooperative, Unitil, and Public Service of New Hampshire).

- Evaluation of LG&E WE Care low-income weatherization program.

PUBLICATIONS

REFEREED JOURNAL ARTICLES

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"Decomposing Energy Conservation into Natural and Incentive-Induced Components" (with D. Waldman). *Southern Economic Journal* April 1996.

"Model Specification and Treatment of Outliers in the Evaluation of a Commercial Lighting Program" (with R. Davis). *Energy Services Journal*. Vol. 1, No. 1, September. 1995.

"Weighing Enriched Samples in Voluntary Energy Conservation Program Evaluation" (with D. Waldman). *The Energy Journal*. Vol. 15, No. 1, March. 1994.

Introduction

Duke Energy offers residential customers a load control program called Power Manager. This program offers customers a monetary incentive for reducing their air conditioning during peak demand periods. This report presents the load impact analysis for 2007 Power Manager control periods. The first two sections below are devoted to estimating the potential average (i.e., per-participant) impact from Power Manager load control; the first section describes data collection and the next section focuses on models derived from this data. The following section presents the operability study conducted in 2007 to identify an explicit de-rating factor for Power Manager load control. This is an important difference from the 2006 load impact analysis, where de-rating was implicit in the impact estimates and not separated from other influential factors such as weather. Hourly load impact estimates for Power Manager control days are given in the next section, in Tables 5-12(d). The maximum impact was 39 MW for Duke Energy Indiana and 8 MW for Duke Energy Kentucky on August 8. It should be noted that Duke Energy Indiana impacts during August were reduced about 4 MW by an IT change unrelated to the program, and this problem is now resolved. The final section describes Duke Energy's plan for diagnostic field testing to be conducted over the next few weeks at customer locations identified in the operability study where switches failed to shed during control periods this summer. Results from these tests will be used to improve future load impacts.

To ensure that Duke Energy maximizes the impacts of the program a quality assurance action plan was put in place prior to the 2007 control season. An assessment of the accuracy of the data and quality of the equipment and procedures being used to evaluate the program was done. One of the factors for the evaluation was the low impacts that were discovered during the 2006 control season. The impact estimates for the 2006 control season were significantly below the targeted load reduction. Details of the quality assurance plan and the impacts measured in 2006 are found in appendix 8.

Load Research Sample

A fresh load research sample ("RS" group) was recruited for summer 2007, with no holdovers from 2006. For each RS participant, HOBO U-9 state data loggers were installed on all AC units and the household kWh meter was replaced with an interval meter. Data logger's records times at which the AC unit turns on or off, allowing duty cycle to be constructed at any desired temporal resolution. To enable efficient collection of logger data, prospective candidates for the research sample were randomly selected with a two stage cluster sampling method. The clusters are based upon zip code, and required to contain at least 120 Power Manager customers to provide an adequate pool for recruitment. Prior to sampling (in January, 2007), small zip codes were combined with adjacent zip codes into a single cluster, so that all clusters meet the minimum size requirement. In the first stage of sampling, eight clusters were randomly selected in Indiana and four clusters in Kentucky. These clusters were drawn in such way that the probability of selection for a cluster was proportional to the number of Power Manager participants in that cluster.

In the second stage of sampling, customers were classified as high, medium, or low users based upon billed kWH for the months June – September of 2006. The kWH breakpoints used for classification were determined at the state level, so that equal numbers are assigned to each category in both Indiana and Kentucky. Clusters selected in the first stage were separated into six groups based upon kWH usage level and program option (1.5 kW or 1.0 kW). Using randomized selection within these groups, two participants were recruited from each 1.5 kW group and one participant from each 1.0 kW group, for a total of nine recruits in each cluster.

Due to a mistake in the preparation of randomized lists for recruiting, several customers were recruited from a zip code cluster that had not been selected in the stage 1 random draw. This cluster was substituted for a nearby cluster which had been selected in the random draw but where no recruits had yet been obtained.

Load Impacts with the Duty Cycle Method

The duty cycle method will be used to estimate load impacts during Power Manager control periods. Air-conditioner (AC) natural duty cycles are measured with HOBO data loggers for the Power Manager load research samples during 2006-2007 summer seasons. Together with connected loads for research sample AC units, the natural duty cycle data enables evaluation of the average load reduction achieved by a cycling strategy within the research sample. Hourly models have been constructed for average load reduction within the research sample as a function of weather conditions and cycling strategy. The potential load impact during a Power Manager control period is determined by evaluating these models with the cycling strategy employed and weather conditions during the control period. The potential load impacts estimated in this manner represent the load reduction which would be achieved if all switches controlled as expected.

Validation of Logger Data

We have found that HOBO U-9 state data loggers, when properly installed record the start and end times of AC duty cycles with good reliability. Installation procedures are given Appendix 1. Nevertheless, it is to be expected that some logger data will not accurately reflect AC cycles, and should be discarded. Premise interval kWh (15-minute) collected for customer sites where data loggers are installed is used to validate the logger data. The validation process is accomplished with a sequence of computer programs that: 1) convert the time stamp data collected from U-9 data logger into interval 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 interval kWh and interval duty cycle and display cross-plots of kWh vs. duty cycle. Every logger data file collected from a customer site is reviewed in this fashion, and added to the duty cycle model database when the interval kWh provides confirmation of the AC cycles in the logger data.

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 research sample AC units through the basic engineering formulas,

Apparent Power (kVA) = (Compressor Amps + Fan Amps) * 240 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, and were obtained for 107 of the 112 research sample AC units.

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. However, we can use the synchronous AC duty cycle and interval kWH data obtained from the research sample to estimate a single, best-fitting power factor within

the research sample. The first step is a regression, for each sample participant with adequate data, of interval kWH on duty cycle,

$$kWH_t = a + b^* DC_t + \varepsilon_t$$

Notice that if the AC unit runs for an entire 15-minute interval, so that $DC_t = 1$, then the regression coefficient b equals the kWH attributed to the unit during that interval. Dividing by the length (in hours) of the interval converts to kW, so 4^*b is the appropriate estimate of the unit's connected load. Next, the results for connected load obtained in the pervious step become the independent variable, and are regressed on Apparent Power (from faceplate FLA and RLA). The slope computed in this regression (Apparent Power vs. connected load) is the best-fitting power factor for the group. The power factor obtained for the 2006 research sample was 0.834, and for the 2007 research sample it was 0.826.

For AC units where information on rated amps is not available, the first regression above provides an estimate of connected load for the unit which can be used instead.

Hourly Models for Load Reduction

The key parameter to a Power Manager control strategy is the shed percentage, the percentage of time within a control interval that AC units are prevented from running. When the natural duty cycle of an AC unit exceeds the complement of the shed percentage within a control interval, then run time for the unit is reduced and load reduction is realized. For shed percentage and natural duty cycle expressed as fractions between zero and one, hourly load reduction can be calculated as follows:

Run time reduction = MAX[Duty cycle - (1 - Shed percentage), 0]

Load reduction = Connected load * Run time reduction

These calculations can be performed in any hour of any day (i.e., hour 16 on June 13) for all AC units of the RS group with valid natural duty cycles in that hour to get average load reduction within the RS group for that particular hour. Hourly average load reductions computed in this manner comprise the dependent variable data in the load reduction models.

Hourly weather is represented in the load reduction models with heat index, which combines temperature and humidity into a single variable. Appendix 2 describes how heat index is calculated from temperature and relative humidity. Separate models for load reduction as a function of heat index are fit for each combination of shed percentage and hour of the day needed in the impact evaluation. The heat index variable in the models is a composite based on weather observations from Cincinnati airport, Indianapolis airport, and Louisville airport. Further detail on model fits is given in appendix 3.

Operability Study

Some switches fail to perform as expected when load control is initiated. A study has been conducted during summer 2007 to estimate the proportion of Power Manager switches in Indiana and Kentucky (Model ACP/F032803 manufactured by Corporate Systems Engineering) that shed the AC unit for the prescribed length of time during Power Manager load control events. The operability study involves about 250 Power Manager participants selected randomly, but in such a way as to ensure adequate geographic representation. The RS group described above is included, and 150 additional Power Manger participants (the "OP" group) were selected randomly from zip codes not represented by the RS group. A large proportion (100-200) of these customer sites were visited after each control day (or group of consecutive control days), and the contents of switch registers downloaded into a Palm PC device designed for this purpose. Switch data is transferred to a PC and aggregated into spreadsheet files for analysis. The de-rating factor (or net-to-gross ratio) obtained from the operability study is incorporated into the load impacts reported for the Power Manager program in this report. The remainder of this section describes in detail the switch data collected and how this data is used to obtain a statistically reliable estimate for the de-rating factor.

Based upon the structure of switch registers and the operation of the Power Manager program, the de-rating factor is constructed as a product of two distinct components: the programming factor and the shed factor. In general terms, the programming factor involves switch register settings that can be established prior to a control day and need not be modified from one control day to the next, while the shed factor measures correct switch response to paging signals sent immediately prior to and during a load control event.

The switch registers which are examined to set the value of the programming factor are shown in Table 1.

Table 1. Switch data for programming factor

Register Identifier	Register Value	Power Manager Code
OpReg1 (upper:lower)	1:3	DEI
	1:1	DEK
	2:37	RS group
OpReg5 (upper:lower)	1:2	1.5 kW
	1:1	1.0 kW
	1:3	0.5 kW
Wildcard (hh:mm:ss)	00:22:12	1.5 kW
	00:16:12	1.0 kW
	00:09:18	0.5 kW

Intended values for these registers are shown in column 2 of this table, and column 3 shows what determines correct values for a particular switch. Correct values depend upon the customer's choice of program option, the customer's location , and whether the

customer is in the RS group. The wildcard register sets the amount of shed time within a 30-minute control period, so the correct values in Table 1 correspond to shed percentages of 74% for the 1.5 kW option, 54% for 1.0 kW, and 31% for 0.5 kW. If values of the three registers in switch data collected from a customer site match the correct values for that customer, then the programming factor for that observation is set to one. If there is any discrepancy in the register values, then the programming factor for that observation is usually zero, although there are infrequent cases with values between zero and one (discussed further below).

The shed factor is a conditional statistic, conditioned on correct programming, or more precisely programming factor greater than zero. Aside from this, the switch registers examined to determine a value for the shed factor are the activation counter and cumulative shed time. The activation counter records the number of times that the switch has shed since the last clear counters command was received. For example, a three hour control event with 30 minute control period should increment the activation counter by six. The cumulative shed time records the total minutes that the switch has shed since the last clear counters command was received, where shed time during a control period is rounded to the nearest minute for accumulation in this register. Table 2 gives the expected increments to these registers associated with each control day of summer 2007. Table 2 also indicates if counters were cleared immediately prior to a control day.

Table 2. Increments to Activation Counter and Cumulative Shed Time

Control Date	Groups Controlled	Control Period (min)	Counters Cleared	Activation Counter Increment	Cumulative Shed Increment (min)	
					1.5 kW	1.0 kW
May 30	RS	30	Yes	4	88	64
June 7	DEI; DEK	30	Yes	6	132	96
June 21	RS	30	Yes	6	132	96
July 17	DEK	30	Yes	4	88	64
Aug 1	DEI; DEK; RS	30	Yes	8	176	128
Aug 8	DEI; DEK	30	Yes	6	132	96
Aug 9	DEI; DEK; RS	30	No	4	88	64
Aug 16	DEI; DEK; RS	45	Yes	4	120	90
Aug 23	DEI; DEK; RS	30	Yes	4	88	64
Aug 29	DEI; DEK	30	No	4	88	64

For switch data collected on a given date from a particular customer site, the information in Table 2 is sufficient to determine the expected contents of the activation counter and cumulative shed time registers. If the collected data values match these expected values (and programming factor is nonzero), then the shed factor for this observation is set to 1. The most common discrepancy encountered is when the activation counter and cumulative shed time collected from a switch are zero, and in this case the shed factor is set to zero. Other cases require further inspection to determine an appropriate shed factor for the observation, and occasionally result in a value between zero and one.

A computer program has been constructed to process switch data and identifies observations for which values in registers described above do not match the values expected for that observation. Because of rounding issues, the value for cumulative shed time is considered to match if it is at least as large as the appropriate value from Table 2, and no larger than that value plus one minute for each expected activation. Observations not matching expected values were examined individually to determine if the observation should be retained (i.e., not off-program due to a dropout or tenant change), and to assign appropriate programming and shed factors.

Results for Programming Factor

The RS group has special programming, as shown in Table 1, to enable it to be controlled independent of the general population. Special attention was devoted to achieving proper programming of the RS group. For these reasons, it is not appropriate to include switch data from the RS group in determining a programming factor for the general population. Results described below for the programming factor are based entirely on data from the OP group.

Although there were multiple observations for more than half of the OP switches, only three showed a change in the program factor over the summer. For all three switches, an incorrect factor observed after June 7 was corrected in subsequent observations. Normal programming changes to switch registers, such as tenant transfers, were excluded from the analysis. Programming factor data is aggregated by switch for statistical analysis, using the average value for the few switches with observations not all identical. Of 151 OP switches, 121 were correctly programmed (factor = 1) in all observations and 27 were incorrectly programmed in all observations (factor = 0). Table 3 shows statistical results.

Table 3. Programming factor statistics
(OP switch data only)

Switch count	151
Sample mean	0.809
Standard error	0.032
90% confidence	0.757 – 0.861

A variation adopted in the analysis of the programming factor for 1.5 kW switches in Indiana requires some further explanation. Early in the 2007 control season, it was decided to refresh the programming of all Power Manger switches. To do this efficiently, a global command was issued on June 27 to reprogram all Power Manager switches in Indiana and Kentucky, and this command set the program option in all switches to 1.0 kW. The plan was to reset appropriate switches to program option 1.5 kW with individual paging commands. This process was completed July 9 for Kentucky switches, but stalled midway through the list of Indiana switches. The reason was eventually identified and corrected – a Duke Energy IT change unrelated to the Power Manager program. But for control days in August approximately 50% of Indiana 1.5 kW customers were actually programmed to 1.0 kW (see OpReg5 in Table 1). This discrepancy was temporary in nature and not related to switch performance, and so it was

disregarded in setting the programming factor. The discrepancy is incorporated into the impacts reported for August control days by modifying the Indiana participant counts for 1.5 kW and 1.0 kW in Tables 7-12(a) below.

Results for Shed factor

The registers examined for the shed factor (activation counter and cumulative shed time) function in exactly the same manner for correctly programmed RS and OP switches, so it is appropriate to use switch data from both groups to derive shed factor statistics. The shed factor for a single observation is normally zero or one, although there are a few observations with activations and cumulative shed greater than zero but less than expected for the control period. It is much more common for multiple observations of a switch to result in a shed factor of one on some control days and zero on other control days. Nevertheless there is correlation between multiple observations of the same switch. To allow for this correlation, a random effects model has been adopted to analyze shed factor observations, which allows for distinct variances within and between switches. Statistical results with this model are given in Table 4.

Table 4. Shed factor statistics
(OP and RS switches correctly programmed)

Observation count	566
Switch count	208
MS between	0.282
MS within	0.062
Sample mean	0.823
Standard error	0.023
90% confidence	0.785 – 0.861

August 16 Shed Avoiding the Wildcard Register

Incorrect wildcard register settings have been identified as a persistent problem for a significant proportion of switches in the OP group, and are the principal source of deficit in the programming factor. Shedding with the wildcard register enables complete flexibility in specifying the shed percentage that is imposed, and for this reason Power Manager protocols have relied upon configuring the wildcard register. However, the switches allow an alternate shed mechanism which involves selecting from a limited number of fixed shed times, with no need to configure the wildcard register. This alternate mechanism was used on August 16, and data was collected from more than 20 switches with incorrect wildcard registers. Careful examination of the activation counts and cumulative shed time in this data found no evidence any shed on August 16 among those switches with incorrect wildcard registers. In view of these findings, the de-rating factors derived above (Tables 3 and 4) are used for the August 16 load impacts in spite of the different shed mechanism employed.

Load Impacts for 2007 Control Days

In all control periods of 2007 except on August 16, the shed percentages were 74% for program option 1.5 kW, 54% for 1.0 kW, and 31% for 0.5 kW. These shed percentages were chosen to achieve the corresponding load reduction target under typical (median) weather conditions at the summer peak, which correspond to a temperature of 93 deg-F and dew point of 73 deg-F (heat index about 103) .

Hourly weather observations from three weather stations are used in the impact evaluation; Cincinnati airport (CVG), Indianapolis airport (IND), and Louisville airport (SDF). Power Manager customers are assigned to weather region by zip code. Kentucky zip codes and zip codes in southeast Indiana are assigned to CVG, zip codes in south-central and southwest Indiana to SDF , and in central Indiana to IND (Indianapolis airport). Indiana zip codes assigned to CVG or SDF are listed in appendix 4. The blended heat index for Duke Energy Indiana in Tables 5-12(b) is calculated as a weighted average of the corresponding hourly heat index in these weather regions. The weights used for each program option correspond to the counts of Power Manager customers for that program option in the three weather regions.

Average shed kW in Tables 5-12(c) is computed with the hourly load reduction models described in that section and appendix 3. The model developed for the indicated hour and shed percentage is evaluated at the appropriate heat index for the prior hour shown in Tables 5-12(b). The CVG heat index is used to compute shed kW for Duke Energy Kentucky, and blended heat index for the corresponding program option is used to compute shed kW for Duke Energy Indiana.

Hourly potential load impacts in Tables 5-12(d) are computed with the participation counts in Tables 5-12(a) and the average shed kW in Tables 5-12(c). A de-rating factor is applied to these potential impacts to get the de-rated impacts appearing in Tables 5-12(d). This factor is 0.666, the product of sample means obtained for the programming factor (0.809, from Table 3) and shed factor (0.823, from Table 4) in the section discussing the Operability Study. August hourly impacts for Duke Energy Indiana in Tables 7-12(d) were reduced about 4 MW by the reprogramming problem discussed in the previous section. The weather normalized, de-rated, per-participant impact is 1.22 kW for option 1.5, 0.80 kW for option 1.0, and 0.39 kW for option 0.5 (hour 17, heat index 103).

Table 5. Load Impacts for June 7

(5a)

	Participant Count		
	1.5 kW	1.0 kW	0.5 kW
DEI	20539	13675	23
DEK	4445	2784	2

(5b)

	Heat Index			Blended Heat Index for DEI		
Hour	CVG	IND	SDF	1.5 kW	1.0 kW	0.5 kW
14	92.6	91.5	93.8	91.8	91.9	91.7
15	92.6	91.0	93.8	91.4	91.5	91.3
16	93.8	91.5	95.5	92.1	92.2	91.9
17	93.3	91.5	94.9	92.0	92.1	91.9

(5c)

	Duty Cycle Model Average Shed kW					
	DEI			DEK		
Hour	1.5 kW	1.0 kW	0.5 kW	1.5 kW	1.0 kW	0.5 kW
15	1.12	0.65	0.28	1.16	0.68	0.30
16	1.17	0.69	0.30	1.24	0.74	0.32
17	1.30	0.79	0.35	1.38	0.85	0.39

(5d)

	Potential Impact (MW)		De-rated Impact (MW)	
Hour	DEI	DEK	DEI	DEK
15	24.0	5.3	16.0	3.5
16	33.5	7.5	22.3	5.0
17	37.4	8.5	24.9	5.7

Table 6. DEK Load Impacts for July 17

(6a)

	Participant Count		
	1.5 kW	1.0 kW	0.5 kW
DEI	-	-	-
DEK	4447	2816	2

(6b)

	Heat Index			Blended Heat Index for DEI		
Hour	CVG	IND	SDF	1.5 kW	1.0 kW	0.5 kW
14	92.6	91.5	93.8	-	-	-
15	92.6	91.0	93.8	-	-	-
16	93.8	91.5	95.5	-	-	-
17	93.3	91.5	94.9	-	-	-

(6c)

	Duty Cycle Model Average Shed kW					
	DEI			DEK		
Hour	1.5 kW	1.0 kW	0.5 kW	1.5 kW	1.0 kW	0.5 kW
15	-	-	-	1.16	0.68	0.30
16	-	-	-	1.24	0.74	0.32
17	-	-	-	1.38	0.85	0.39

(6d)

	Potential Impact (MW)		De-rated Impact (MW)	
Hour	DEI	DEK	DEI	DEK
15	-	5.3	-	3.5
16	-	7.6	-	5.0
17	-	8.5	-	5.7

Table 7. Load Impacts for August 1

(7a)

	Participant Count		
	1.5 kW	1.0 kW	0.5 kW
DEI	20563	13993	23
DEK	4442	2812	2
DEI Reprogram	10282	24274	23

(7b)

	Heat Index			Blended Heat Index for DEI		
Hour	CVG	IND	SDF	1.5 kW	1.0 kW	0.5 kW
14	91.4	89.9	93.9	90.5	90.6	90.3
15	90.6	89.9	95.0	90.6	90.7	90.4
16	92.0	92.5	96.1	92.9	93.0	92.8
17	93.0	92.0	94.0	92.3	92.4	92.3

(7c)

	Duty Cycle Model Average Shed kW					
	DEI			DEK		
Hour	1.5 kW	1.0 kW	0.5 kW	1.5 kW	1.0 kW	0.5 kW
15	1.06	0.61	0.26	1.10	0.64	0.28
16	1.13	0.66	0.28	1.13	0.66	0.28
17	1.34	0.82	0.37	1.29	0.78	0.35
18	1.38	0.85	0.38	1.41	0.87	0.40

(7d)

	Potential Impact (MW)		De-rated Impact (MW)	
Hour	DEI	DEK	DEI	DEK
15	22.7	5.0	15.1	3.3
16	32.6	6.9	21.7	4.6
17	39.0	7.9	26.0	5.3
18	40.2	8.7	26.8	5.8

Table 8. Load Impacts for August 8

(8a)

	Participant Count		
	1.5 kW	1.0 kW	0.5 kW
DEI	20554	13987	23
DEK	4439	2819	2
DEI Reprogram	10277	24264	23

(8b)

	Heat Index			Blended Heat Index for DEI		
Hour	CVG	IND	SDF	1.5 kW	1.0 kW	0.5 kW
14	102.9	103.0	109.4	103.9	104.0	103.6
15	108.1	104.0	107.9	104.6	104.8	104.5
16	104.2	105.4	109.2	105.9	105.9	105.7
17	91.9	106.8	109.7	106.8	106.6	106.4

(8c)

	Duty Cycle Model Average Shed kW					
	DEI			DEK		
Hour	1.5 kW	1.0 kW	0.5 kW	1.5 kW	1.0 kW	0.5 kW
15	1.71	1.08	0.50	1.66	1.05	0.49
16	1.85	1.21	0.56	2.02	1.33	0.63
17	1.97	1.32	0.65	1.89	1.25	0.62

(8d)

	Potential Impact (MW)		De-rated Impact (MW)	
Hour	DEI	DEK	DEI	DEK
15	37.8	7.8	25.2	5.2
16	54.8	12.7	36.5	8.5
17	58.9	11.9	39.2	7.9

Table 9. Load Impacts for August 9

(9a)

	Participant Count		
	1.5 kW	1.0 kW	0.5 kW
DEI	20533	13968	25
DEK	4442	2815	2
DEI Reprogram	10267	24234	25

(9b)

	Heat Index			Blended Heat Index for DEI		
Hour	CVG	IND	SDF	1.5 kW	1.0 kW	0.5 kW
14	105.5	101.6	109.7	102.8	103.0	102.4
15	105.1	98.9	108.8	100.3	100.6	99.9
16	104.6	98.9	108.8	100.3	100.6	99.9
17	105.1	100.2	106.7	101.2	101.4	101.0

(9c)

	Duty Cycle Model Average Shed kW					
	DEI			DEK		
Hour	1.5 kW	1.0 kW	0.5 kW	1.5 kW	1.0 kW	0.5 kW
16	1.63	1.05	0.47	1.87	1.22	0.57
17	1.70	1.11	0.52	1.90	1.27	0.62

(9d)

	Potential Impact (MW)		De-rated Impact (MW)	
Hour	DEI	DEK	DEI	DEK
16	36.0	8.8	24.0	5.9
17	50.4	12.0	33.6	8.0

Table 10. Load Impacts for August 16

(10a)

	Participant Count		
	1.5 kW	1.0 kW	0.5 kW
DEI	20495	13942	29
DEK	4433	2813	4
DEI Reprogram	10248	24189	29

(10b)

	Heat Index			Blended Heat Index for DEI		
Hour	CVG	IND	SDF	1.5 kW	1.0 kW	0.5 kW
14	107.2	101.6	107.8	102.6	102.8	102.4
15	104.2	97.5	106.0	98.8	99.1	98.5
16	104.7	104.1	107.8	104.6	104.7	104.4
17	99.7	92.2	93.2	92.5	92.7	92.8

(10c)

	Duty Cycle Model Average Shed kW					
	DEI			DEK		
Hour	1.5 kW	1.0 kW	0.5 kW	1.5 kW	1.0 kW	0.5 kW
15	1.43	0.93	0.31	1.64	1.07	0.37
16	1.34	0.88	0.29	1.60	1.06	0.36
17	1.68	1.15	0.41	1.68	1.15	0.42

(10d)

	Potential Impact (MW)		De-rated Impact (MW)	
Hour	DEI	DEK	DEI	DEK
15	31.7	7.7	21.1	5.1
16	39.7	10.1	26.5	6.7
17	50.5	10.7	33.6	7.1

Table 11. Load Impacts for August 23

(11a)

	Participant Count		
	1.5 kW	1.0 kW	0.5 kW
DEI	20456	13946	32
DEK	4428	2801	5
DEI Reprogram	10228	24174	32

(11b)

	Heat Index			Blended Heat Index for DEI		
Hour	CVG	IND	SDF	1.5 kW	1.0 kW	0.5 kW
14	100.8	98.0	103.0	98.8	98.9	98.5
15	101.3	99.3	103.5	99.9	100.0	99.7
16	101.4	98.6	103.5	99.3	99.4	99.0
17	100.8	98.6	102.7	99.2	99.3	99.0

(11c)

	Duty Cycle Model Average Shed kW					
	DEI			DEK		
Hour	1.5 kW	1.0 kW	0.5 kW	1.5 kW	1.0 kW	0.5 kW
15	1.46	0.90	0.41	1.56	0.97	0.45
16	1.60	1.02	0.46	1.68	1.07	0.49

(11d)

	Potential Impact (MW)		De-rated Impact (MW)	
Hour	DEI	DEK	DEI	DEK
15	31.9	7.2	21.2	4.8
16	47.1	10.4	31.3	7.0

Table 12. Load Impacts for August 29

(12a)

	Participant Count		
	1.5 kW	1.0 kW	0.5 kW
DEI	20453	13937	33
DEK	4429	2796	6
DEI Reprogram	10227	24163	33

(12b)

	Heat Index			Blended Heat Index for DEI		
Hour	CVG	IND	SDF	1.5 kW	1.0 kW	0.5 kW
14	97.9	95.1	95.8	95.3	95.4	95.3
15	96.1	96.1	101.1	96.8	96.9	96.4
16	96.7	94.5	101.3	95.5	95.6	95.0
17	98.0	95.8	95.5	95.8	95.8	95.9

(12c)

	Duty Cycle Model Average Shed kW					
	DEI			DEK		
Hour	1.5 kW	1.0 kW	0.5 kW	1.5 kW	1.0 kW	0.5 kW
16	1.45	0.90	0.40	1.41	0.87	0.39
17	1.46	0.92	0.42	1.52	0.96	0.45

(12d)

	Potential Impact (MW)		De-rated Impact (MW)	
Hour	DEI	DEK	DEI	DEK
16	31.6	6.5	21.1	4.3
17	42.7	9.4	28.4	6.3

Action Plan for Improving Load Impact

The operability study has identified many customer sites where switches have not been effectively configured with paging signals (62 in Indiana, 16 in Kentucky), or where properly configured switches appear not to have not shed during any of the 2007 control intervals (8 in Indiana, 6 in Kentucky). Diagnostic testing of these sites and switches will begin immediately, to identify the cause of these problems and determine whether the problems are associated with the customer site (e.g., a problem with the paging signal or switch installation) or with the switch itself. The customer locations are displayed in appendix 5 and 6.

A technician will visit several of these customer sites with problematic switch performance. The technician will communicate by phone with someone using the paging software and document results of several switch tests. He will also use the handheld device to observe and download the results of the tests. The type of additional testing on the switches will include:

- Observing whether or not our test on/test off commands are being transmitted to the switch
- Sending a test paging command to a different paging device at the same location as the switch to determine if the page can be transmitted successfully
- Plugging in a special test switch to an outside outlet if available at the site and sending commands to it to determine if the paged commands get transmitted.
- Open/close the disconnect and repeat the paging tests and record results
- Observe and record any indication of tampering
- Record location of possible physical structures that could impede paging commands

A checklist showing actions to be performed during site visits for diagnostic testing is attached as appendix 7. Switches that appear to be completely non-functioning will be removed at a later time and taken to the switch vendor for internal component testing. A technical resource from the switch vendor has already been assigned to this project.

In addition to these tests, we will revisit a sampling of switches that were found to be incorrectly reprogrammed last year. Again the registers will be read with the hand-held device and the data downloaded. The purpose of this will be to assess the success of the reprogramming effort.

Appendix 1. HOBO U9 Logger Installation and Data Retrieval Procedure for 2007

HOBO U9 Logger

The HOBO U9-001 logger records the change of state of the compressor by direct connection. Each time the compressor starts or stops, the logger records the new state, along with the date/timestamp. The logger directly reads the continuity of a set of relay contacts that close when the compressor is started. The relay is field installed at the time of the logger installation. The relay has a 240 volt coil wired in parallel with the compressor and when the compressor is energized by the compressor contactor, the relay coil is simultaneously energized, pulling in the contacts. The logger interprets this as a change of compressor state (the start of the compressor). When the contactor deenergizes the compressor windings, the relay contacts open and the logger interprets this as another change of state (the end of the compressor run cycle).

The loggers will be installed in a weatherproof enclosure to keep them dry.

Definitions:

HOBOware – the software application that is used to launch and readout the HOBO loggers.

Launch – Process that turns on the logger, checks its battery and prepares it to begin logging data. A logger must be launched initially and after each data readout. Launching deletes all on/off state data in the logger.

Readout – off-loads the data from the logger. When reading out a logger, it is possible to either stop the logging process or to continue logging. The data in the memory is not deleted simply by reading out the logger. You must launch the logger to delete the old data.

Procedures

Update your HOBOware version. The version on the CD is out of date. You need to update to HOBOware Pro.

PC Time Set

Each HOBO U9 logger is launched by the HOBOware application on the PC – this sets the clock in the logger. Set the PC time each day before connecting the PC to a logger. This can be done by either the time-syncing feature of the Microsoft operating system (if your version supports that feature) or by connecting over the Internet to a site to sync with the atomic clock. Here are links to free utilities that can sync the PC to the atomic clock.
http://www.analogx.com/contents/download/network/ats.htm
http://www.worldtimeserver.com/atomic-clock/

During the initial launch, install new battery in all loggers.

Replacing Batteries

1. Remove logger from weather proof case
2. Unplug grey wire from logger
3. Remove battery using a pencil.
4. Install new battery with positive side facing up.
5. Plug the grey wire back into the logger.

Installation

Suggested tools: Nut driver, screw drivers, small diagonal cutters.

Materials: Logger, relay, 2 conductor wire, nylon cable ties, extra sheet metal screws.

1. Do not install on rainy days or when humidity approaches 95% (near dewfall).
2. Set the PC time before leaving home.
3. Open disconnect switch or pull fuses.
4. Open A/C unit.
5. Determine which relay to use.
    a. If voltage is present on the load side of the contactor, a 24 volt coil relay must be used (Part number 90-293q). To energize this relay, low voltage from the contactor must be connected to 1 and 3. The black and white wire from the logger should be connected to numbers 2 and 4 on the relay (normally open).
    b. If voltage is NOT present on the load side of the contactor, a 240 volt coil relay must be used (Type 91 relay). To energize the Type 91 relay, connect wires on the load side of the contactor to each side of the coil on the relay. The logger should be connected to 1 and 3 (normally open).
    c. If voltage is NOT present and there are clearance issues, the part number 90-295q should be used. To energize this relay, connect two wires from the load side of the contactor to 1 and 3 on the relay. The logger should be connected to 2 and 4 (normally open).
6. Mount the relay in the control compartment of the A/C unit, near the contactor.
7. Mount the black case outside of the ac unit. Attach black case to the conduit between the Power Manager switch and the air conditioning unit with a wire-tie. Locate the black case containing the logger in the shade and out of direct rainfall if possible.
8. Run the gray wire from the logger along the conduit and through a grommet leading to the air conditioning unit control compartment.
9. Connect the black and white wires from the logger to the relay as described above in step 5.
10. Secure all wiring with cable ties.
11. Connect the logger to the PC with the USB cable and launch the logger by clicking the Launch Logger icon.
12. HOBOware Launch Logger screen. These fields are to be completed at time of launch:

    Description: must be set to **serial number**

    State channels S-1: name = State Sensor, open = State Off, closed = State On

Channels to log: **UN-check** Logger's Battery Voltage
Launch Options: **Now**.

13. After all fields have been set, click **Launch**.
14. After the logger has been relaunched, click the Logger status icon and verify that the current status is "Launch, Logging" and the proper state of compressor running, On or Off, is being displayed.
15. While in the logger status mode, verify that the logger is correctly recording the compressor starts and stops. To do this, close the disconnect switch, manually engage the contactor to force the compressor to start, taking care to avoid the high voltage terminals on the contactor or start capacitor. Verify the state sensor display on the screen indicates State On when the compressor is running and State Off when the compressor is off. If you are not getting the correct response, see the **Troubleshooting** section below.
16. After verifying proper operation, disconnect the USB cable, close the logger enclosure, remount the logger.
17. Close A/C unit, replacing any lost or damaged sheet metal screws.
18. If still open, close disconnect switch or replace fuses. Make sure fuse holder is properly oriented.

Readout/Relaunch

The readout schedule for U9 loggers is every four weeks.

Do not readout the logger during a Power Manager event. You can call 877-392-4848 to see if there it an event under way. If the red LED on the Power Manager device is lit, there is an event under way and you should wait until a non-event day to readout the loggers.

Loss of good data will be minimized if you can avoid readouts during afternoon hours (12:00 - 6:00 PM), especially when temperature exceeds 85 deg-F. However, this is not an essential requirement, and can be disregarded when it would significantly complicate data collection.

Suggested tools: Nut driver, screw drivers, small diagonal cutters.
Materials: nylon cable ties, extra sheet metal screws, logger batteries

1. Do not readout on rainy days or when humidity approaches 95% (near dewfall).
2. Set the PC time before leaving home.
3. Connect logger to PC using the USB cable.
4. Using HOBOware, click the Readout logger icon. It will ask if you want to stop logging. Click **Stop**.
5. While doing the readout, HOBOware will suggest a file name based on the Description that was defined at the time of last launching. This file name should be the logger serial number perhaps with additional numerical suffixes if you are saving to a folder with other files with the same name. Click **Save**.
6. The Plot Setup screen will now appear. Click Cancel.
7. You must relaunch the logger to clear its memory. Click the Launch Logger icon.
8. HOBOware Launch Logger screen.

9. If the battery level is 25% or less, you must replace the battery in the logger.
10. To replace battery, remove logger from weather-proof case.
11. Unplug grey wire from logger.
12. Remove battery.
13. Install new battery with positive side facing up.
14. Plug the grey wire back into the logger.
15. These fields to be completed at time of launch:
    Description: must be set to **serial number**
    State channels S-1: name = State Sensor, open = State Off, closed = State On
    Channels to log: **UN-check** Logger's Battery Voltage
    Launch Options: Now.
16. After all fields have been set, click **Launch**.
17. After the logger has been relaunched, click the Logger status icon and verify that the current status is "Launch, Logging" and the proper state of compressor running, On or Off, is being displayed.
18. After verifying proper operation, disconnect the USB cable, close the logger enclosure, remount the logger.
19. Helpful tip on closing weather-proof case: Place logger in case such that grey wire is on the hinge side of the case lid. The length adjustment of grey wire can be accomplished by loosening the outside nut on the case and adjusting the wire so that the lid of the case closes easily. A 2 ½ inch length of grey wire on the inside of the case will allow the lid to close easily.

Email the all data files to Carol Burwick at amanda.goins@duke-energy.com . Save a backup copy of the data files to a diskette or CD.

Troubleshooting
You can check the green LED to see if the logger is recording the A/C start but in sunlight it will probably be easier to look at the Logger Status screen in HOBOware. The status should be Launched, Logging and the State should be On when the compressor is running and Off when the compressor is off.

If the logger is not logging, it needs to be launched.

If the State does not change to On when the compressor starts, the problem is either with relay or the wiring. Make sure the relay contacts close when the compressor starts and they open when the compressor stops. You can do this by checking the stereo plug with an ohm meter. Connect the meter to the tip and sleeve of the plug (the middle ring is not connected to anything) and measure the resistance when the compressor is off and again when the compressor is running. When the compressor is running, the resistance should be near zero (less than 5 ohms). When the compressor is off, the resistance should be infinity. If this is not the case, make the same check at the terminals of the relay contacts to determine if the problem is with the relay or the cable. Also verify that the relay coil is energized with 240 vac when the unit is running. If not, rewire it.

Appendix 2. Heat Index

The basic formula we use to calculate heat index is a 16 element polynomial in temperature (T, deg-F), and relative humidity (H, 0-100),

$$\begin{aligned} HI = {} & 1.6923e{+}1 + 1.85212e{-}1 * T + 9.41695e{-}3 * T^2 \\ & - 3.8646e{-}5 * T^3 + 5.37941 * H + 7.28898e{-}3 * H^2 \\ & + 2.91583e{-}5 * H^3 - 1.00254e{-}1 * (T * H) \\ & + 3.45372e{-}4 * T^2 * H + 1.42721e{-}6 * T^3 * H \\ & - 8.14971e{-}4 * T * H^2 + 1.97483e{-}7 * T * H^3 \\ & + 1.02102e{-}5 * T^2 * H^2 - 2.18429e{-}8 * T^3 * H^2 \\ & + 8.43296e{-}10 * T^2 * H^3 - 4.81975e{-}11 * T^3 * H^3 \end{aligned}$$

This formula is not used for temperature below 70, and in this case we define heat index to be identical to temperature. To achieve a smooth transition, we use the following definition for temperature between 70 and 80,

$$\text{Heat index} = 0.1 * (T - 70) * HI + 0.1 * (80 - T) * T$$

For temperature above 80, the heat index is HI.

Appendix 3. Hourly Load Reduction Model Fits

The model specification for hourly load reduction is of the form

$$LR = a + b * MAX[(HI - HI_0), 0]$$

Coefficients a, b and the knot point HI_0 are model parameters to be determined through the model fit procedure. Data for average load reduction (LR) used in the model fit procedure was obtained from the RS group as described in section 2.3. The data for hourly heat index (HI) is a composite of heat index computed from hourly weather observations at the weather stations CVG, IND, SDF. Each RS group participant is associated with a weather station, as described in Section 4 (see also Appendix 4). The relative weighting of each weather station in the composite HI is determined on an hourly basis according to the counts of valid RS duty cycles in that hour associated with the three weather stations. Weather observations are collected near the end of an hour. Since we want HI in the above formula to be heat index at the beginning of the hour of the LR data, HI must correspond to the weather observations for the prior hour.

For impact evaluation during 2007 control periods, models are needed for hours 15-18 and shed percentages 74%, 54%, 31%, 67%, 50%, 22% (not all combinations are required). The general approach of the model fit procedure is to perform a sequence of regressions with the equation given above, resulting in values for parameters a and b, as the knot point HI_0 varies over a grid. The model with highest R-square is selected. Model parameters obtained with this procedure are given in the table below:

Load Reduction Model Parameters

Shed%	Hour	Knot	a	b	R-sq
74	15	85.9	0.831	0.490	0.711
74	16	87.2	0.958	0.509	0.685
74	17	85.2	0.960	0.487	0.637
74	18	85.2	1.015	0.507	0.609
54	15	85.9	0.441	0.356	0.714
54	16	87.2	0.525	0.387	0.713
54	17	85.2	0.525	0.382	0.655
54	18	85.2	0.564	0.397	0.607
31	15	86.3	0.183	0.184	0.667
31	16	87.2	0.215	0.198	0.673
31	17	85.2	0.209	0.214	0.644
31	18	87.3	0.269	0.227	0.567
67	15	85.9	0.676	0.451	0.712
67	16	87.2	0.791	0.475	0.700
67	17	85.2	0.794	0.456	0.647
50	15	86.0	0.385	0.326	0.712
50	16	87.2	0.456	0.354	0.710
50	17	85.2	0.456	0.354	0.656
22	15	86.0	0.110	0.122	0.626
22	16	87.2	0.136	0.134	0.665
22	17	85.2	0.127	0.149	0.638

Appendix 4. Indiana Weather Regions

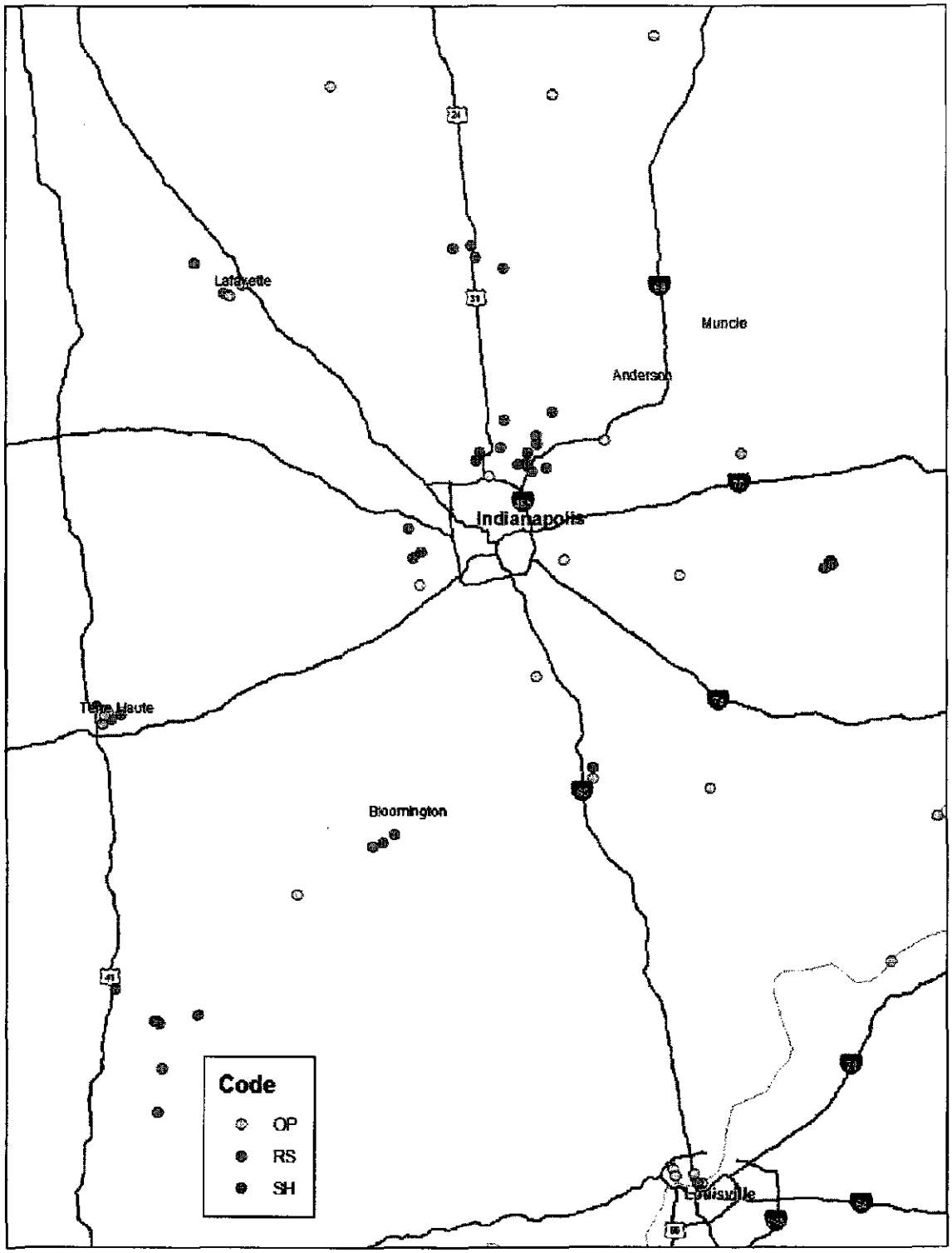
Indiana Zip Codes Assigned to Weather Region CVG:

47001	47023	47036
47003	47024	47037
47006	47025	47041
47010	47030	47042
47012	47031	47043
47016	47032	47060
47018	47034	47223
47022	47035	47250

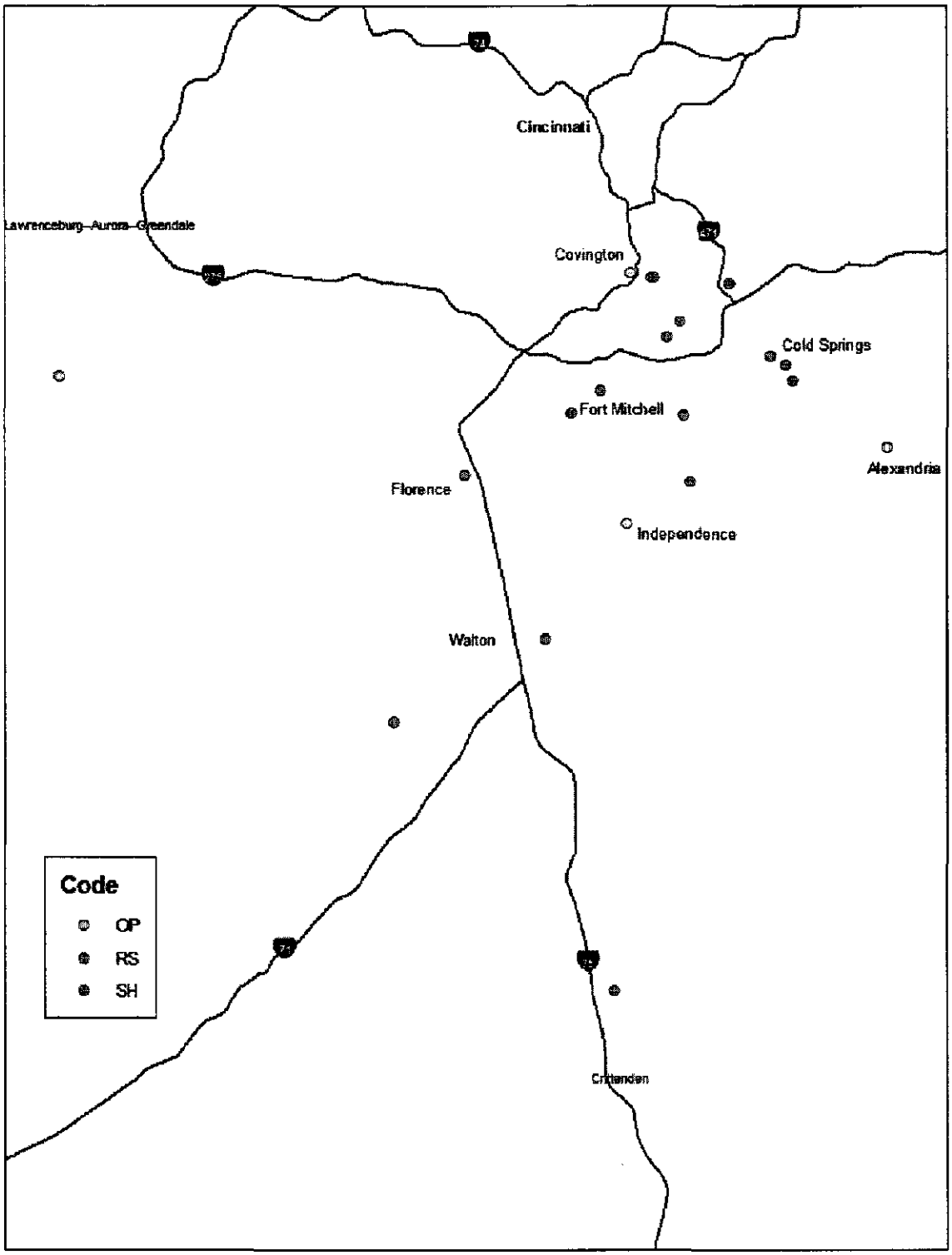
Indiana Zip Codes Assigned to Weather Regions SDF:

47102	47161	47524
47104	47162	47553
47106	47164	47557
47108	47165	47567
47111	47166	47581
47112	47167	47584
47114	47172	47591
47115	47220	47597
47118	47227	47612
47119	47229	47613
47120	47230	47616
47122	47231	47619
47123	47243	47633
47124	47260	47639
47125	47270	47640
47129	47281	47647
47130	47282	47649
47136	47432	47654
47137	47446	47660
47138	47452	47665
47140	47454	47666
47145	47469	47670
47147	47470	47683
47150		

Appendix 5. Indiana - Field Testing Locations



Appendix 6. Kentucky- Field Testing Locations



Appendix 7. Power Manger QC Field Test Check List

Date _____ **Address** _____
Time_____ **Temperature**_____

Switch ID_____

- Once at the house have Rose send the test to the plug in switch.
- Plug into the switch and read the register information:

Switch Data	
Option (Register 5)	
Opco (Register 1)	
Substation (Register 3)	
Feeder (Register 4)	
Group (Register 8)	

Activation Information	
Relay #1 Activation Counter	
Relay #1 Cumulative Shed	
Frequency	

General Inspection

- Verify that the switch is still connected to the air conditioner
  - Yes
  - No

- Check if the amber light is flashing on the switch
  - Yes
  - No

- Check the test on/ off light- (Green is on)
  - On
  - Off

- Verify the Paging signal 1.....2.....3

- Call Rose and have the switch put in the special test group

- Plug into the switch and read the register information

Switch Data	
Option (Register 5)	
Opco (Register 1)	
Substation (Register 3)	
Feeder (Register 4)	
Group (Register 8)	

- If the switch was verified in group _____ have Rose send a short event to the switch. Plug into the switch and read the register information

Switch Data	
Option (Register 5)	
Opco (Register 1)	
Substation (Register 3)	
Feeder (Register 4)	
Group (Register 8)	

Activation Information	
Relay #1 Activation Counter	
Relay #1 Cumulative Shed	
Frequency	

- If the switch responds to one or both of the tests above, move on to the next switch
- If the switch doesn't respond to the tests, open and close the disconnect and retry both tests.

Disconnect opened and closed:

- Call Rose and have the switch put in the special test group
- Plug into the switch and read the register information

Switch Data	
Option (Register 5)	
Opco (Register 1)	
Substation (Register 3)	
Feeder (Register 4)	
Group (Register 8)	

- If the switch was verified in group _____ have Rose send a short event to the switch. Plug into the switch and read the register information

Switch Data	
Option (Register 5)	
Opco (Register 1)	
Substation (Register 3)	
Feeder (Register 4)	
Group (Register 8)	

Activation Information	
Relay #1 Activation Counter	
Relay #1 Cumulative Shed	
Frequency	

Appendix 8: Power Manger Customer and Impact Evaluation Study 2006

Power Manager Customer and Impact Evaluation Study

Duke Energy Indiana
Duke Energy Kentucky

2006 Event Year

Impact Modeling/ Metering
conducted by Duke Energy staff/ contractors

Customer Evaluation
conducted by Integral Analytics

Report Compilation and Review
conducted by Integral Analytics

Quick Summary

Duke Energy currently offers a residential load control program called Power Manager to qualifying residential customers. This program offers customers a monetary incentive for reducing their air conditioning during peak demand periods. Duke is evaluating the current program to find ways to increase participation, insure customer satisfaction and improve the impact of the program. Several different methods of analysis were used to evaluate the program. A mail satisfaction survey was conducted with current participants. A conjoint study was conducted with participants as well as non-participants to discover what attracts customers to sign up for the program. Finally, a load research impact evaluation was completed using data loggers, end use metering and whole house metering equipment.

The Power Manager satisfaction survey revealed that the participant's satisfaction with the phone representative that handled their call was the most important indicator of overall satisfaction of the Power Manager program. The survey also revealed that the level of the participant's comfort during a control event was the second most important factor of participant's satisfaction. This important finding suggests that Duke needs to pay just as much attention to the process and operational aspects of participant sign up as it does on the program design and/or financial incentives.

Further, It was discovered through the conjoint analysis that the current program incentive offering of $25 and $35 was the most attractive incentive to customers to participate in the program. Alternatives like free thermostats held less appeal. It was also uncovered that a per event incentive is the most important feature to customers when they are considering signing up for the program. Presumably, this event savings is attractive in that it is shared with customers, and it increases as the level of potential interruptions increases.

Finally, It was discovered through the impact evaluation of the program that load impact estimates of the load control events done during the summer were substantially below the targeted load reduction. However, the report details possible reasons for the low impacts, cites a plan to diagnose the source of the problem, and fix it. At present, it is believed that the most likely reason for the low impacts is due to operational problems experienced with the signaling software tested among just the metered homes, and perhaps did not occur to the same extent, or perhaps not at all, among the population participants at large.

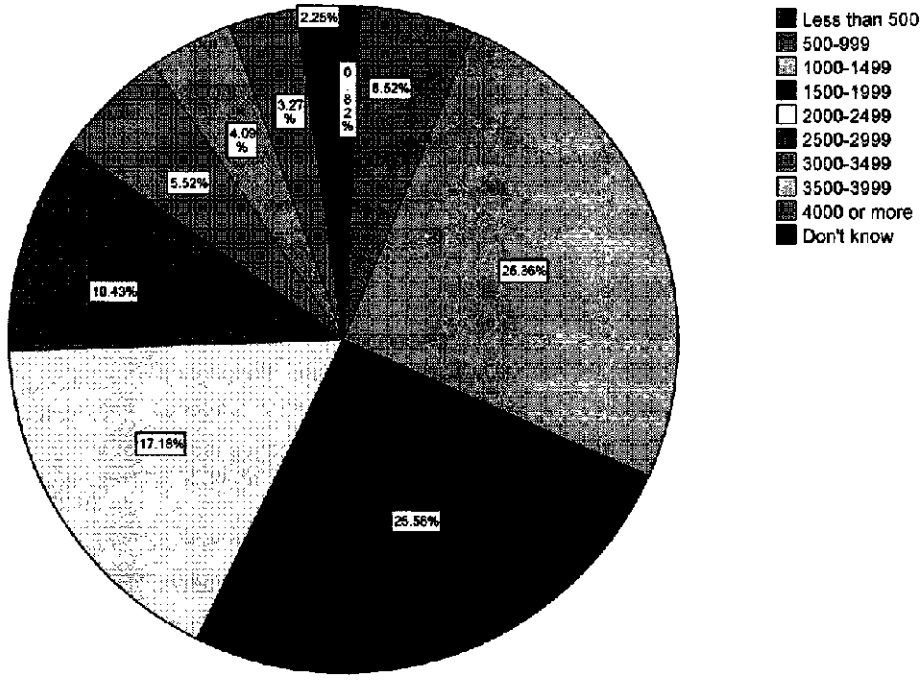
Although, the load impact estimates were substantially below the targeted load reduction expected, the program still passed cost-effectiveness tests. The Utility Cost Test result was 2.38.

Power Manager Satisfaction Survey

A Power Manager Satisfaction study was conducted in September 2006. A survey was sent to a random sample of 3,000 current Power Manager customers, 2,000 Indiana and 1,000 Kentucky. Of the 3,000 surveys that were sent out 1,392 customers responded for a 46% response rate. The intent of the study was to discover ways to increase the number of customers signing up for the program as well as to increase the satisfaction of the customers currently on the program.

Power Manager Participants Square Footage

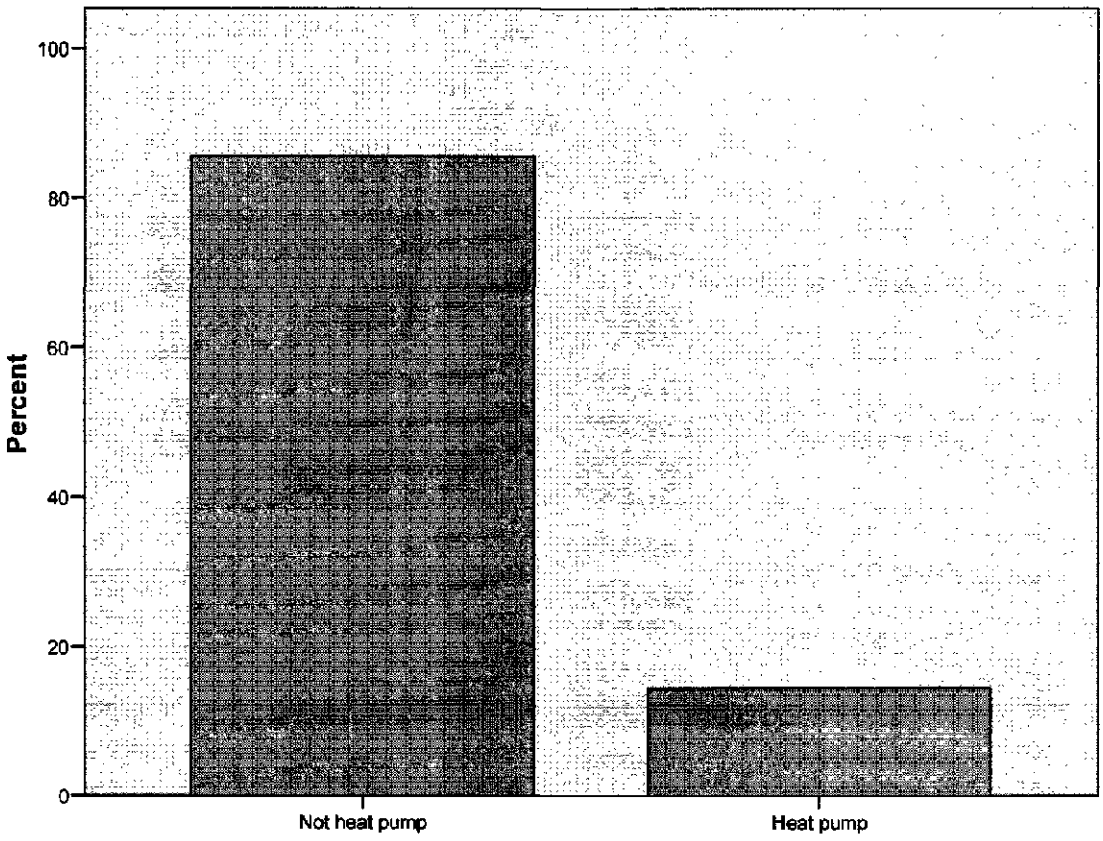
More than 50% of respondents live in a house between 1,000 and 2,000 square feet. Less than 1% lives in home smaller than 500 square feet. About one quarter of the population lives in homes between 2,000 and 2,999 square feet.



About how many square feet of living space are in your home?

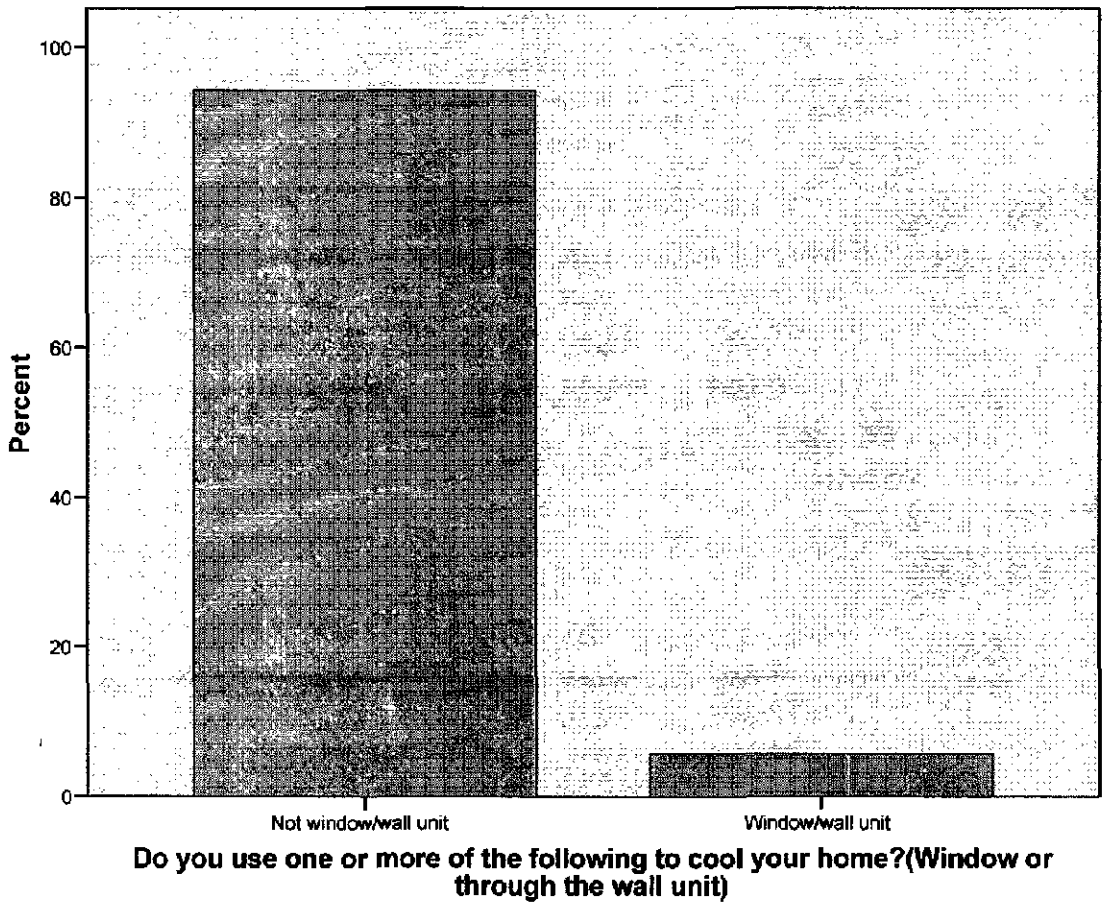
Heat Pump Participants vs. Central Air Participants

The primary source of cooling among participants currently is central air systems. Only 14.4% of the respondents use heat pumps for cooling their homes.



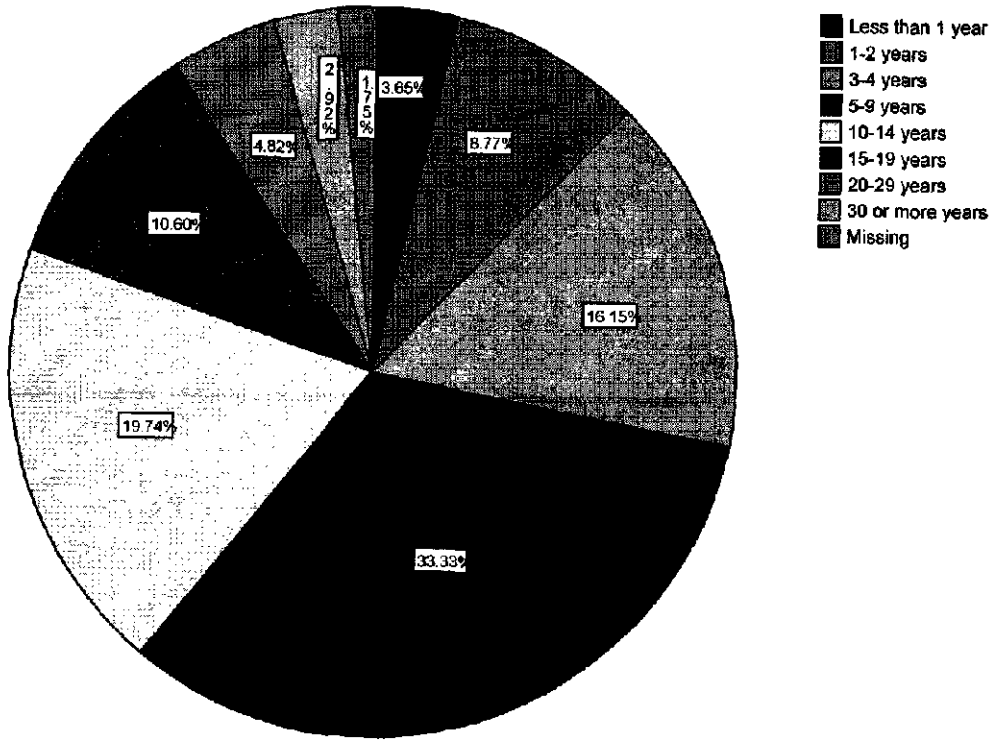
Window Unit Participants vs. Other Cooling System Participants

Although window unit cooling systems are not usually as efficient 5.7% of participants use window/wall units (sometimes in conjunction with AC). This group would make a good candidate for participation in the program due to high usage during peak hours.



Age of Cooling System

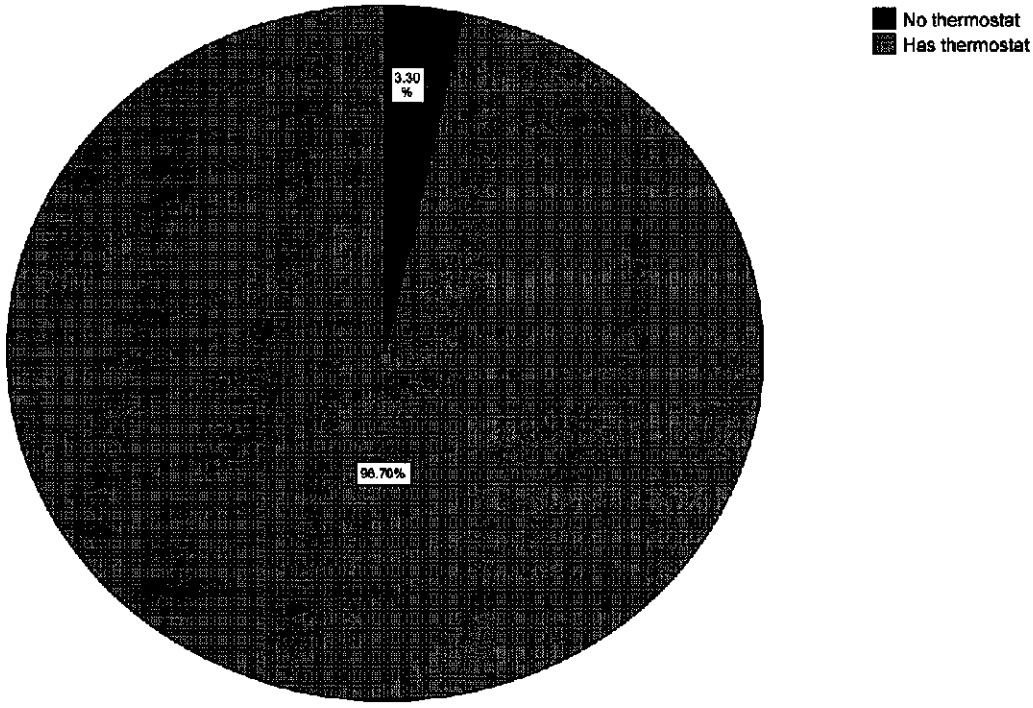
More than half of the sample population has cooling systems that have been installed between 5 and 14 years ago. One third of the cooling systems were about 5 to 9 years old. 18.34% of participants had cooling systems that were 10-30 years old or more. Only about 12.42% are using newer high efficient cooling systems that have been installed during the past two years. It is suggested to try and not target customers with high efficient cooling systems.



How old is your cooling system?

Thermostat Participants vs. No Thermostat Participants

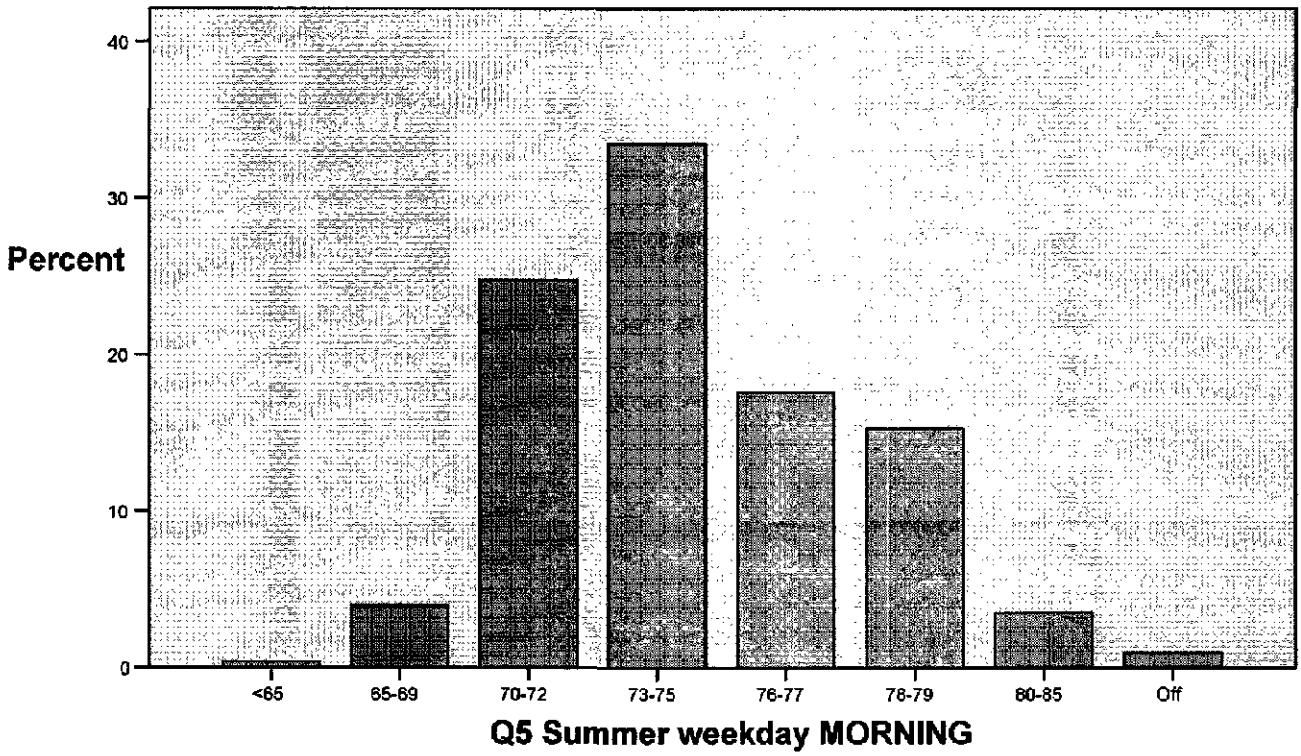
Only about 3.3% of participants have no thermostat. Not having a thermostat is a good indication of an older cooling system. Older systems with no thermostat are less efficient.



Do not have a thermostat

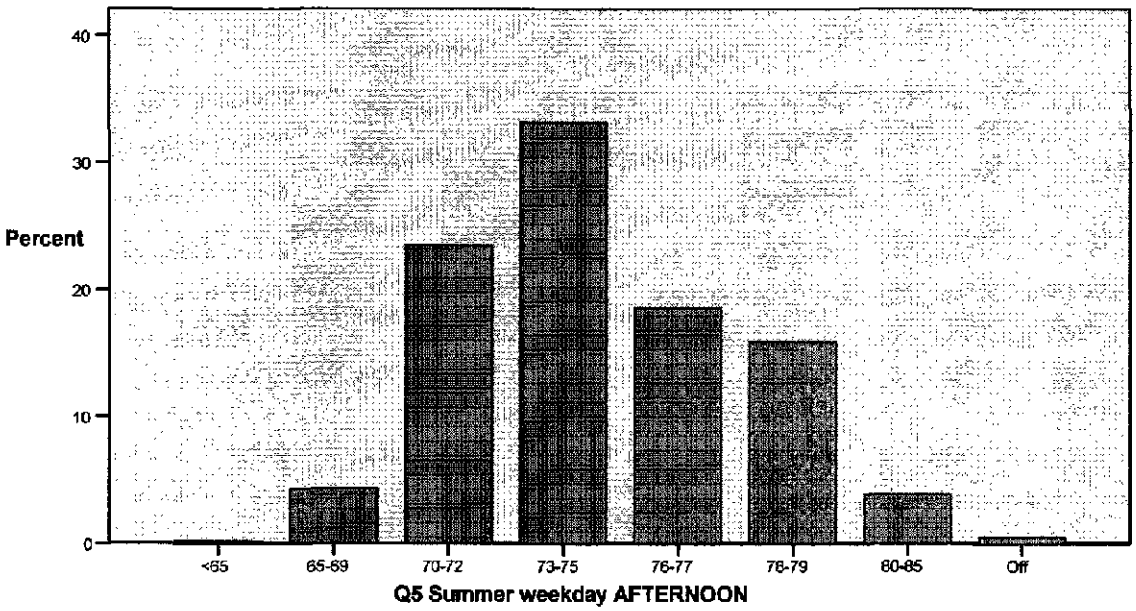
Temperature of Thermostat Summer Weekday Morning

About one third of respondents set their thermostat between 73 to 75 degrees in summer weekday mornings. 37.1% of customers set their thermostat above 76 degrees with .9% of which turn it off during summer morning weekdays.



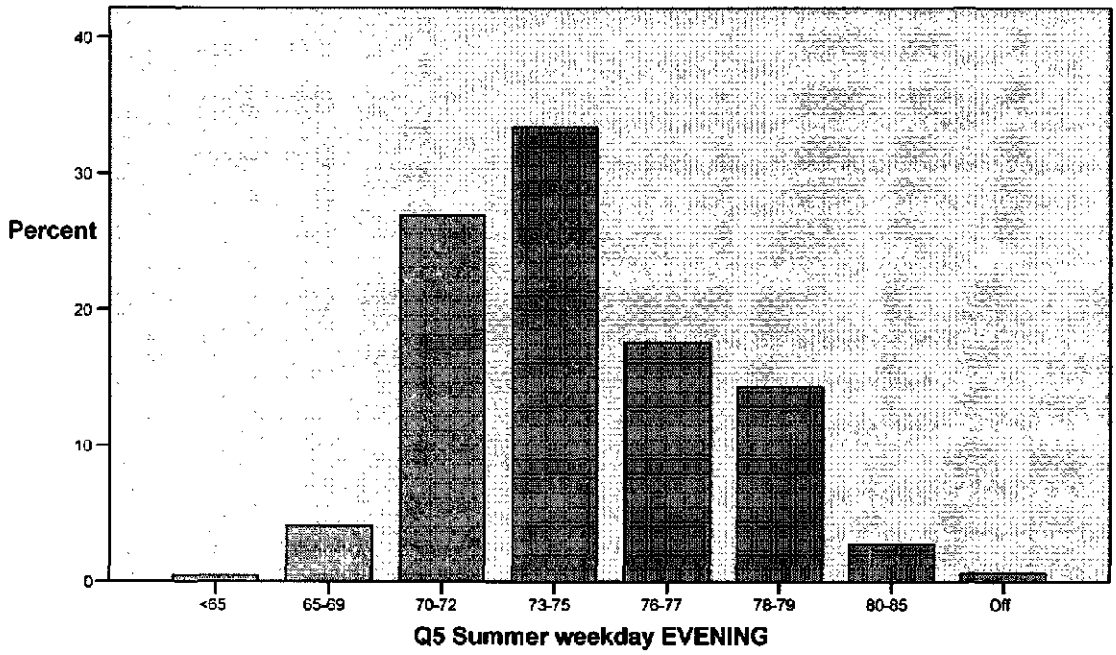
Temperature of Thermostat Summer Weekday Afternoon

About one third of respondents set their thermostat between 73 to 75 degrees.
38.9% of customers set their thermostat above 76 degrees with .5% of which turn it off during summer afternoon weekdays.



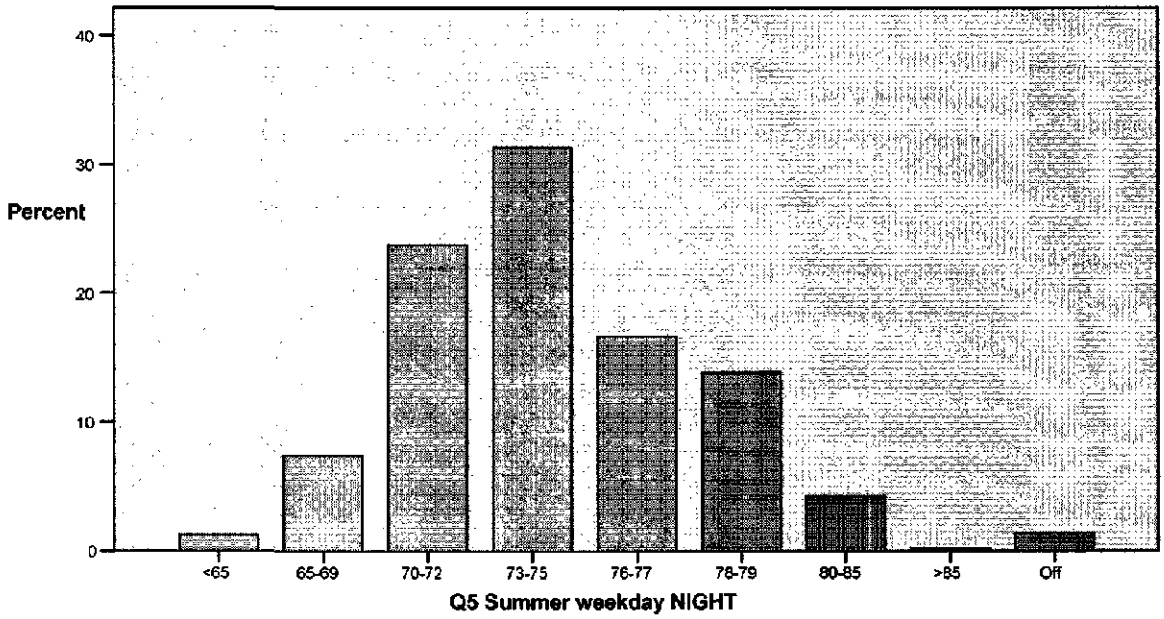
Temperature of Thermostat Summer Weekday Evening

About one third of respondents set their thermostat between 73 to 75 degrees. 35.1% of customers set their thermostat above 76 degrees with .6% of which turn it off during summer evening weekdays.



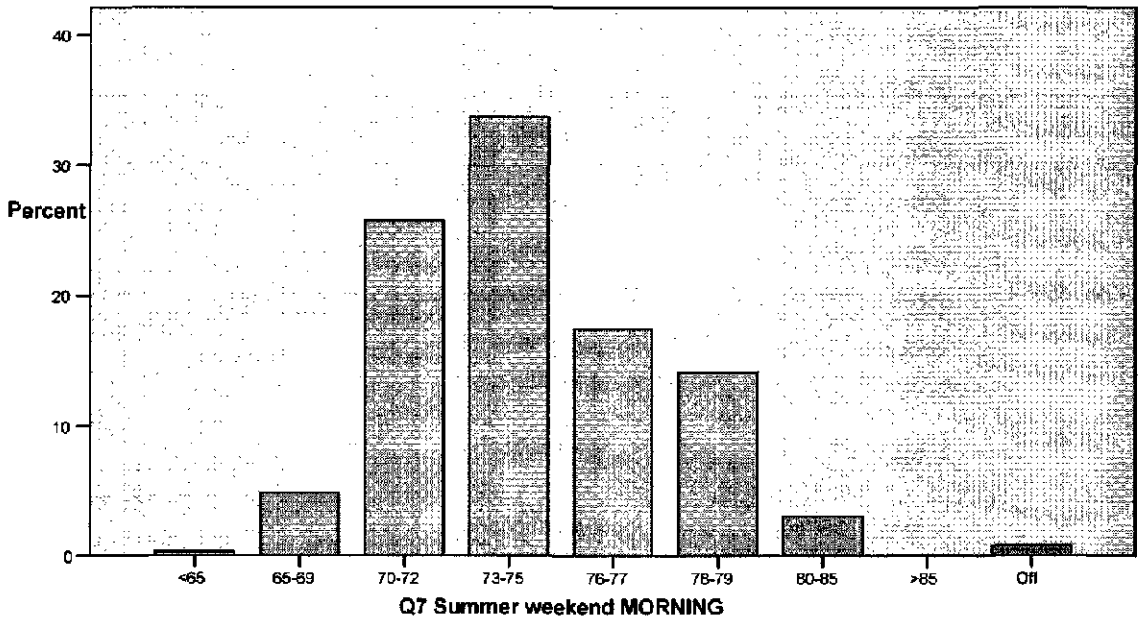
Temperature of Thermostat Summer Weekday Night

Less than one third (31.3%) of respondents set their thermostat between 73 to 75 degrees. 36.4% of customers set their thermostat above 76 degrees with 1.4% of which turn it off during summer night weekdays.



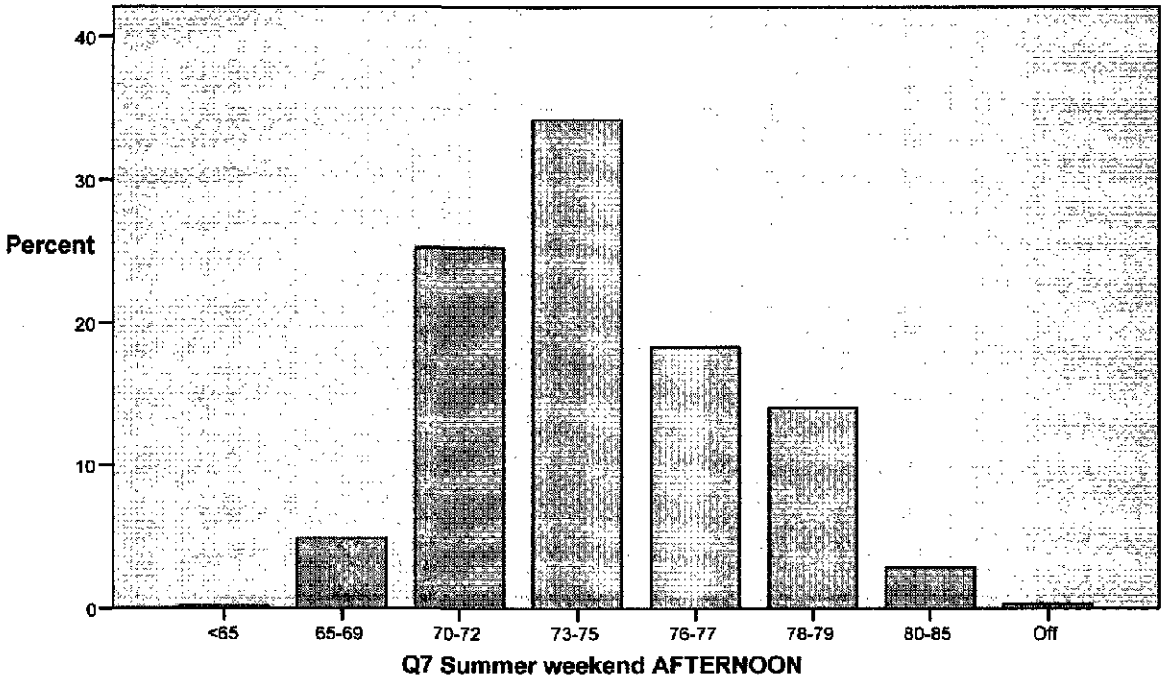
Temperature of Thermostat Summer Weekend Morning

About one third of respondents set their thermostat between 73 to 75 degrees.
35.5% of customers set their thermostat above 76 degrees with .9% of which either set it on higher than 85 degrees or turn it off during summer weekend mornings.



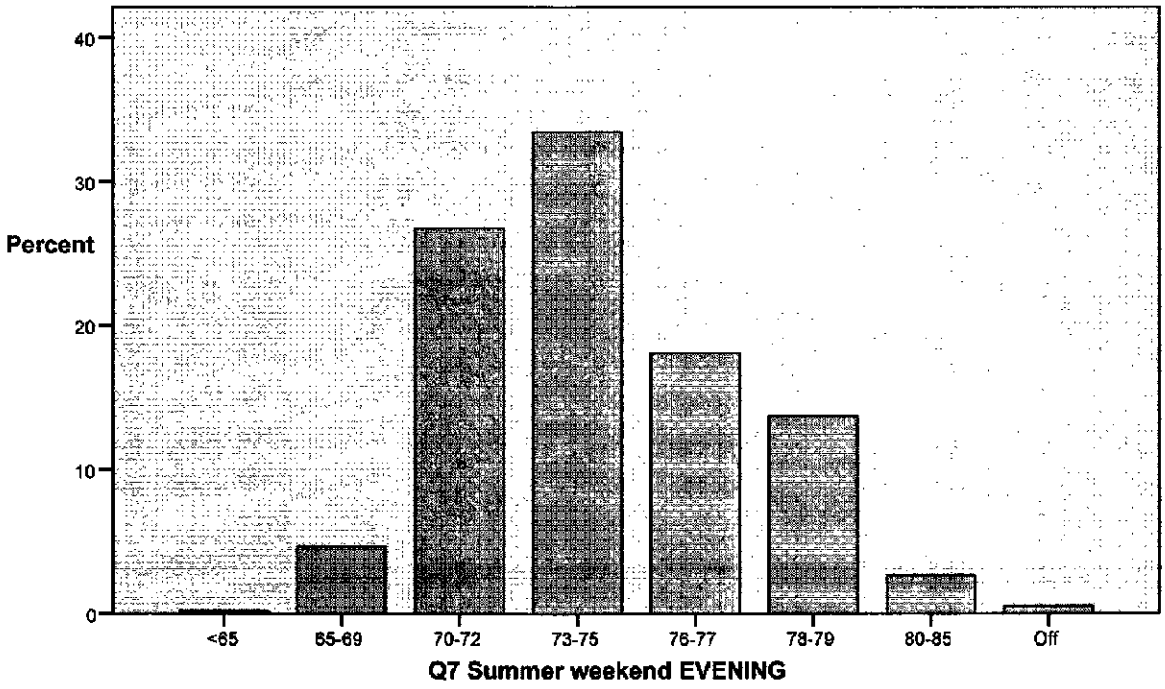
Temperature of Thermostat Summer Weekend Afternoon

More than one third of respondents set their thermostat between 73 to 75 degrees. 35.5% of customers set their thermostat above 76 degrees with .3% of which turn it off during summer weekend afternoons.



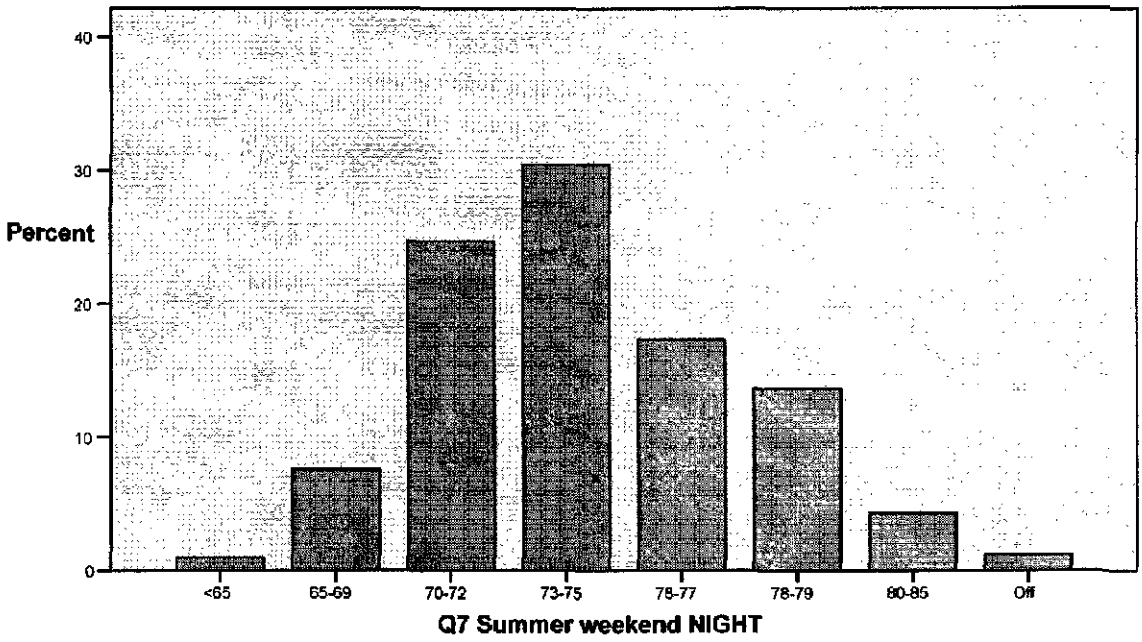
Temperature of Thermostat Summer Weekend Evening

About one third of respondents set their thermostat between 73 to 75 degrees.
35% of customers set their thermostat above 76 degrees with .5% of which turn it off during summer weekend evenings.



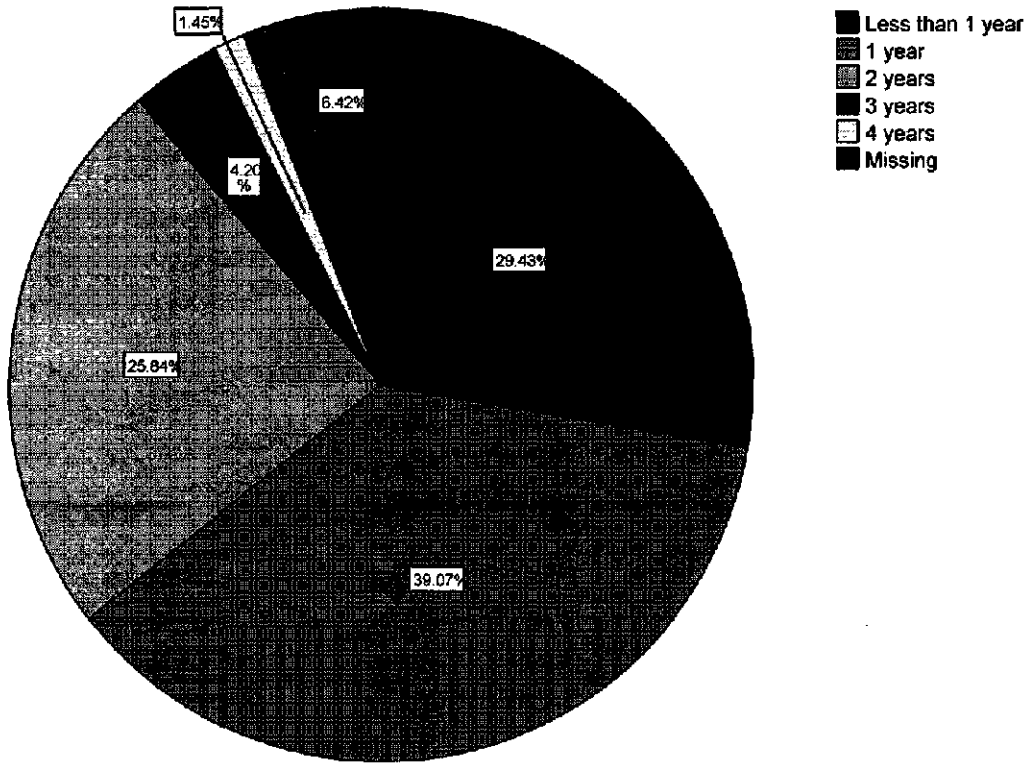
Temperature of Thermostat Summer Weekend Night

Less than one third of respondents set their thermostat between 73 to 75 degrees. 36.4% of customers set their thermostat above 76 degrees with 1.2% of which turn it off during summer weekend nights. It is recommended to target customers with thermostats set in cooler degrees during peak hours of weekdays.



Length of Participation in Power Manager Program

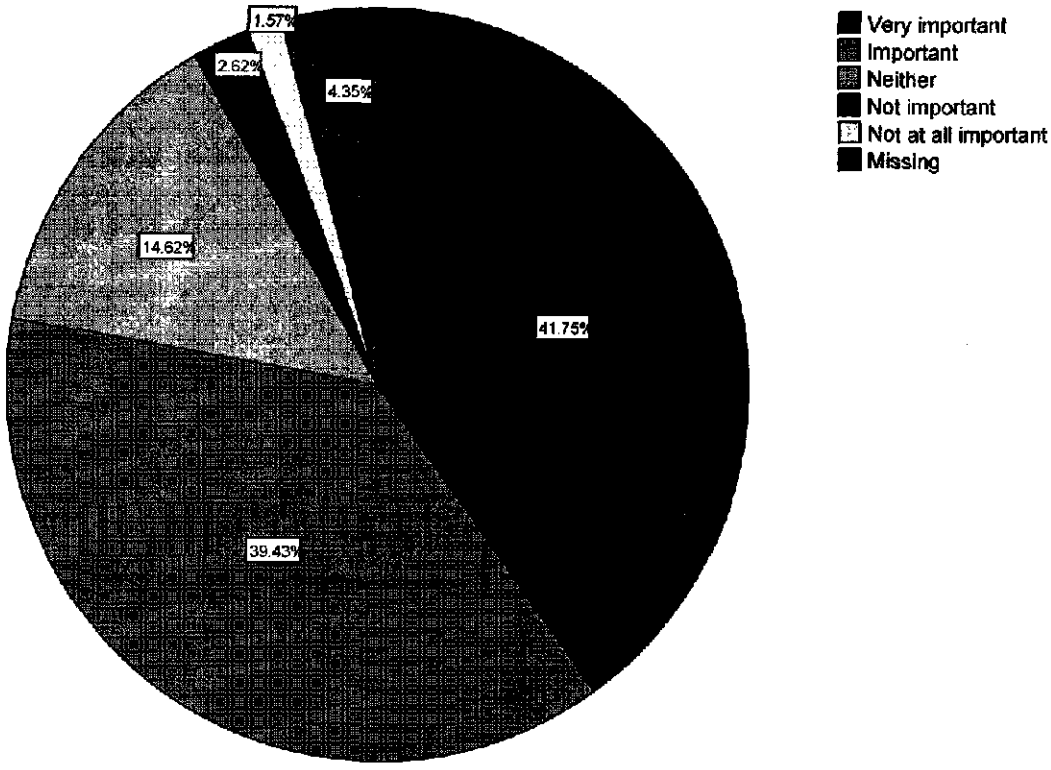
Less than one third of the customers have been participating in the program for less than 1 year, while 39.07% have been in the program for one year. One fourth of participants have been with the program for two years and less than 6% have been with the program for three to four years. It might be a good idea to send an appreciation note to customers who are in their first or second year of participation.



How long have you participated in the Power Manager Program?

Importance of Monetary Incentive

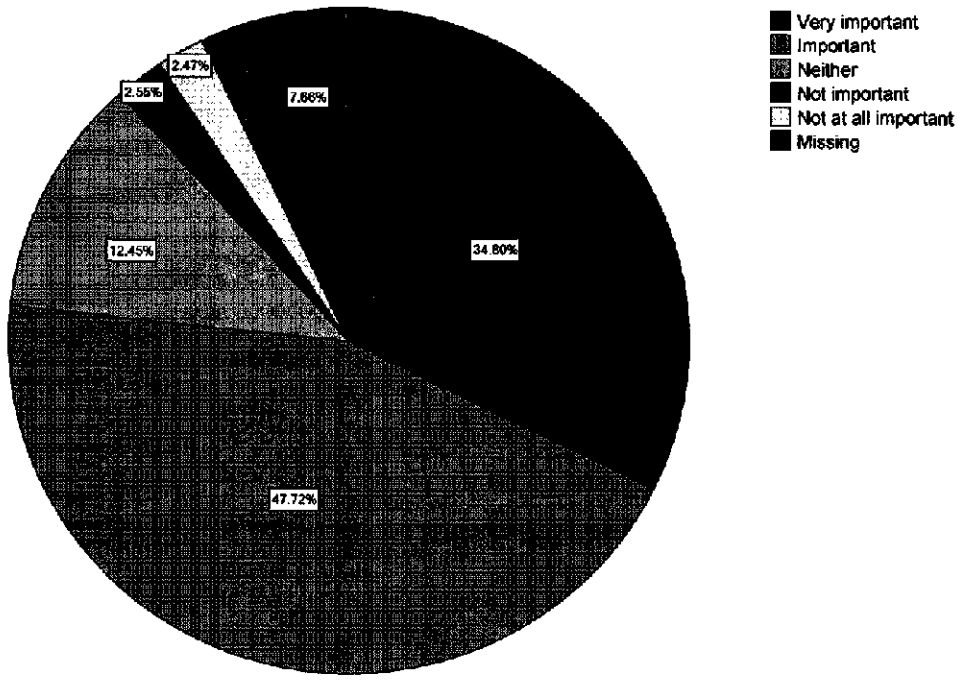
Money is a significant factor for more than 80% of participants while only less then 4% of participants claim that money is not an important factor for them. Depending on budget limitations, increasing monetary rewards would satisfy most participants.



Q10 Factors - MONEY

Importance of Environment

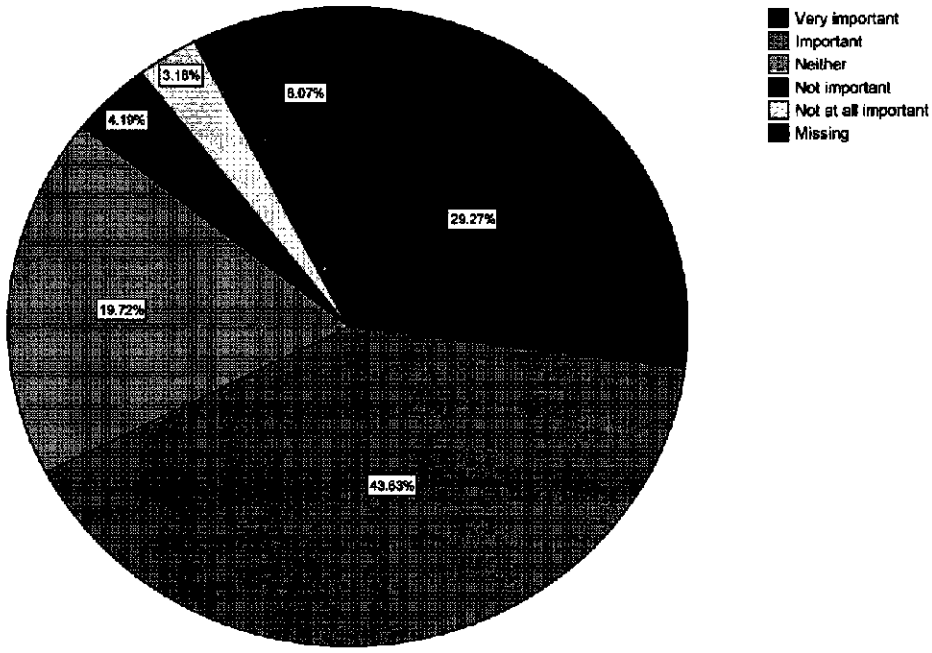
More than 82% of participants consider environment as an important or very important factor while only about 5% claimed that environment is not an important factor for them. Improving the environment is as strong of a factor as monetary rewards. It is recommended to send participants information on the impact their participation in the program is making on the environment.



Q10 Factors - ENVIROMENT

Importance of Not Building Power Plants

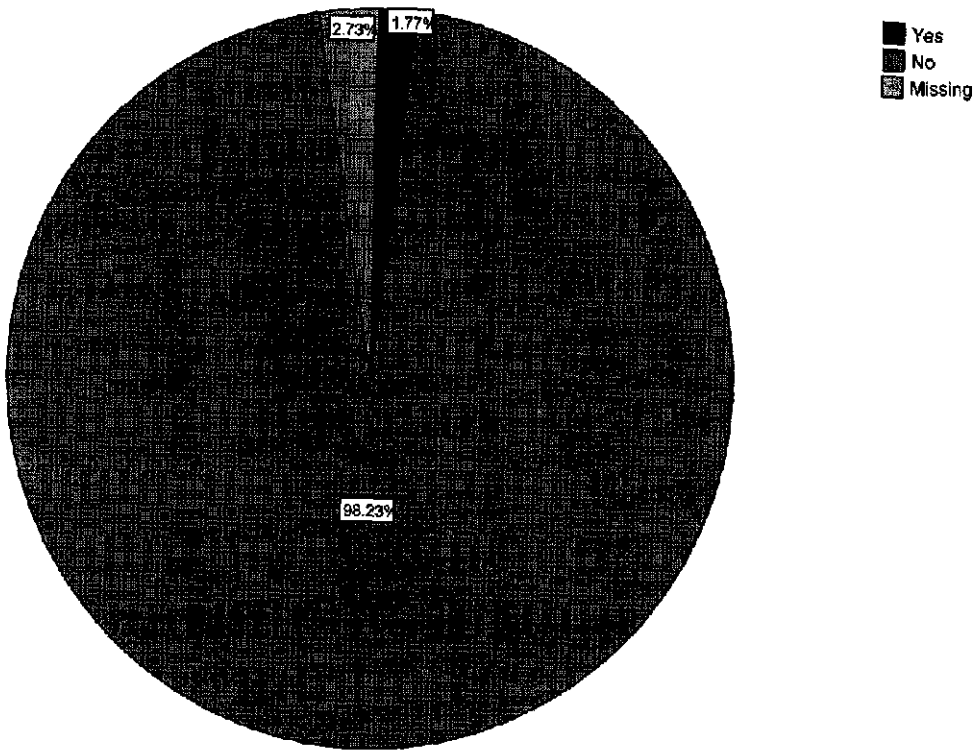
For almost two third or 67.5% of participants "Not Building a Power Plant" is either important or very important. About 20% of participants are indifferent. While only 7.37% of participants believe that "Not Building a Power Plant" is not important. It could be beneficial to send participants information on the impact that their participation in the program has on plans to build additional power plants since for the majority of participants not building a Power Plant is an important factor.



Q10 Factors - NOT BUILD POWER PLANTS

Option to Opt out of Control Event

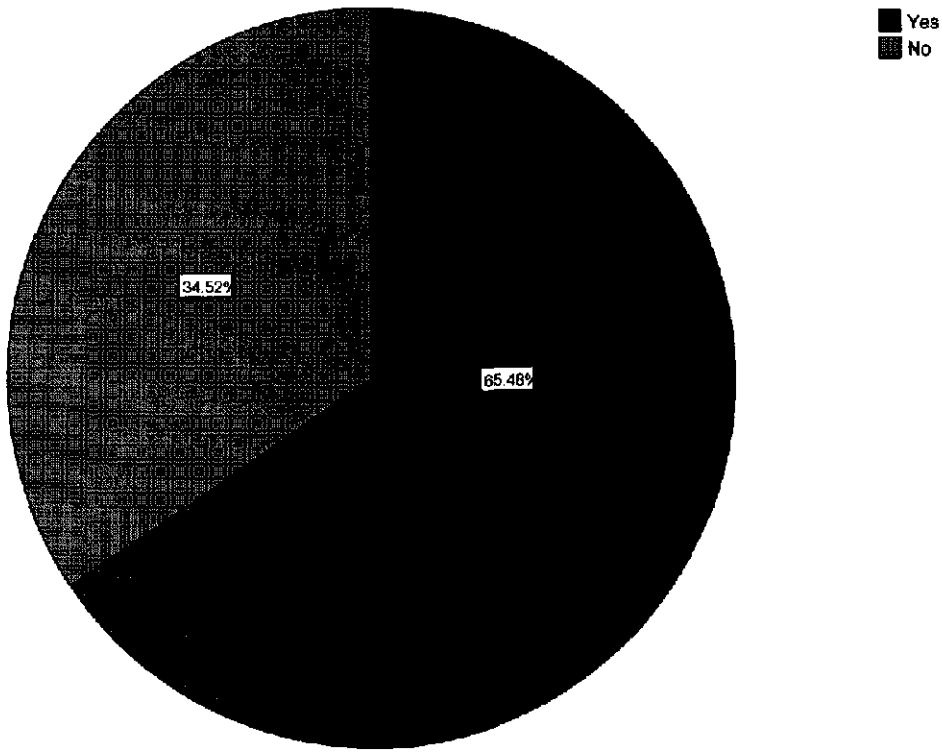
Only about 1.77% of participants would choose to opt out of one of the control events.



Did you ever choose to opt out of one of the control events?

Participants that were Home during Control Events

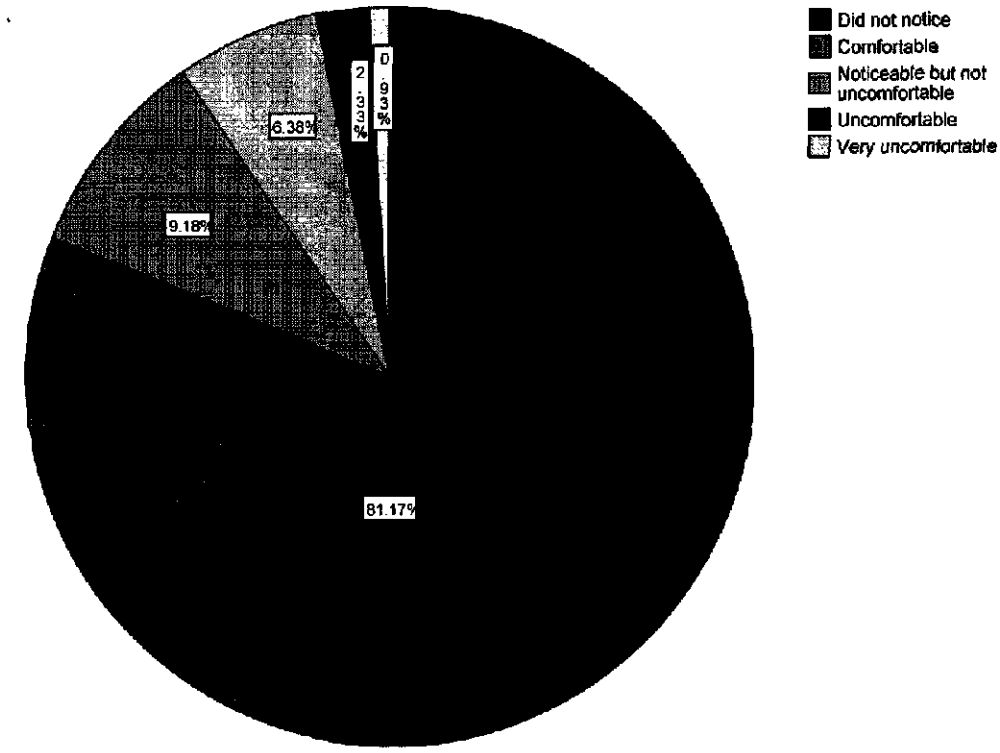
About two third of participants were home during the control events. 30.22% of participants did not answer this question suggesting that they might not have noticed when the control event happened, indicating they did not experience any discomfort.



Were you usually home during control events that occurred?

How Comfort Level was Affected during Control Event

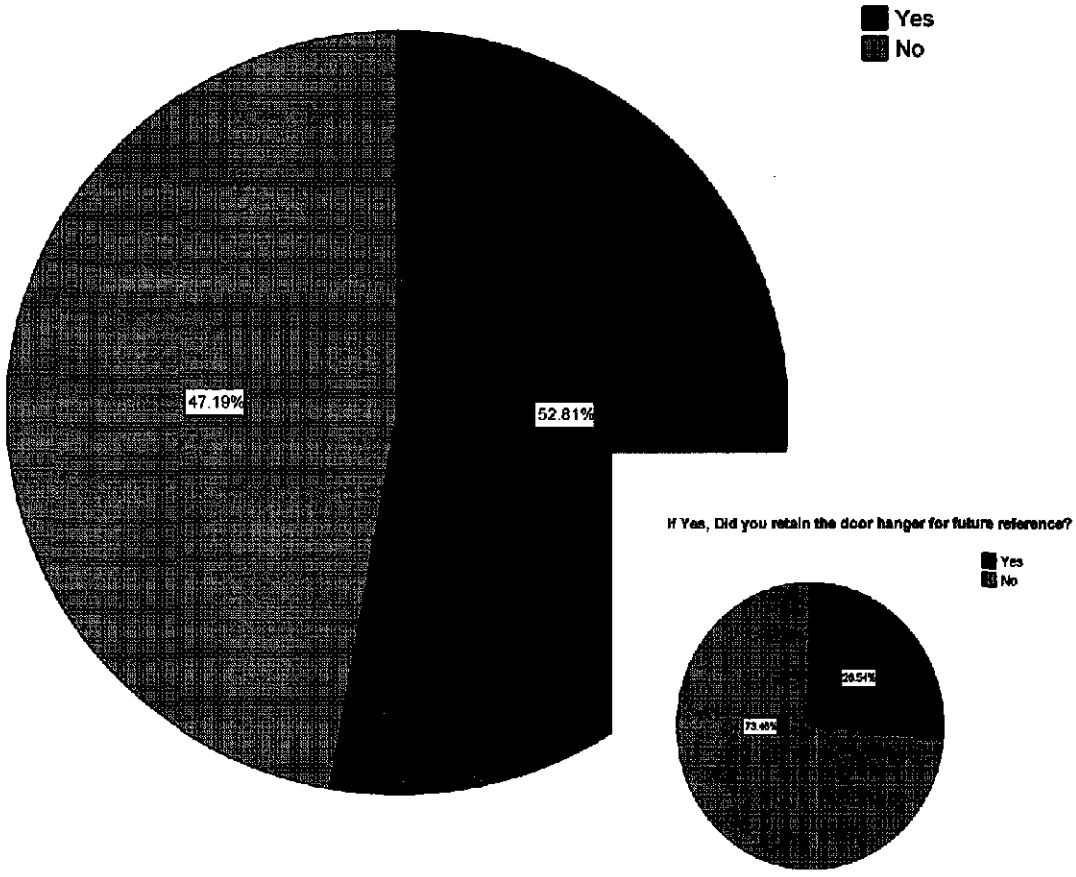
More than 90% of participants either did not notice or were comfortable during the control event.
Only less than 1% of participants were very uncomfortable while 3.2% were either uncomfortable or very uncomfortable. It could be recommended to give the people who are uncomfortable the option to receive a notice a day in advance about the control event occurring and give them the option to opt out.



How much did the control event affect your comfort level?

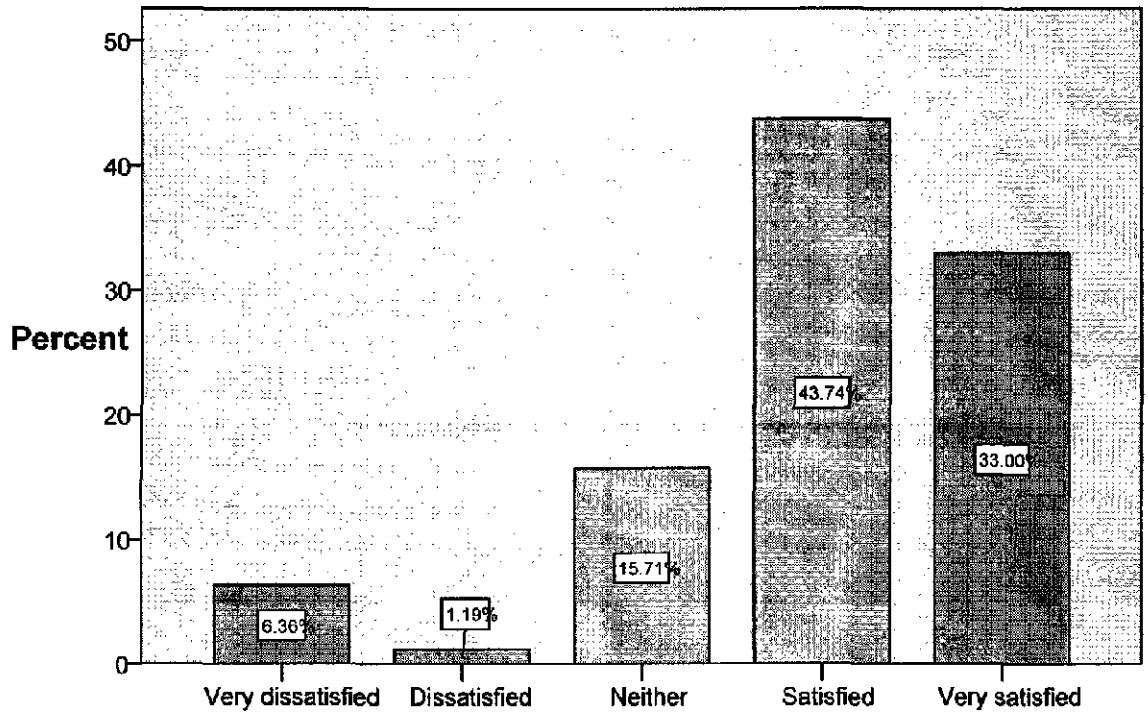
Retention of Informational Door Hanger

More than half of the participants received a door hanger with the power manager 1-800 number on it, more than one fourth of which kept it.



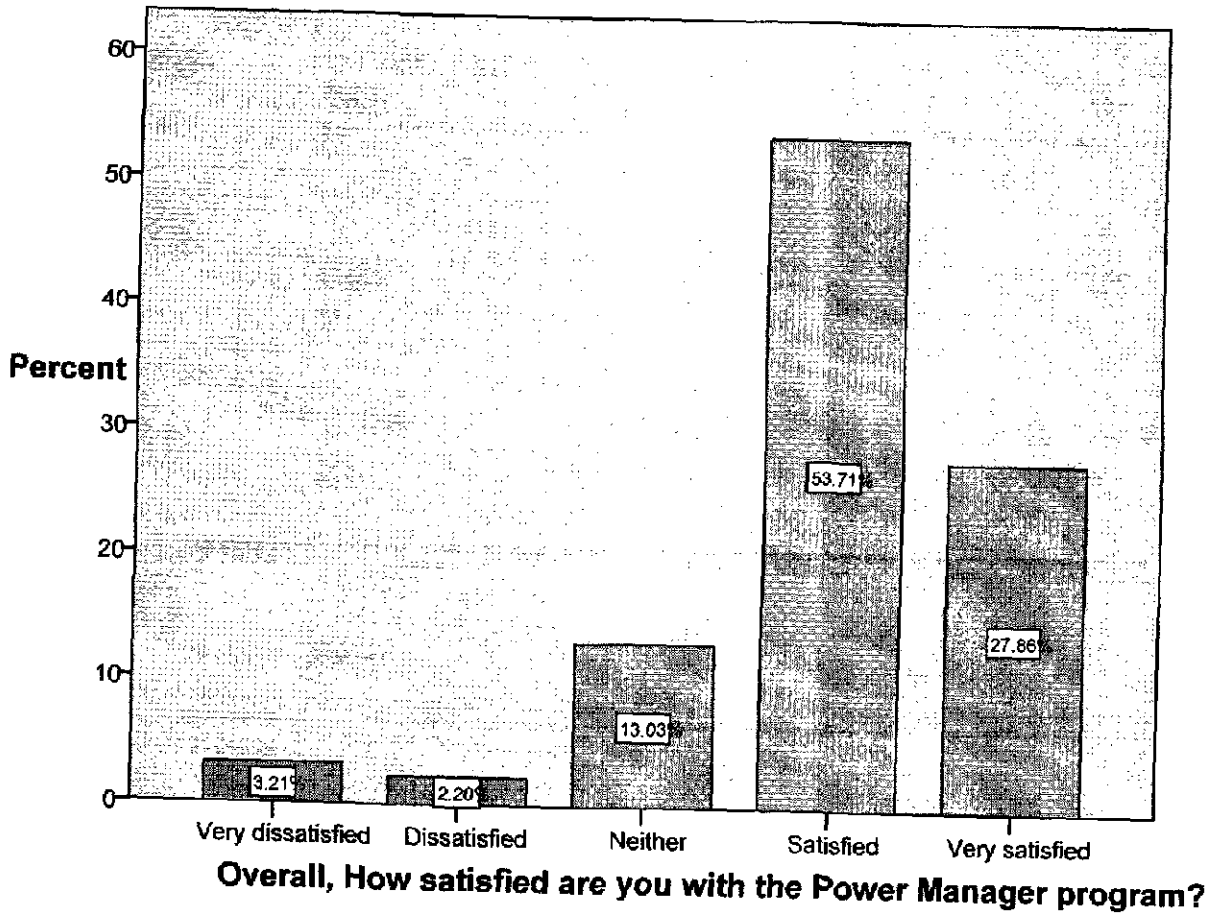
Satisfaction with Power Manager Phone Representative

76.74% of participants were either satisfied or very satisfied with the Power Manager phone representative whereas 7.55% were dissatisfied or very dissatisfied with phone representatives. More research could be done to uncover what made them unsatisfied with the phone representative. Based on the research the phone representative could than be trained better in those areas.



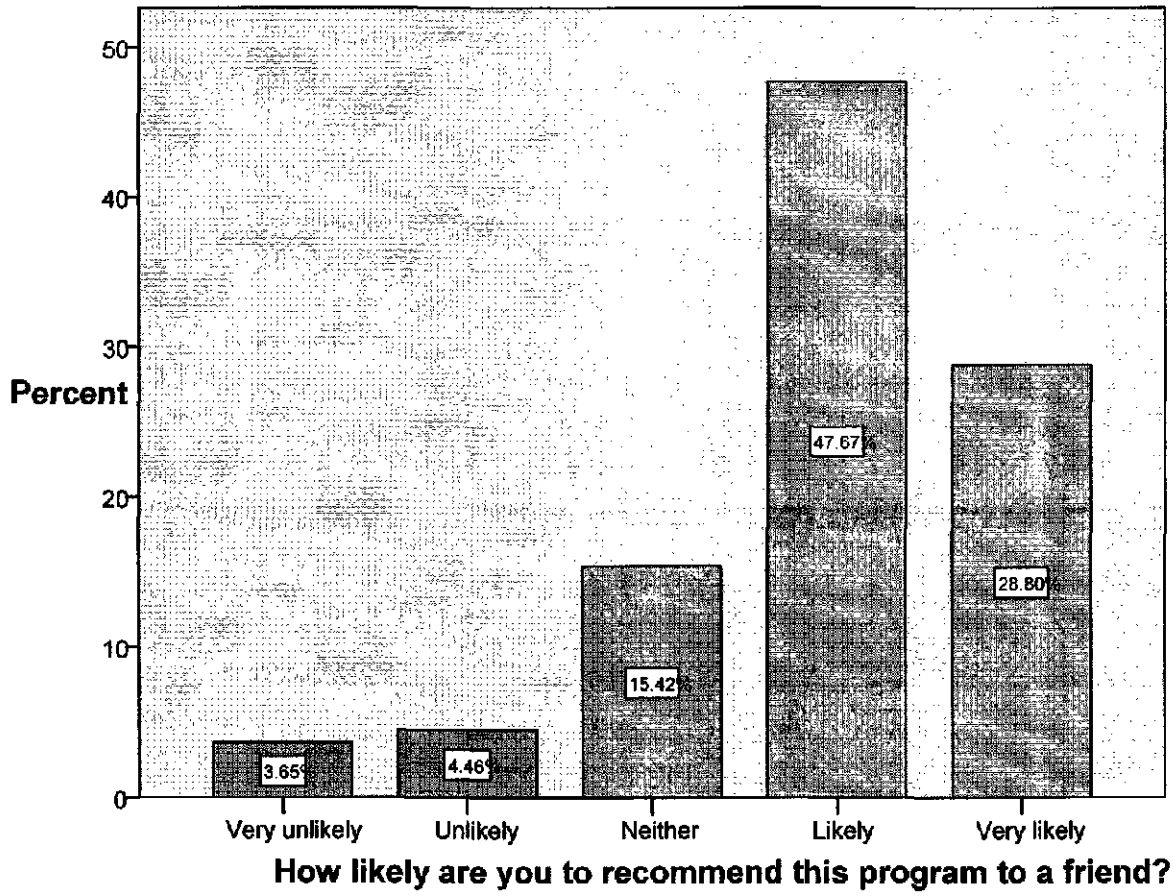
Overall Satisfaction with Power Manager Program

81.57% of participants were either satisfied or very satisfied with the Power Manager program whereas only 5.41% were dissatisfied or very dissatisfied.



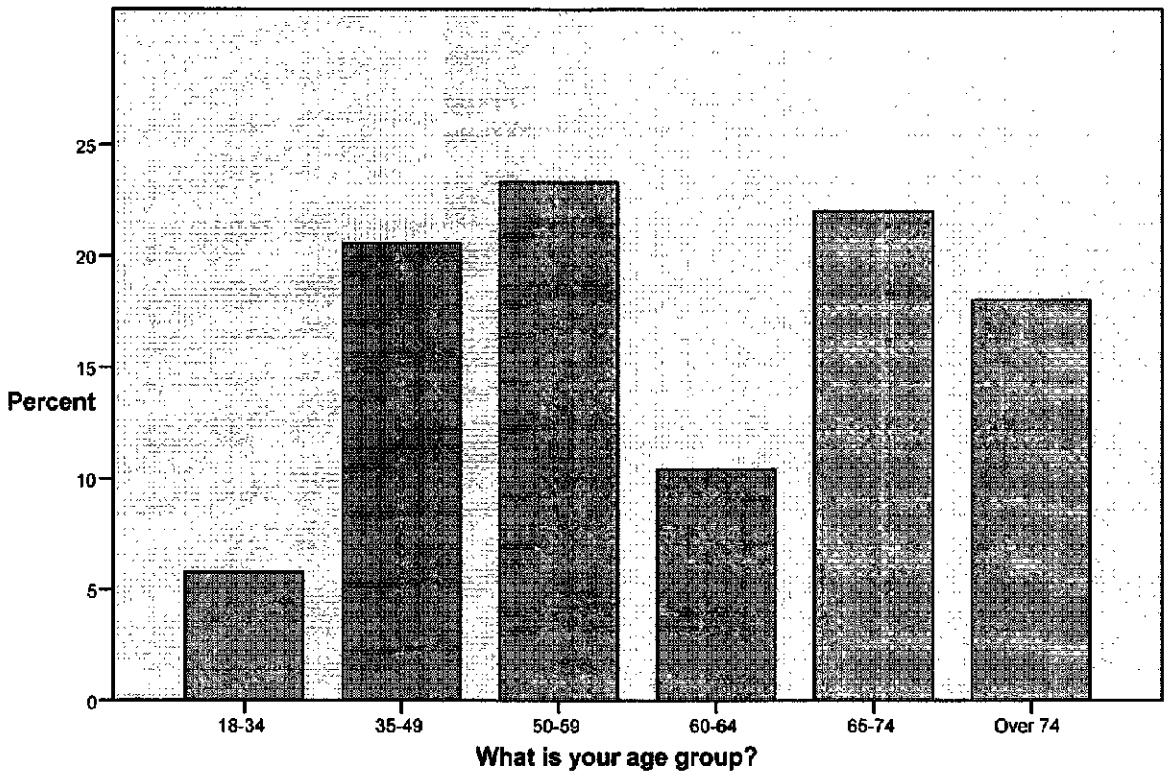
Likelihood to recommend Power Manager to a Friend

76.47% of participants are either likely or very likely to recommend this program to a friend whereas 8.11% of them are unlikely or very unlikely to do so. To increase the word of mouth about the program, a monetary reward to get a friend to sign up could be implemented.



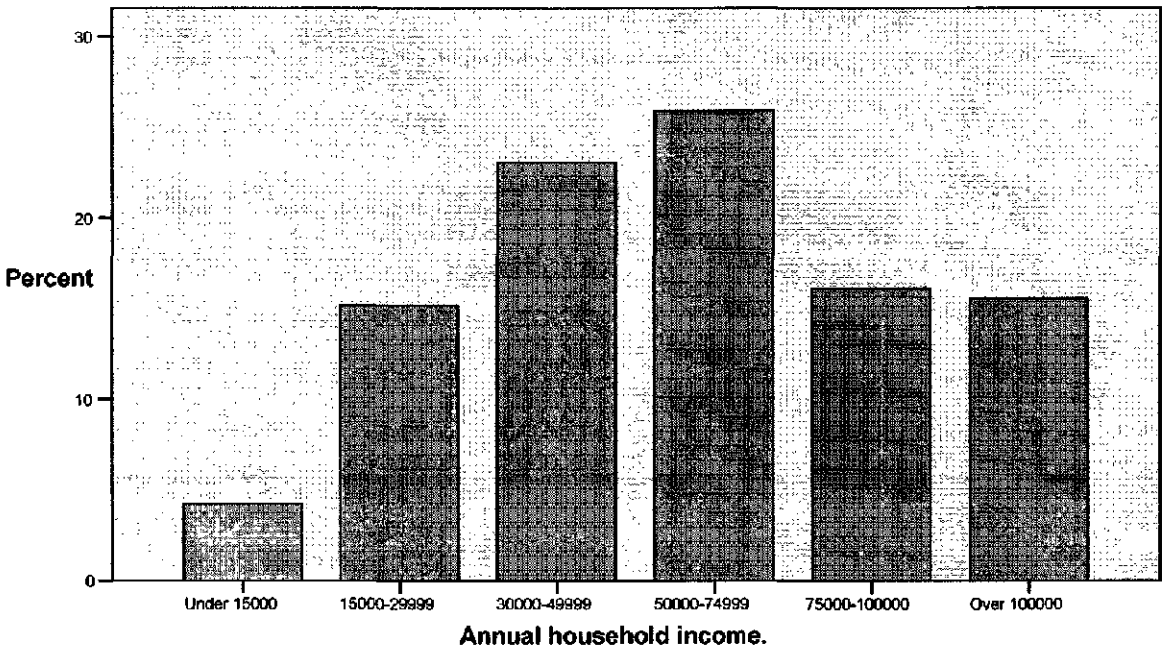
Age of Participants

More than half of the participants (53.8%) are between 35 and 59 years of age while 40% of them are 65 and over.



Annual Income of Participants

About 49% of the participants had annual income of 30,000 to 74,999. While 19.4% of people had annual income of less than 30,000, over 31% of participants have an annual income of 75,000 or more.



Drivers of the Power Manager Program Participant's Satisfaction

A regression analysis was done to discover which variables are the most important attributes at contributing to satisfaction of the Power Manager program. The following is the results of the analysis.

Participant's satisfaction of how the power manager phone representative handled their questions is the most important indicator of overall satisfaction of the power manager program. This may suggest:

- Special attention to training phone representatives is viable.
- Constant tracking of the performance of phone representatives is important.
- Placing courtesy thank you calls after control events may sustain/increase satisfaction.

To what extent participants become uncomfortable during control events is the second most important indicator of participant's satisfaction. The more uncomfortable they become the greater the dissatisfaction. Recommendations are:

- Targeting younger customers may increase participation as they are less sensitive to change in temperature during control events.
- Targeting customers who are not at home during control events is recommended.

Helping the environment is an important factor in satisfying participants. Recommendations are:

- Emphasizing on environmental outcomes in marketing campaign is an effective tool in obtaining customers in the program.
- Reminding participants of the environmental benefits when they call the 800 number.

There is a relationship between temperature settings and summer weekend nights. This indicates that participants who have the habit of setting their thermostat on higher degrees during the summer are generally more satisfied with the program since they have a higher tolerance for heat. This may suggest:

- Targeting customers with such habits as turning their thermostat up in the summer.

Target Marketing Recommendations

A correlation analysis was performed on the most important Power Manager attributes from the regression analysis to discover how those attributes related to each other. Using focused cluster and regression analysis makes it possible to have a better understanding of causes of satisfaction and dissatisfaction of participants and will provide more effective ways to promote and keep these participants.

Details regarding the correlation analysis can be found in Appendix A.

Grouping the participants based on income and age provides very accurate results for deciding which groups to target for future marketing in the program.

Participants with lower income are more likely to witness the control event and call the 1-800 number and in general feel more uncomfortable during the event. On the other hand the very wealthy people are more likely to have newer and more efficient cooling system and are less likely to have heat pumps in their homes. In general, the wealthy people are less concerned about the Power Manager Program. So we could conclude that the very low income and very high income households would not make a good candidate for the program while the middle income households (income between 30,000 and 100,000) would be the best candidates.

Older people are more likely to own older cooling systems as well as using window unit as cooling systems. Older people are also more likely to have less income and to keep the informational door hanger. They are also less likely to call the 1-800 numbers and they tend to stay in the program longer. Despite the fact that in general participants who were home during control events experienced more discomfort and would leave the program, the older group of participants tend to stay longer in the program even though they were more likely to be home more often during control events than the younger participants.

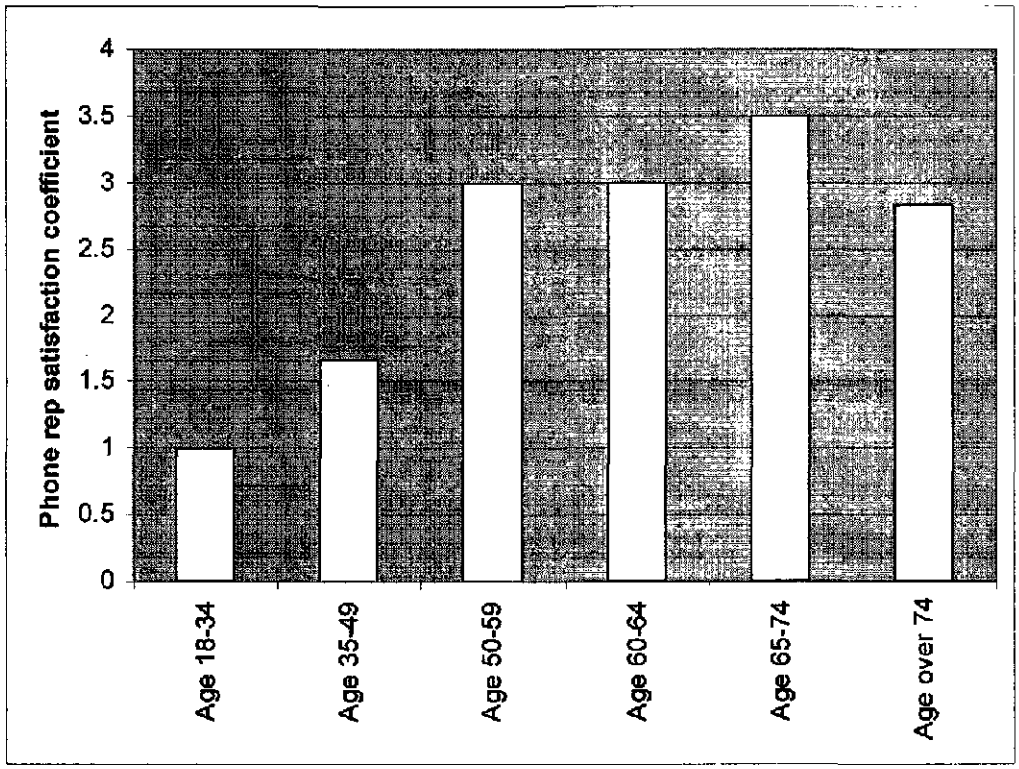
In order to maximize participation in the future, the study also suggests a closer look at people with homes between 1,000 and 2,999 square feet. Customers with homes in the above mentioned range make up 75% of total participants in the program thus a significant target for any promotional campaign. Targeting residents of smaller homes (less than 500 square feet) does not seem to be effective since these are low usage customers also make up less than one percent of participants in the program.

Satisfaction of the Power Manager Phone Representatives

The most important indicator of overall satisfaction was the participant's satisfaction of the power manager phone representative that handled their call. Due to this attributes importance further analysis was done on the satisfaction of the phone representative and overall satisfaction.

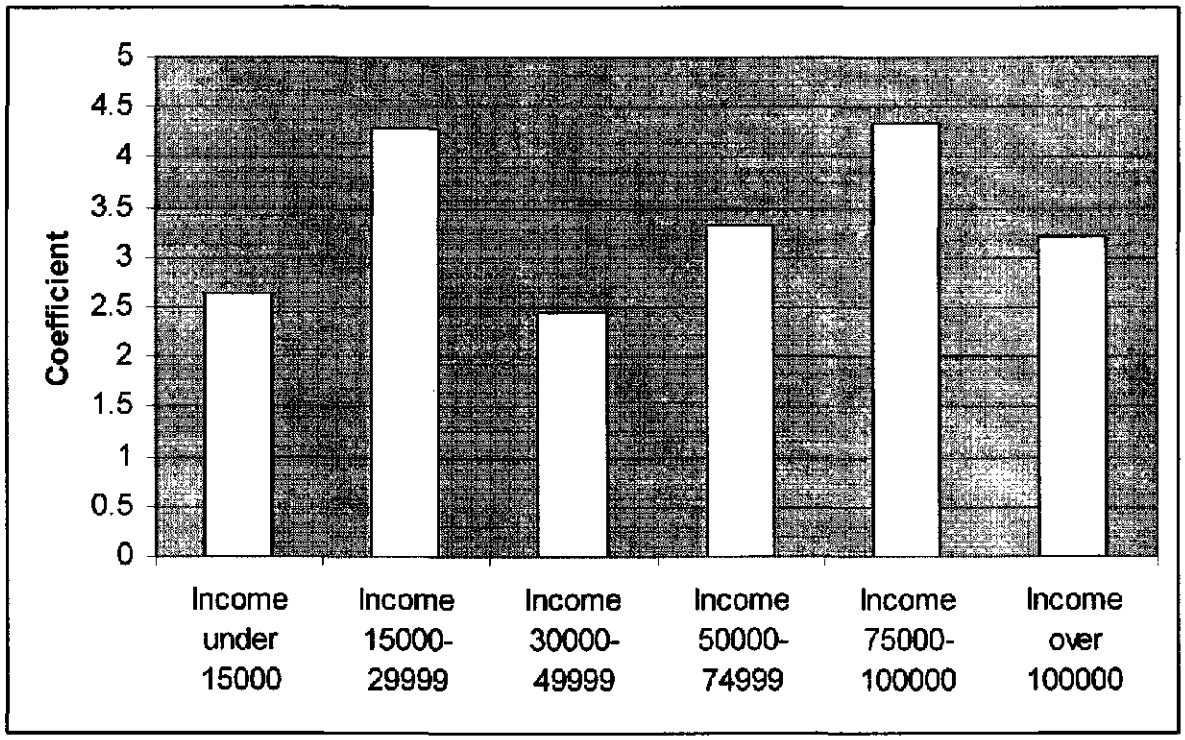
Satisfaction of Power Manager Phone Representative by Age Groups

Regressing overall satisfaction against satisfaction of phone representatives for different age groups for those customers who called power manager phone representative shows a lower coefficient for younger customers. This suggests that participants younger than 50 years, especially age 35 and below, are less satisfied with the service they received from the Power Manager phone representative.



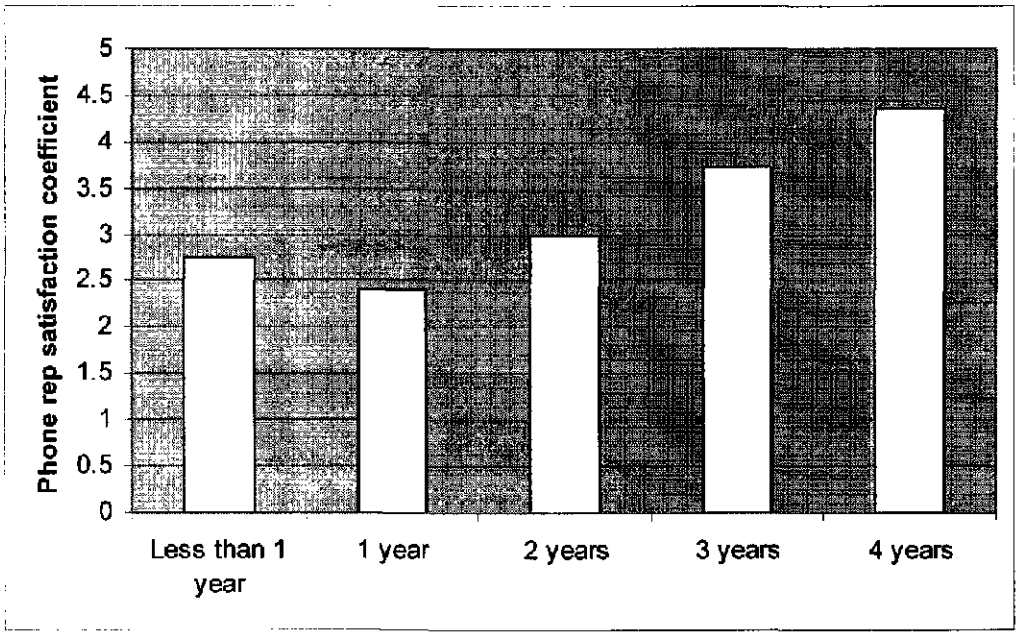
Satisfaction of Power Manager Phone Representative by Income Groups

Regressing overall satisfaction against satisfaction of phone representatives for different household income groups shows a lower coefficient for customers with annual income of 50K to 30K as well as customers having lower income of fewer than 15K suggesting these income groups are less satisfied with the service they received from the Power Manager phone representative.



Satisfaction of Power Manager Phone Representative by Length of Participation

The results of regressing overall satisfaction against satisfaction of phone representatives for different participation time period shows a higher coefficient for customers who have been with the program longer. This might suggest that participants who stay longer with program find the phone representatives more helpful or the upward coefficient trend is because satisfied participants stay longer in the program.

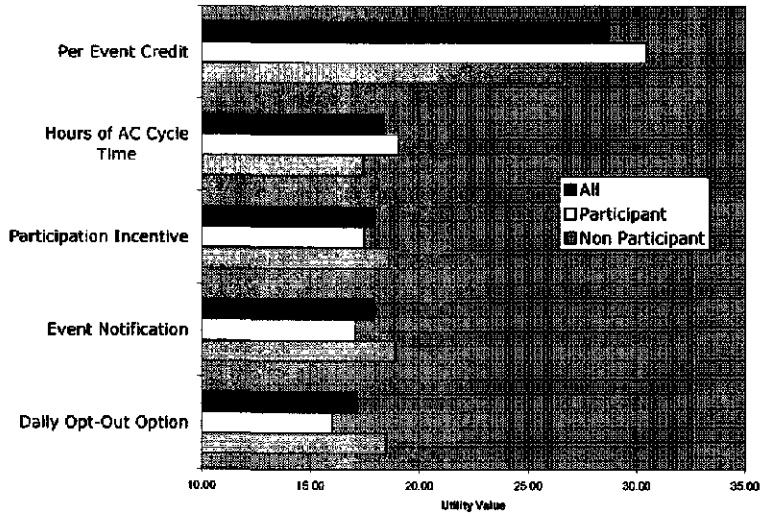


Additional insight on increasing participation in the Power Manager Program

To gain further insight on ways to increase participation in the Power Manager program a conjoint study was conducted was conducted in November 2006 in the Duke Energy Midwest Region to over 100 respondents. Respondents included a blend of current Power Manager Customers, and non-Power Manager Customers. All customers surveyed were eligible for the Power Manager program.

Results indicate that the current program offering sign up incentive of $25 (and $35) obtain the highest participation likelihood scores compared to a proposed free thermostat as a participation incentive. The free thermostat sign up incentive was still a viable option, but would need a considerable amount of marketing to communicate the benefits and value of a programmable thermostat, as well as educational material and additional features such as a toll free technical assistance phone number for operational questions. Over 60% of the customers indicate they do not adjust their thermostats settings (programmable or non-programmable) throughout the day.

Additional results indicate a per event incentive is the most important feature to customers considering signing up for a Power Manager program option, compared to features such as sign-up incentive, event credit, notification, and opt-out options.



(How important the attribute is compared to the others)

The current program offering includes a $25 sign-up incentive for a 1 kW reduction in load, and a $35 incentive for 1.5 kW reduction in load. Average AC cycle times for 2006 in total were around 3 hours. Event credits were given on a per kW basis. Customers were offered a 1 time per month opt-out option. This current opt-out offering is preferred by customers, and increases participation. Offering more than 1 opt-out option is not recommended, as it will not increase participation likelihood significantly.

Based on the conjoint results, three (3) hours of AC cycle time obtained a positive utility value. Increasing the cycling time from three (3) hours to five (5) hours reduces the probability of participation from 37% to 27%. But adding program feature enhancements will offset this difference.

Increased sign-up likelihood can come from program enhancements such as an email notification of an event occurring 1 day ahead, which moreover would be the least cost notification method. Respondents preferred email notification to phone call notification, and some notification to no event notification.

Additional suggestions include a per event credit instead of a per kW credit. Per Event is defined as any day that Duke Energy cycles a customer's AC unit on and off.

	Option A	Option B	
Sign Up Incentive	$25	$35	
Hours Cycle Time	3	3	
Event Credit	1	2	
Event Notification	None	None	
Monthly Opt-Out	1	1	
CURRENT OFFERINGS	10%	15%	**Relative Share**
Increase Cycle Time to 5 hours	7%	13%	**New Relative Share**
Add Event Notification	**11%**	**17%**	**Final Relative Share**

Relative Share of preference can be thought of as how many consumers would chose one option over another in the same menu. Share of Preference scores capture information about what product is most preferred and also the relative desirability of the remaining products. Share of preference does not represent market share potential. However, to some extent it can be viewed as a relative gauge, if both programs were offered by Duke Energy to every eligible customer and external effects were applied. An external effects multiplier can be included to better represent a market share potential, but again does not represent market share, as it is missing factors such as level and effectiveness of advertising, length of time on the market, and competitive or similar programs on the market. External Effects have been applied above to obtain the relative share estimates based on current share of participants to eligible customers. Current share of eligible customers is .047 for Option A and .082 for Option B.

Temperature Settings

- On average, respondents set their thermostats in the summertime to between 73 and 75 degrees.

- Regardless of temperature setting, it can be determined that having a thermostat set at 2 degrees warmer than current setting, customers will experience no difference in comfort level.
- 4 degrees warmer, causes customers to feel slightly less comfortable, except those setting their temperatures initially at 65 – 69.

Evaluating the impacts of the Power Manager Program

To evaluate the impacts of the program a load research study was conducted during summer 2006 of Power Manager. During summer 2006, nearly 29,000 Duke Energy Indiana residential customers in Indiana and 5,900 Duke Energy Kentucky residential customers in Kentucky participated in Power Manager load control events. The main purposes of the load research study is to evaluate how well load reduction targets were achieved during load control events and provide data for modeling purposes to support the program in future years. A new control model was developed for the 2006 Power Manager program based on data captured during 2005. This model called for substantially greater cycling percentages to achieve 1.0 or 1.5 kw target reduction levels than were in effect in the 2005 model. Overall load reduction achieved in 2005's program was generally too low according to the impact evaluation. The difference in the model is largely due to better capturing the "flattening" of the AC KW curve at higher temperatures. The summer of 2005 had many days with temperatures above 89 degrees; so this flattening was well represented in the dataset. This was not the case for the summer of 2004, the basis for 2005's model.

The results from this study are estimates of the load impact of the Power Manager program during five load control events conducted in summer 2006. These estimates are significantly below the targeted load reduction. Potential sources of this discrepancy include failures in paging communication and incorrect programming of switches, both of which have been encountered in spot field tests. A QA plan addressing how these problems will be investigated and remedied is presented. It may also be that expected load reductions from the Power Manager control model are too high for the moderate to low temperatures that prevailed during control periods this summer (see Table 2 below). To address this possibility, model methodology and data sources will be carefully reviewed and model results will be compared to studies in other areas. Lastly, model error in estimating realized shed kWh within the research sample during load control periods may also contribute to the discrepancy. Other results in this study include a small study with apartments, and estimates of payback during the two hours immediately following Power Manger load control events.

Power Manager Control Events

In a Power Manager control event, air conditioner units on the program are cycled off for a portion of each 30-minute interval; a random delay of up to 30 minutes at the beginning of the control period is used to stagger the off and on periods. The cycling percentage (i.e., percentage off) is chosen to achieve a specific load reduction target. This is accomplished with the Power Manger control model, which uses forecasted weather for

the control period to calculate the cycling level needed to achieve a specified target reduction, on average, over the program population. A choice of program options with different target reduction levels is offered. The two commonly used program options are identified by typical target levels, "1.0 kW" and "1.5 kW," but other load reduction targets can be specified for either program option.

Power Manager load control was implemented on five days during summer 2006; July 17, 19, 26 and August 2, 7. The time period for each load control event was 2:00 – 5:00 PM (EDT). A simplified cycling strategy was adopted this year. Rather than modifying the cycling in each hour to achieve a fixed hourly load reduction, a fixed cycling percentage was imposed in all hours of an event. This cycling percentage was calculated with the Power Manager control model to achieve the load reduction target over the event as a whole, but not necessarily in each hour of the event. The load reduction targets (total kWh for the three hour event) and corresponding cycling percentages specified for the control events of summer 2006 are shown in Table 1. Cycling percentages for Duke Energy Kentucky were calculated with the CVG weather forecast, and cycling percentages for Duke Energy Indiana were calculated with the IND weather forecast.

Table 1. Control Event Cycling

	1.5 kW			1.0 kW		
	Target	DEK %	DEI %	Target	DEK %	DEI %
July 17	3.3	62	58	3.0	58	52
July 19	3.6	65	65	3.0	58	58
July 26	3.9	76	73	3.0	63	60
August 2	4.5	71	71	3.0	48	48
August 7	4.5	75	75	3.0	56	56

An initial estimate of load impact after a control event can be obtained with the control model algorithm, using actual weather during the control period together with the cycling percentages imposed. Deviation of actual weather from the weather forecast results in a total impact estimate different than the load reduction target. These estimates are the starting point for load impact results developed later in this report (see Table 6-a). Table 2 provides an overview of the weather experienced during Power Manager load control events f summer 2006, showing average hourly temperature and heat index during the control period. Notice the very low temperature at IND during the August 7 event.

Table 2. Temperature and Heat Index (deg-F) during Control Periods

	CVG		IND		SDF	
July 17	90	93	89	93	91	95
July 19	91	97	89	95	93	100
July 26	86	89	83	88	88	95
August 2	91	99	91	99	94	104
August 7	90	96	77	80	94	101

Load Research Sample

The 2006 load research sample consists of 159 single-family residences in the main load impact study, and 12 apartments in a side study of the effectiveness of Power Manager for multi-tenant properties. Interval KWH (15-minute) is collected for all research sample participants. State data loggers were installed on the air-conditioner units for about half (83) of the main study and all in the apartment study, which allow air-conditioner duty cycles to be constructed. The research sample for the main study was chosen to achieve reasonable geographic representation of the Power Manager population in Indiana and Kentucky, while also allowing for reasonably efficient data collection (residences with data loggers were visited every 4 weeks for data collection). Participants with data loggers are distributed in clusters in the Indianapolis area (32), Kokomo (10), Terre Haute (9), Jeffersonville-New Albany (9), and Cincinnati area (23). The rest of the sample for the main study, with interval meters only, was selected from areas not represented in the clusters.

Research sample participants with data loggers were separated into two control groups, RS1 and RS2, with about an equal split in each cluster. In Power Manager events, one group was controlled along with the general population and the other group was not controlled, and so provided information on the natural duty cycle. For evaluation of load impact, participants in the main study are grouped according to weather region (CVG, IND, SDF), and control group. The control group is RS1 or RS2 for participants with data loggers, or MET for participants with interval meters only. Table 3 below shows the breakdown into these evaluation groups.

Table 3. Evaluation Groups

Weather Region	Control Group	Participants
CVG	RS1	11
CVG	RS2	12
CVG	MET	17
IND	RS1	26
IND	RS2	25
IND	MET	49
SDF	RS1	5
SDF	RS2	4
SDF	MET	10

Weather regions are assigned by zip code. All Kentucky zip codes are assigned to CVG (Cincinnati airport). Zip codes in southeast Indiana are assigned to CVG, in south-central and southwest Indiana to SDF (Louisville airport), and in central Indiana to IND (Indianapolis airport). Appendix E lists Indiana zip codes assigned to CVG or SDF.

The research sample was also chosen to achieve balanced representation of high and low kWh usage. Quartile statistics of monthly kWh during summer 2005 were used to divide

(separately for DEI and DEK) Power Manager participants into low (below Q25), medium (between Q25 and Q75), and high (above Q75) usage segments. About 25% of the research sample participants were drawn from each of the low and high segments, and the remaining 50% were drawn from the medium segment. Table 4 illustrates this balance, comparing quantiles of overall 2006 summer usage for the research sample (main study) and the Power Manager population in each weather region. The numbers in Table 4 are total monthly KWH for June – September, 2006 billing cycles.

Table 4. Quantile Statistics for Summer-2006 KWH

	CVG		IND		SDF	
Q	Population	Sample	Population	Sample	Population	Sample
0.1	3312	3020	3154	2758	3106	3571
0.2	3853	3794	3786	3586	3782	3786
0.3	4351	4199	4266	3930	4215	4050
0.4	4819	4580	4743	4488	4721	4744
0.5	5315	5518	5259	5099	5255	4822
0.6	5828	6160	5832	5616	5902	6600
0.7	6505	6807	6529	6032	6569	8114
0.8	7446	7139	7446	7465	7552	8803
0.9	8824	8564	9024	9678	9164	10011

Load Reduction within Research Sample

This section describes the method used to estimate load reduction within the portion of the research sample controlled during each Power Manager event of summer 2006. Group MET was controlled on all event days, group RS1 was controlled July 17, 26 and August 2, and group RS2 was controlled July 19 and August 7.

Impact evaluation is based on separate models for average 30-minute interval KWH within each of the evaluation groups in Table 3. Explanatory variables in these models are linear temperature splines based at 66, 77, and 88 deg-F, a humidity adjustment factor, the hour of the day, and interventions for intervals during control events. The humidity variable in the model depends upon both temperature and humidity, and is defined as the natural logarithm of the ratio of heat index to temperature. The models are estimated with research sample interval KWH for 1:00–7:00 PM (EDT) on non-holiday weekdays from Memorial Day to Labor Day (May 30 – September 1, 2006). By including the hour prior to control period and two hours subsequent to the control period in the model, it will be possible to investigate additional effects such as autocorrelation and payback. Interaction variables between temperature splines and hour of the day were investigated but discarded from all models. The temperature spline at 88 deg-F was retained in IND models, but was not significant and was dropped from CVG and SDF models.

The load reduction achieved within each evaluation group of Table 3 during load control is estimated by coefficients of corresponding intervention variables in the model for this group. A unique intervention variable is specified for each 30-minute interval during a control event, and so the models estimate average load reduction within each group during every 30-minute interval of the control event. Intervention variables are also specified for the intervals subsequent to a control event (four 30-minute intervals for the period 5:00 – 7:00), and coefficients of these variables estimate payback, which will be discussed further later in the report.

For overall impact evaluation of the Power Manager program, we focus on the total load reduction achieved in evaluation groups on a control event day. This is the sum of intervention coefficients for the control period, 2:00 – 5:00 PM for all control days in summer 2006. In summing estimated intervention coefficients, a positive coefficient is treated as zero load reduction. Table 5 gives the results obtained for total load reduction within evaluation groups on control event days. In blocks with results, the middle row is the weighted average of total KWH reduction for two evaluation groups identified in the leftmost column. The top row gives the expected total KWH reduction calculated with the Power Manager control model using actual weather and event cycling levels, and reflecting the mix of program option (1.5 KW or 1.0 KW) in the evaluation groups. The bottom row shows the ratio of realized KWH reduction (middle row) to expected KWH reduction (top row). A complicating factor is that MET groups are subject to a random delay of up to 30 minutes in the start of the control period, the same as for the general program population. This means that initial MET intervention coefficients (for 2:00 – 2:30) will be somewhat reduced. The remaining MET intervention coefficients during the control period are not affected. RS1 and RS2 groups are not subject to random delay. To deal with this, sums were calculated both with and without the initial 30-minute interval of the control period. Results with the greater ratio appear in Table 5 and are used in the impact evaluation.

Table 5. Estimated load reduction within research sample by weather region.

Group	July 17	July 19	July 26	August 2	August 7
CVG RS1-MET	2.80 0.49 18%		3.41 1.06 31%	3.25* 1.42 44%	
CVG RS2-MET		2.82* 1.77 63%			3.63 1.32 36%
IND RS1-MET	2.42 0.35 14%		2.38* 1.36 57%	3.12* 1.90 61%	
IND RS2-MET		2.69* 1.35 50%			0.93 0.0 0%
SDF	2.34*		3.06*	3.55*	

RS1-MET	1.23 52%		0.74 24%	1.02 29%	
SDF RS2-MET		3.61 1.55 43%			3.75* 0.85 23%

* load reduction excludes initial half-hour of event period

Figures 1(a)-(c) provide a graphic representation of load reduction estimates within the research sample - Figure 1(a) shows estimates for the CVG weather region, Figure 1(b) for IND and Figure 1(c) for SDF. The horizontal axis in each individual graph corresponds to the period 1:00 – 7:00 PM, the hours covered by our model, on a Power Manager control day. The vertical axis corresponds to KWH within 30-minute intervals. The solid blocks show KWH at 30-minute intervals averaged over research sample groups controlled that day. The line with open blocks shows the composite model fit for the controlled groups, excluding intervention terms. Moving left to right in the graphs, the first two points (open or closed blocks) correspond to the hour prior to the control period, the next 6 points correspond to the three-hour control period, and the final 4 points correspond to the two hours immediately after control is released (ignoring random delay, which complicates the picture a bit for the first interval of the control period and the first interval after the control period). During the control period, the distance of the solid block below the line is the estimated load reduction. After the control period, the distance of the solid block above the line is the estimated payback. In both cases, since the estimate is for a 30-minute interval, it must be doubled to correspond to kWh.

Figure 1(a). Controlled Groups in CVG Weather Region

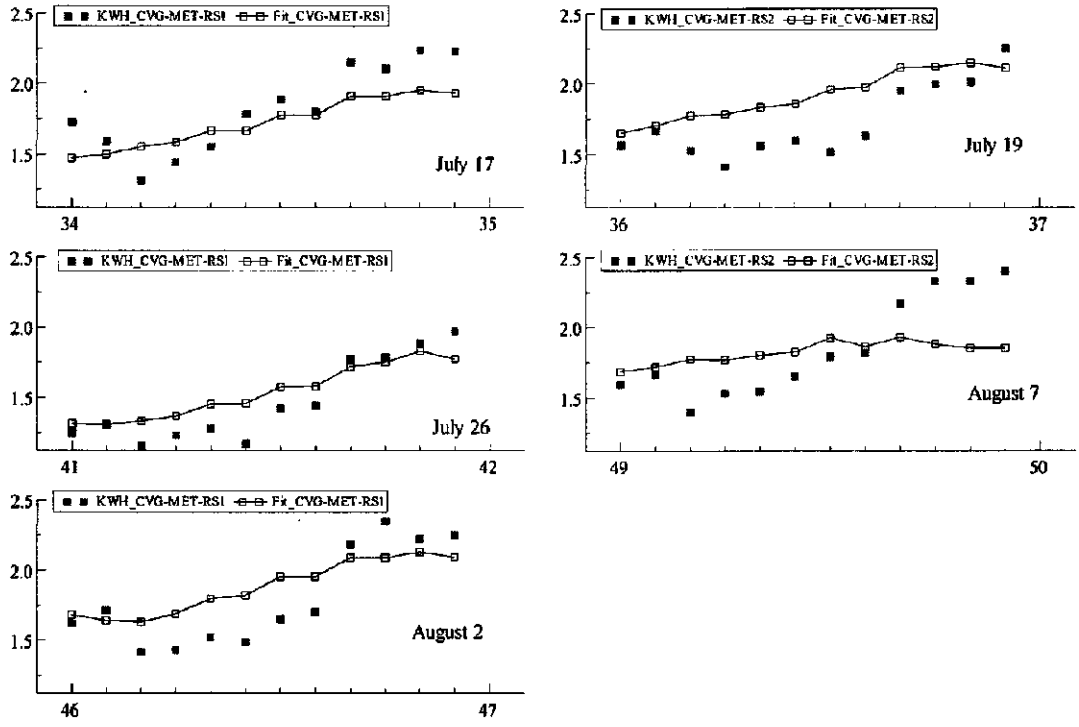


Figure 1(b). Controlled Groups in IND Weather Region

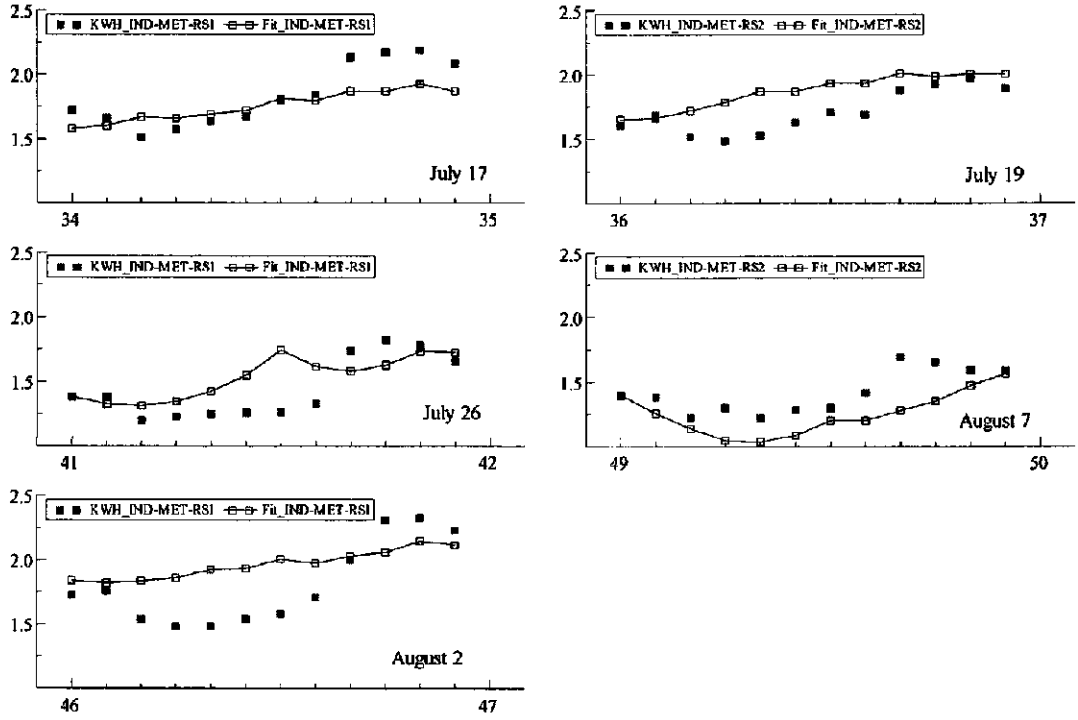
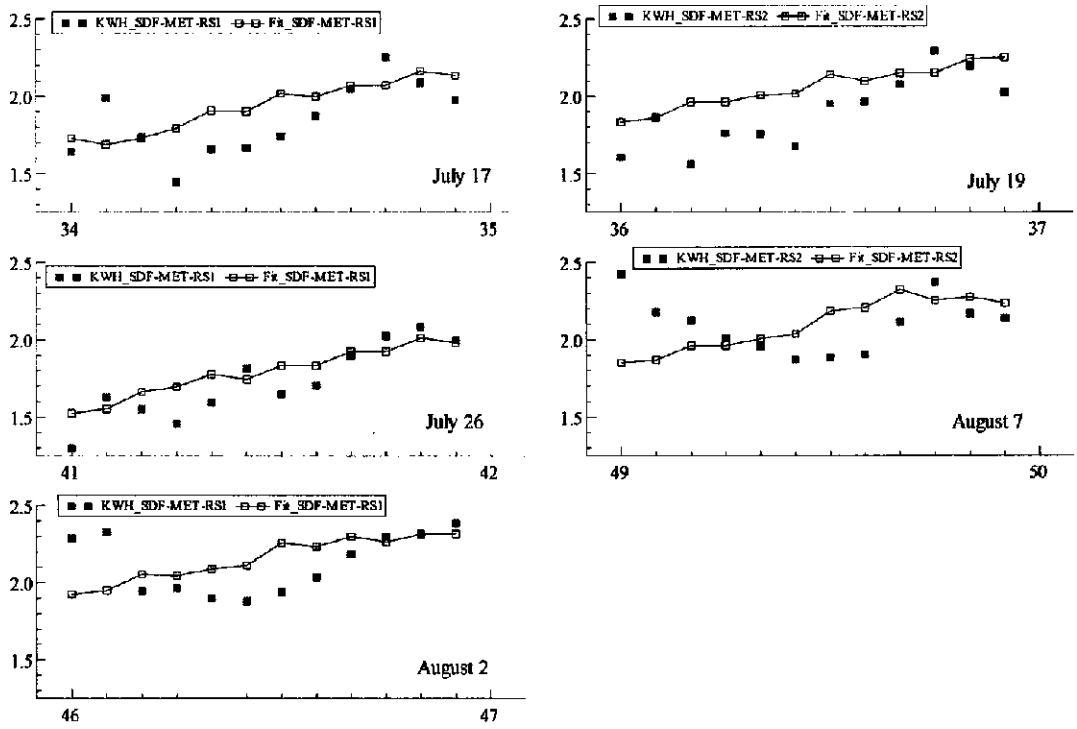


Figure 1(c). Controlled Groups in SDF Weather Region



Power Manager Program Load Impact

This section presents hourly impact estimates for Power Manager load control events of summer 2006. Tables 6(a)-(b) illustrate intermediate steps in the calculation of these estimates, and final impact results are in Table 6(c).

Table 6(a) shows separate estimates of average hourly shed kWh during control events for each weather region (CVG, IND, SDF) and program option (1.5 kW, 1.0 kW). These estimates were computed with the Power Manager control model algorithm using the control event cycling percentage (see Table 1) and actual weather during the control period. Also shown in Table 6(a) are participant counts by operating company (DEI, DEK) for each weather region and program option. Participants are assigned to weather regions according to their zip code.

In Table 6(b), the results from Table 6(a) are accumulated for each operating company. These numbers represent expected impacts immediately after an event, before any consideration of results from the research sample.

The upper section of Table 6(c) lists the adjustment factors from Table 5 of the previous section, derived from the research sample. The lower sections of Table 6(c) contain the final hourly impact estimates by operating company. These estimates start with the product of three factors which have been described:

1) Control model average kWh reduction with event cycling and actual weather;
2) Participant count by operating company;
3) Adjustment within weather regions based upon research sample results.

Factors 1 and 2 appear in Table 6(a) and factor 3 is from the upper section of Table 6(c) (and also Table 5). For each operating company, these products are summed over weather regions and program options to get overall hourly impact estimates.

Table 6(a). Expected Hourly Shed with Control Model Algorithm

	Jul_17	Jul_19	Jul_26	Aug_2	Aug_7
CVG-DEK 1.5_kw					
Model Shed - Hr 15	0.85	1.00	1.08	1.22	1.18
Model Shed - Hr 16	0.94	1.14	1.18	1.35	1.36
Model Shed - Hr 17	1.06	1.27	1.31	1.48	1.40
Count	4210	4215	4228	4264	4260
CVG-DEK 1.0_kw					
Model Shed - Hr 15	0.77	0.84	0.77	0.71	0.77
Model Shed - Hr 16	0.86	0.97	0.86	0.82	0.90
Model Shed - Hr 17	0.98	1.10	0.98	0.92	0.92
Count	1465	1470	1482	1565	1550
CVG-DEI 1.5_kw					
Model Shed - Hr 15	0.77	1.00	0.99	1.22	1.18
Model Shed - Hr 16	0.86	1.14	1.09	1.35	1.36
Model Shed - Hr 17	0.98	1.27	1.21	1.48	1.40
Count	483	483	483	480	480
CVG-DEI 1.0_kw					
Model Shed - Hr 15	0.67	0.84	0.69	0.71	0.77
Model Shed - Hr 16	0.75	0.97	0.78	0.82	0.90
Model Shed - Hr 17	0.85	1.10	0.89	0.92	0.92
Count	358	358	358	355	354
IND-DEI 1.5_kw					
Model Shed - Hr 15	0.73	0.99	0.82	1.23	0.24
Model Shed - Hr 16	0.85	1.08	1.17	1.38	0.37
Model Shed - Hr 17	0.92	1.20	0.96	1.42	0.44
Count	16568	16579	16596	16643	16623
IND-DEI 1.0_kw					
Model Shed - Hr 15	0.62	0.82	0.55	0.73	0.10
Model Shed - Hr 16	0.74	0.91	0.84	0.83	0.16
Model Shed - Hr 17	0.79	1.01	0.67	0.85	0.20
Count	6969	7059	7104	7316	7238
SDF-DEI 1.5_kw					
Model Shed - Hr 15	0.84	1.10	1.17	1.32	1.33
Model Shed - Hr 16	0.93	1.25	1.23	1.47	1.50
Model Shed - Hr 17	1.04	1.29	1.35	1.60	1.66
Count	2533	2552	2561	2575	2568
SDF-DEI 1.0_kw					
Model Shed - Hr 15	0.73	0.94	0.86	0.81	0.90
Model Shed - Hr 16	0.81	1.07	0.91	0.93	1.05
Model Shed - Hr 17	0.91	1.11	1.01	1.03	1.20
Count	1422	1463	1480	1529	1521

Table 6(b). Operating Company Total Expected Hourly Shed (MW)

	Jul_17	Jul_19	Jul_26	Aug_2	Aug_7
DEK					
Hr 15	3.5	4.1	4.3	4.7	4.7
Hr 16	5.2	6.2	6.3	7.0	7.2
Hr 17	5.9	7.0	7.0	7.8	7.4
DEI					
Hr 15	15.1	20.4	16.9	23.5	7.7
Hr 16	23.5	30.0	30.8	35.1	13.7
Hr 17	25.4	33.0	26.5	36.6	15.9

Note: First event hour reduced 25% to account for random delay

Table 6(c). Operating Company Hourly Impact Estimates (MW)

	Jul_17	Jul_19	Jul_26	Aug_2	Aug_7
Research Sample Adjustment					
CVG	18%	63%	31%	44%	36%
IND	14%	50%	57%	61%	0%
SDF	52%	43%	24%	29%	23%
DEK Impact					
Hr 15	0.6	2.6	1.3	2.1	1.7
Hr 16	0.9	3.9	1.9	3.1	2.6
Hr 17	1.1	4.4	2.2	3.4	2.7
DEI Impact					
Hr 15	3.0	10.0	8.4	13.1	1.1
Hr 16	4.6	14.8	15.8	19.6	1.6
Hr 17	5.1	16.3	13.2	20.3	1.8

Note: First event hour reduced 25% to account for random delay

Apartment Study

Twelve participants were recruited from apartment complexes in Franklin, IN (IND weather region) and New Albany, IN (SDF weather region) to investigate the suitability of multi-tenant properties for Power Manager program. Both state data loggers and interval meters were installed for the apartment sample, but data for the bulk of summer 2006 is available for only 8 of these participants. These apartment accounts are listed in Table 7 below, with apartment size and total kWH for June – September bill cycles. Notice the comparatively low KWH usage for two accounts, even though one is the largest apartment in the study.

Table 7. Apartment Research Sample Characteristics

Account	Size (Sq Ft)	Summer KWH
26502594	1066	3577
90602594	833	3311
79802594	962	3189
06202929	1360	3797
91602946	1000	3756
45602946	840	4740
93302929	1440	1943
96302929*	1080	1845

* tenant changes in July and August

Separating apartment accounts into evaluation groups and modeling average kWh usage within these groups is not feasible due to the small sample size. Instead, load reduction by apartment accounts is estimated individually for each account by comparing kWh usage during a control period to kWh usage during the same time period on days with similar weather. For each control event and account, three weekdays are selected to most closely match temperature and heat index during the control period, avoiding any days where load control was implemented or kWh data is not available for that account. Total kWh during the control period is subtracted from total kWh during the same time period, averaged for the three comparable days. Table 8 below gives results for each apartment account and Power Manger control event. The layout of Table 8 is similar to Table 5; the top row in each block is the estimated load reduction for the apartment, the middle row is the expected load reduction computed by the Power Manager control model (with 1.0 kw program option and appropriate weather region), and the bottom row is the ratio between the top and middle rows. The bottom row of Table 8 shows averages for all apartments controlled in each Power Manager control event.

Table 8. Estimated Load Reduction for Apartments

Account	July 17	July 19	July 26	August 2	August 7
26502594 IND-RS1	2.48 2.15 115%		1.29 2.06 63%	1.43 4.02 36%	
90602594 IND-RS1	0.00 2.15 0%		1.39 2.06 67%	0.00 4.02 0%	
79802594 IND-RS2		0.00 2.74 0%			0.00 0.46 0%
06202929 SDF-RS1	2.05 2.45 84%		0.55 2.78 20%	1.42 4.40 32%	
91602946 SDF-RS1	3.57 2.45 146%		1.06 2.78 38%	0.00 4.40 0%	
45602946 SDF-RS2		1.65 3.12 53%			0.00 3.15 0%
93302929 SDF-RS2		0.00 3.12 0%			0.00 3.15 0%
96302929 SDF-RS2		1.57 3.12 50%			0.00 3.15 0%
Event Average	2.03 2.30 88%	0.81 3.03 27%	1.07 2.42 44%	0.71 4.21 17%	0.00 2.48 0%

Payback

As discussed previously, the models used to measure average kWh impact within the evaluation groups during control events include intervention coefficients for four 30-minute intervals subsequent to each control event (the time period 5:00 – 7:00 PM). These intervention coefficients measure the increase in average kWh usage within evaluation groups above the expected level (i.e., the model) immediately after a control period, which is often referred to as payback. The sum of these intervention coefficients estimates the total payback during the two hours immediately after a control event, on average within the evaluation group. Payback results are given in the bottom row of blocks in Table 9. For comparison, the top row of these blocks contains the estimated total load reduction during the control period (the sum of intervention coefficients during the control period).

Table 9. Payback (kWh) over Two-Hour Period After Control

Group	July 17	July 19	July 26	August 2	August 7
CVG	-0.49		-1.06	-1.63	
RS1-MET	1.02		0.34	0.61	
CVG		-2.03			-1.32
RS2-MET		0.0			1.83
IND	-0.35		-1.48	-2.20	
RS1-MET	1.04		0.33	0.54	
IND		-3.16			0.0
RS2-MET		0.0			-
SDF	-1.23		-0.85	-1.13	
RS1-MET	0.0		0.19	0.10	
SDF		-1.55			-0.85
RS2-MET		0.0			0.0

Power Manager Quality Assurance Action Plan

As a result of the Power Manager impact evaluation analysis, and in order to maximize the impact of the program, Duke Energy has developed the following action plan for 2006-7 to insure that the full program impacts can be realized prior to the execution of the 2007 control season. During November and December, 2006, discussions took place Duke Energy personnel and service provider partners, so that we could better understand control equipment performance issues. The lower than expected load reductions during the 2006 season could possibly have been due to somewhat milder peak temperatures than expected, but it is also possible that other structural causes may be the cause. To insure that all causes are systematically analyzed and corrected, where needed, prior to the 2007 season, Duke Energy intends to pursue the following quality assurance action plan.

Validate Data and Complete On-site Assessments

Work started in December 2006 is targeted to insure that the data used to complete the analysis of impacts is accurate and representative of the actual load reductions during the control events. Verification of the data received from the interval meters (measures actual energy usage in 15 minute intervals), data loggers (shows time stamped on/off cycling of A/C units) and weather data will be completed before Jan 2007. The modeling logic used to forecast load reduction potential will also be reviewed to ensure proper representation.

An on-site visit will be made to more than 100 homes that encompass the representative data sample. Technicians will visit each site with portable diagnostic equipment that will determine the operational condition of each switch. The inspection will evaluate the following:

- Switch programming
- Event history – did the switch receive the commands
- Signal strength
- Proper installation and functionality
- Switch tampering

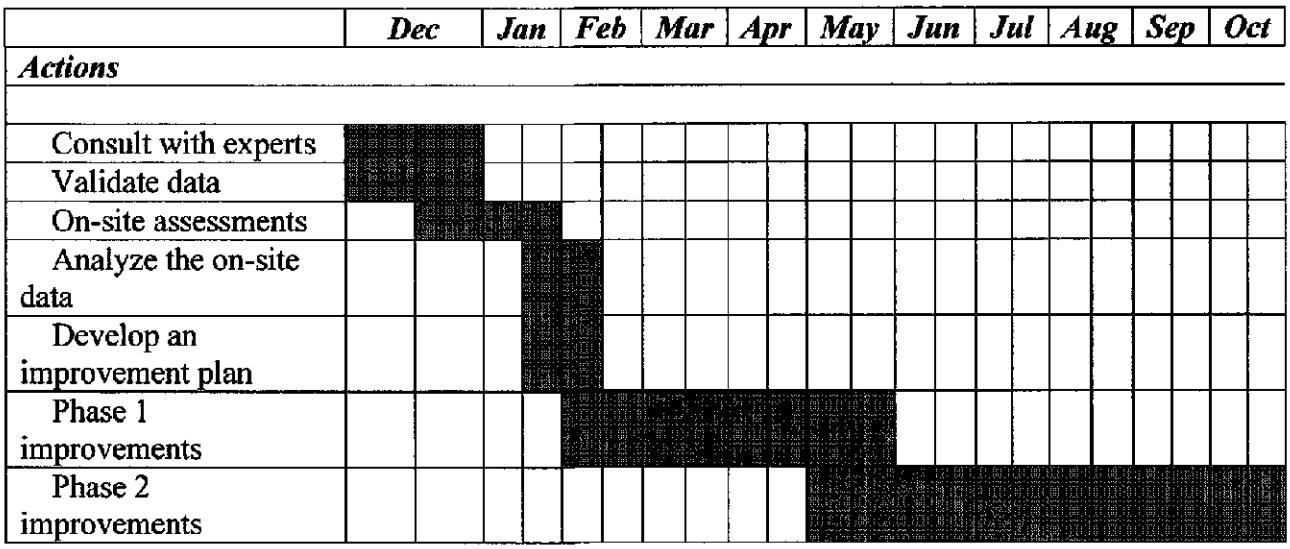
If required, technicians will make repairs while on site and they will document their findings, so that the system integrity can be evaluated.

Analyze the results

The information gathered from the site visits will point the way to improving system performance and ultimate load reduction potential. The data will be analyzed and a list of prioritized initiatives will be developed and implemented to maximize performance for the 2007 Power Manager event season. A list of modification or repairs includes, but is not limited to the following:

- Programming enhancements to software (switch or command software)
- Changes in the paging or command protocol
- Paging company coverage improvements
- Antennae modifications
- Additional site visits assessments
- Switch replacement
- On site monitoring during a simulated command event

These options and others will be considered as opportunities to improve load reduction impacts. The items listed above have varied timeframes for implementation, so a comprehensive solution will incorporate short and long term solutions. Ideally, the chosen remedies will be implemented in parallel when possible and test will be conducted to verify results. The following chart represents the proposed timeline for implementing the action plan.



Initial results

The initial stage of the Power Manger QA program involved site visits to 96 program participants in late December and early January. 45 of these were selected from the 2006 research sample, after analysis of interval load data indicated little or no load reduction from these households during load control events. 51 were selected from the general population of Indiana program participants. Key registers in the switches still contained values from the final Power Manger event of the summer, on August 7. Analysis of the switch register data collected in the test has identified two types of switch problems that contributed to lower than expected impact: some switches were not correctly programmed prior to the August 7 event, and many switches (24 from the research sample and 8 from the other group) apparently correctly programmed did not actually shed during the event period. The first problem will be addressed by re-programming all Power Manger switches (remotely, by paging) prior to next summer. Further QA tests

will be conducted early in 2007 to identify the source of the second problem. No significant problems with paging signal strength, installation, or switch tampering were found in the site visits.

Final Report

An Evaluation Energy Star Products

Results of a Process and Impact Evaluation of Duke Energy's CFL Promotion and Lighting Logger Programs

September 24, 2008

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Table of Contents

This evaluation was conducted by TecMarket Works and BuildingMetrics with support from Duke Energy.

The process evaluation was conducted by TecMarket Works. The impact evaluation was conducted by Duke Energy with BuildingMetrics supervision and approval. The CFL surveys were conducted by Duke Energy and the analysis was supervised and approved by TecMarket Works. TecMarket Works and BuildingMetrics are independent evaluation firms providing energy efficiency program evaluation services to government and utility clients.

Executive Summary

This report presents the findings of the CFL Promotions Programs for Duke Energy from November 2007 through February 2008. This report reviews the program's customer satisfaction, customer demographics, customer CFL use, and the impacts from the CFLs purchased through the program. The evaluation is separated into the two components: first is the Wal-Mart CFL Promotion; the second is the Logger Study (Initial and Final). In addition, four surveys were conducted across various program participant groups, including:

- **Wal-Mart CFL Promotion (October-December 2007)**
  - Description: Customers were mailed coupons to purchase General Electric CFLs for $1 at Wal-Mart Stores.
  - Surveys:
    - Wal-Mart CFL Redeemer Survey
    - Wal-Mart CFL Non-redeemer Survey
    - Wal-Mart In-Store Purchases Survey (same as Wal-Mart CFL Redeemer Survey but also included additional in-store purchase questions).

- **Initial Lighting Logger Study (November 2007)**
  - Description: 41 households participated in a lighting logger study in which four or five light bulbs in the homes were fitted with loggers. Usage was tracked for approximately one month.
  - Survey:
    - Premeasure Survey

- **Final Lighting Logger Study (February 2008)**
  - Description: 51 households who indicated that they redeemed Wal-Mart CFL coupons were fitted with loggers on four or five bulbs in their homes. Their lighting usage was tracked for approximately one month.
  - Survey:
    - Wal-Mart CFL Redeemer Survey

Each of the program's participant groups (as bulleted above) are first presented separately, then Section 6 compares the program's demographics and survey results to each other for the reader to better understand the results and optimal demographics to target in future outreach efforts of CFL promotions and programs.

According to the program manager, the primary objective of this program is for Duke Energy customers to purchase and install 500,000 CFLs in Ohio. Other objectives include identifying new ENERGY STAR® products to promote, and to improve customer satisfaction with Duke Energy. Program staff is continuing to look at new products that they can include - cost effectively - into the mix of program offerings, such as clothes washers and LED Christmas lights. However, this evaluation report focuses on CFLs only.

Methodology

To conduct the energy impact analysis this study combined the information from two data collection approaches that together allowed the estimation of saved energy. In addition, this study conducted interviews with program managers and retail store managers, that when combined with customer surveys allowed for the assessment of the operations of the program.

The kilowatt hour savings were calculated using the data obtained from the initial and final logger studies performed on homes in the area, which provided average hours of use by room type. The savings were then applied to the CFL programs based on customer responses to the survey which indicated the room type and wattage of lamp replaced. The surveys were sent to customers who both redeemed the CFL coupons sent to them and those that did not redeem the coupons sent to them, and were also filled out by customers that participated in the Logger study.

The surveys can be found in the appendices of this report, and the statistical analysis of the populations of the logger study can be found in Appendix 5.

Program operations were evaluated through an in-depth interview with two program managers, five retail store managers from Kentucky, and 16 retail store managers from Ohio.

Process Evaluation Summary

The retailers are overall very happy with the program's operations and offerings. They are experiencing increased foot traffic in their stores, are happy to offer more energy efficient options to their customers, and are very happy with their communications with Duke Energy. According to the store managers interviewed, this program is a success for them, Duke Energy, and customers.

Other key findings include:

- All but one of the retailers is doing special advertising or displays for the CFL promotion. The exception is Retailer B. All five Retailer B managers interviewed indicated that they do not do any additional or special marketing for the CFLs.
- Most retailers believe that this program is needed. The most common reason given is that there needs to be more awareness of energy efficient options among their customers. The immediate savings of the coupon and long-term savings through reduced energy consumption are both needed to encourage previously unaware customers to try out the CFLs.

Energy Savings Summary

Gross Energy Savings Calculations – Wal-Mart CFL promotion

Using hourly use data from the initial and final lighting logger studies energy savings were extrapolated according to the participant's responses to the survey. From this calculation a gross yearly energy savings of 207,526 kWh/year was estimated for those customers participating in the Wal-Mart CFL promotion. This estimation includes those that responded to the Wal-Mart CFL Redeemer survey as well as those who responded to the Wal-Mart In-Store Purchases survey.

Free Riders and Free Drivers – Wal-Mart CFL Promotion

From the Wal-Mart CFL Redeemer and In-Store Purchases survey results, it was determined that 22.6% of purchases made were due to free riders[1], while 13.2% of purchases made were due to free drivers[2].

Total Program Net Energy Savings Calculations

The final total program energy savings was 14,378,038 kWh/year, based on a net savings of 188,019 kWh/year calculated from the survey and lighting logger data and the number of bulbs redeemed. Program impacts are presented in Table 1 below.

Table 1. CFL Program Impacts

Gross program savings	207,526
Gross savings per bulb	67.7 kWh/year
Freeridership level	22.6%
Freedriver (spillover) level	13.2%
Net program savings = 207,526*(1-(22.6%-13.2%))	188,019 kWh/year*
Total bulbs in gross and net savings calculations	3,067
Net savings per bulb	61.3 kWh/year
Total bulbs purchased using coupons	234,552
Total program savings	14,378,038 kWh/year

Table 2 below shows a summary of the usage in various rooms calculated from the logger data from both the initial and the final lighting logger studies. The kitchen lights were turned on for a longer period of time than the lights in other rooms that were monitored, followed closely by the living room lights. Table 3 shows the location of where the purchased CFLs were installed in the participants' homes, what the average wattage of the bulb replaced was, and the self-reported average number of hours the CFL is turned on each day. Purchased CFLs could include 13W, 20W, and/or 26W bulbs.

Table 2. Average hours of use and wattages replaced from Lighting Logger Study

[1] Free rider: someone who would have taken the same action without the program's influence.
[2] Free driver: someone who takes *additional actions as a result of the influence of the program.*

Room	Average Logged Hours Bulb was Used[3] per Day
Kitchen	5.15
Living Room	4.65
Basement	3.29
Dining Room	3.15
Bedroom	2.41
Other	2.16
Bathroom	2.05

Table 3. CFL Redeemer Survey: Location of Purchased Bulbs, n=583

Room	Number of Replacements in This Room	Percent of Respondents Replacing Bulb in This Room	Average Wattage of Bulb Replaced[4]	Average Self-Reported Hours bulb used[5]
Living Room	384	65.9%	70	5.09
Bedroom	262	44.9%	67	2.89
Kitchen	185	31.7%	67	5.46
Bathroom	147	25.2%	63	3.19
Basement	91	15.6%	68	4.08
Dining Room	65	11.1%	63	4.21
Outside	58	9.9%	67	9.65
Hallway	56	9.6%	64	3.92
Office	43	7.4%	73	4.44
Garage	23	3.9%	79	3.34
Utility Room	14	2.4%	75	2.29
Closet	7	1.2%	66	1.29

[3] From logger studies.
[4] From In-Store Purchase Survey. Median wattage = 60 for all locations.
[5] From In-Store Purchase Survey

Section 1: Program Operations

Two program managers and 21 retail store managers were interviewed for this evaluation. Store manager responses are split into the following categories:

- **Kentucky Retailers** – includes responses from five different retailers in Kentucky.
- **Ohio Retailers** – includes responses from:
  - **Retailer A** (n=2)
  - **Retailer B** (n=8)
  - **Retailer C** (n=1)
  - **Retailer E** (n=5) [6]

The Ohio Retailers have been with the program for a few months to about a year, so their program experience is somewhat limited. Kentucky retailers estimate that they've been a partner in the program for 2 to 4 years.

To ensure confidentiality, the Kentucky Retailer responses are grouped together, and the Ohio Retailer responses are all grouped together or are grouped by the store.

The program manager and the retail store managers feel that the program objectives are being met (or on track to be met). However, there are some recommendations that were made for improvements to the program and possible expansion of offerings.

Program Operation Overview

Duke Energy, Wal-Mart and the manufacturer were involved in the program planning process, however, the coupons and the mailer (in which the coupons went out) had to be approved by Wal-Mart, GE and Duke Energy staff. The initial planning for the program involved both Duke Energy and Wal-Mart managers who designed a program in which customers were sent coupons to purchase CFLs. The coupons lowered the price of a CFL to $1 per bulb. The product and packaging offered was a three-pack of GE bulbs ($3 for a package of three 20watt or 26 watt bulbs).

The coupons (4 in a single mailer) were mailed to the Ohio customers. To ease the purchase burden and help maintain program records at the same time the coupons had a customer ID barcode on the back (to identify the customer), and a regular checkout product barcode on the front (to speed the check-out process). Images of the coupon mailer are in Appendix 6. When customers redeemed the coupon the transaction record went back to GE via a national rebate clearinghouse. Duke Energy paid GE for the processed coupons and retrieved the coupons (with the customer ID's) back from GE for evaluation and tracking purposes.

This type of campaign has since been replicated with Sam's Club, Home Depot, and other big box stores.

[6] Note: Retailer D refused to participate in any interviews for this program evaluation.

While this approach was successful, other program tracking mechanisms are being tested and used in other stores and states. For example, campaigns with Retailer C have included in-store promotions with the coupons available in the store. The customers print their name and address on the coupon before it is redeemed.

Duke Energy is also testing a campaign with Retailer A, in which they are asking customers to go to Duke Energy's website and print coupons. Promotion of this program consists of 10,000 customer mailings and electronic bill messages that direct customers to the coupons.

Retailer Participation

Reasons for Participating

Retailers were asked about their reasons for participating in the program. Their responses are mostly related to their desire to increase customer foot traffic in their store. Their responses are below:

Kentucky Retailers:

- Feel like we have to because customers come in and want to know about them and you don't want them to go to a competitor
- It brings a lot of people into the store and helps overall sales
- The customers really come after them
- Increases traffic flow to the store
- Drive foot traffic

Ohio Retailers:

- Retailer A:
  - Make them more aware or offer the retailers something in return for participating.
  - To give our customers the best possible shopping experience. I think it's a wise business move to provide as many options as possible, plus I believe in energy conservation.
- Retailer B:
  - Retailer B does it as a whole, so my store does it as well. Wise business move, service to the customers and helps reduce energy consumption
  - Giving the customer more options. I think energy reduction is important, and everyone likes to save money.
  - It is a company program. Personally, I think anything that can be done to save energy is great, so I fully support the program.
  - All Retailer B stores are involved.
  - Good to save energy and work with Duke to reduce costs, and we can carry their products and get good publicity.
  - Satisfying customers.... We do it to provide the best service possible to our customers.

  - To offer the customers a wider variety of products at the best possible prices. It is a company-wide initiative. It provides a service to our customers and I believe in it professionally.

- Retailer C:
  - To offer the customers a wider variety of products. I think it is a good idea to sell energy efficient products.
- Retailer E:
  - Energy savings for the customer
  - It's a company program. I believe it provides better service to our customers by offering them more products.
  - It's required
  - Mandatory. I think it is always good to give customers more choices and rebates always encourage people to purchase things, especially those that can save them money immediately and in the long run.

Impact of Participation on Business

We also asked the retailers if the program has made any difference in their businesses. Many think that their participation in this program has increased the stores' traffic and customer satisfaction.

Kentucky:

- Very seldom do people buy something else in addition to the bulbs
- Yes, picks up business during the slow times of the year
- Brought new people in, yes, driving in more traffic
- Yes and no, increases traffic flow from people looking for bulbs but nothing else
- Yes, bringing in more customers

Ohio:

- We're selling a lot of the CFLs with the coupons, it boosted the sales for a while
- Boost in light bulb business
- Keeping customers satisfied.
- Increased sales
- We are able to sell a product at a cheaper price than we'd otherwise be able to.
- Good PR, keeping our customer's satisfied and involved in a program that is energy conscious
- Increased options for our customers therefore increased sales.
- The perception that we offer the products and participate.
- It shows we are energy conscious
- More options for the customers which leads to increased customer satisfaction.
- A wider variety of products for our customers

Retailers Promoting the Program to Customers

After retailers agree to participate in the program, they are free to promote the CFLs as they wish. We asked the retailers how they make their customers aware of the program and the CFLs offered. The responses are below:

Kentucky:

- If they don't see the information and they ask about a normal bulb we show them the CFLs and the program and tell them about it
- Advertise it in local paper and point of sale in the store, lots of signage
- Right at the front door so they can see it when they come in
- Signage, advertisement

Ohio:

- Retailer A:
  - I let the customers know that they can purchase better, longer lasting light bulbs for less money through the program.
  - I make sure our employees are up to date on the program and answer any questions customers may have about it.
  - Inform them verbally and mail things to frequent customers.
- Retailer B:
  - If I am asked a question pertaining to lighting, I inform them about the program. Otherwise I remind my employees to do the same.
  - Promotions and literature, in the store and mailed to customers
  - Eligibility is not an issue, and I simply tell them about the program and the bulbs.
  - My employees and I tell them upon any inquiries.
  - Unless approached, I don't introduce it to customers. I make the employees aware so they can tell the customers; otherwise I believe we mail something out to certain customers.
  - We sell the products that Duke is pushing and we use them in the store as well. We have signs around the store directing people. We mail things directly to the customers or sometimes just promote the visibility of the products.
  - Unless approached, I do very little to introduce the program. I make sure all employees are aware of it and in turn are able to answer customers' questions.
  - Signs and flyers
  - If I am questioned about it or about lighting in general, I briefly mention that such a program exists and tell the customer where to find more information if they so desire.
  - There was a lot of marketing and promotion initially but it has declined since then.
- Retailer C:
  - Explain the products and program.
- Retailer E:
  - They get the mailer so they know about it

  - Signage and put them up front
  - I tell the customers about the differences between incandescent and compact fluorescent bulbs, the savings they receive instantly as well as that they will save money on their energy bills.
  - I inform them the program exists if they ask anything related; otherwise the employees handle their questions.
  - Through the mail and through our employees engaging in conversation with them.

The retailers told us about how they market and/or display the CFLs and Energy Star products. Most of the retailers do some kind of special advertising or displays for these products. Ohio Retailer B managers all stated that they do not do any kind of special advertising or displays for these products.

Kentucky:

- Set them aside separate from the other bulbs so it's the first thing they see
- Put up all the signage and make our own signs, put them on endcaps
- Put it right up front in easy line of sight
- We use more direct advertising methods such as radio and newspaper advertising

Ohio:

- Retailer A:
  - Yes, by offering a rebate and grouping them all together so they are more noticeable.
- Retailer C:
  - They are all grouped together and are more noticeable, plus we offer the rebate.
- Retailer E:
  - Energy star logo is on the label for it, occasionally an ad for them but not too often
  - Just put them up front
  - We offer a rebate and make them more noticeable.
  - Yes, the rebate makes them easier to market. Also, we have them all grouped together and close to regular incandescent light bulbs so people can see the difference

All but one of the Kentucky retailers indicated that they would still offer the energy efficient options if the program were discontinued, however, most believe that the program is still needed (Four were not sure). Their reasons they believe the program is still needed are below:

Kentucky:

- As long as the customers feel like they're saving money by buying the bulbs it's still needed.

- It's a good program to help the customer save energy in the long term and we need to save energy in this country. Right for the customer, the country, and business.
- The people won't buy the energy efficient bulbs unless they're close to the price of the other bulbs.
- People come back every year asking when light bulbs are on sale, customers want it.
- Still many people unaware of the need for energy conservation

Ohio:

- I think we need to continue to promote energy awareness and energy conservation on all possible fronts.
- Until people are aware of the good that they can do for them, they need people to show them. Once everyone knows what they are and can do, it won't be necessary
- People are looking for eco options and any way to save money
- Not sure. I don't know if it convinces people to buy the bulbs if they had no original intent to do so.
- It encourages people to buy energy efficient bulbs, which in turn increases their knowledge of energy conservation and may encourage them to look into other means of energy efficiency.
- Energy is still in short supply and every little bit helps
- Most likely, because there is still an energy crisis
- Yes, energy is still in short supply
- It's always beneficial to save energy.
- Yes. It saves energy.

Customer Awareness and Satisfaction

Kentucky retailers estimate that 50-90% (mean=60%) of their customers are aware of the program when they enter the store, and that 40-80% (mean=65%) of them take advantage of the savings offered through the program's coupon.

Ohio retailers estimate that 0-100% (mean=40%) of their customers are aware of the program when they enter the store, and that 60-90% (mean=78%) of them take advantage of the savings offered through the program's coupon.

All retailers stated that the customers are satisfied with the CFLs, with the exception of one stating that there are some concerns over the mercury content.

Retailer Recruitment

The retailers offered suggestions for recruiting more stores to participate in the program. The responses center around increased advertising and more signage that details the benefits of CFLs:

Kentucky:

- Magazine advertising
- Have Duke program staff go out and meet one on one with store managers
- Just ask them

Ohio:

- By making more retailers aware or by offering them some sort of rebate.
- Tell more of them about it
- Offer retailers some sort of incentive
- Contact more of them or offer rebates to the retailers
- With the energy crunch, I think more and more retailers will jump on the wagon.
- Make it more well known
- Increased or improved marketing
- Offer them something in return.
- It will happen as energy savings becomes more public and demand increases
- If they marketed it to more retailers I'm sure they would get more participation
- Maybe get rid of the rebates and just charge less right off the bat

Marketing Materials

All Kentucky retailers indicated that they have and have had enough marketing materials to properly promote the program. Most Ohio retailers agreed, however, when asked a few retailers offered suggestions for other materials that would be helpful. Their responses include:

- We could use more [product information], then I would have less to explain, although that may be a biased answer. Signs or graphics that explain the difference and give an actual idea of money/energy saved over some period of time. (Retailer A)
- We could use a little more [advertising] right on the actual shelf space. (Retailer B)
- Some sort of graphic displaying actual savings would be a good way to show customers tangible savings. (Retailer E)

What Works Well

Retailers were asked to indicate what they thought works well about the CFL/Energy Star promotion. All of the retailers are happy with the program and offered the following responses as to what they thought worked well:

Kentucky:

- The people are getting a good product for their money and getting the point of sale advertising, people are saving money and energy
- So inexpensive and people realize the savings
- Works because it gets people to try it and then they continue using

Ohio:

- Retailer A:

  - People always are enticed to at least consider something with a rebate.
  - It saves money.
- Retailer B:
  - It saves people money as well as helps reduce the burden on energy companies and natural resources
  - The fact that people can purchase several energy saving bulbs cheaper than a regular bulb saves them money instantly as well as on bills.
  - It is an above average product at a below average price.
  - It saves the customers money.
  - It helps people save money and energy and it shows that Duke actually cares about saving energy.
  - Money is offered back on a superior product.
- Retailer C:
  - It offers customers money back on a money saving product.
- Retailer E:
  - They send it to their house, it's a piece of mail all on its own and it's immediate
  - Savings that it gives the customer
  - It offers the customers money back on a money and energy-saving product.
  - It is a step in the right direction concerning energy conservation.
  - The bulbs actually are energy efficient and the fact that there is a rebate is encouraging.

Suggested Changes To the Program

Even though the retailers are generally happy with the program and its offerings, operations, and impact on their business, they did have suggestions for improving the program. Retailers were asked to suggest changes to the program, their responses include:

Kentucky:

- Make the customers aware of how to get replacement bulbs when they're defective before they're supposed to be
- Putting it in a commercial would really help
- More advertising and promotion

Ohio:

- Offer instant rebates. (Retailer B)
- A place to dispose of the bulbs to prevent mercury contamination. (Retailer B)
- Offer different wattages and do it for a longer period of time each year. (Retailer E)

Retailers' Experiences with Duke Energy

All the retailers expressed that their communications with Duke Energy have been satisfactory and none of them could offer any suggestions for improvement.

Limitations of Promotion

The program experienced a minor and limited amount of coupon abuse. For example, a customer can use a self-check-out lane and not hand in the coupon to the cashier. When this occurs the coupon is not bundled and shipped to Duke Energy for updating participant records. If the customer then re-uses the same coupon this can result in the purchase of more bulbs than intended by the program to a single individual. However, the occurrence of this can be documented by comparing the sales records with the participant records. To date this has not been a significant problem for the program and corrective action is not recommended unless this becomes more of an issue.

Items Promoted Through the Program

One change that Duke Energy may want to research is expanding the types of CFLs that they are promoting. At the current time only the standard sized "curly que" are offered. However, specialty lamps may be another part of the market that has potential, such as the LED Christmas lights. Another option is to look into residential CFL fixtures (not bulbs). Any of these new products will have to be evaluated for their cost effectiveness and market potential before the campaigns can be planned and organized.

All of the Kentucky Retailers that were interviewed felt that the proper technologies were being offered through the program, and did not suggest that there were any inappropriate technologies included. However, one did suggest that high efficiency ballasts with high efficient bulbs be included in the program offerings.

Four out of five of the Kentucky retailers reported that they have heard some customer complaints about the program and the CFLs offered. These include:

- Someone buys the bulb and it doesn't last as long as it's supposed to and people don't know what to do to get it replaced
- People questioning on what to do to dispose of the light bulbs
- Some don't like the slight hesitation of the light coming on
- Some bulbs have been dying early, brought back in a couple months

All of the Ohio Retailers that were interviewed felt that the proper technologies were being offered through the program, and did not suggest that there were any inappropriate technologies included. However, two retailers (Retailer C, Retailer E) did suggest that faucet aerators be included in the program offerings. A Retailer E manager suggested that the program expand its CFL offerings and include dimmable bulbs.

Seven out of sixteen of the Ohio retailers reported that they have heard customer complaints about the CFLs offered. These include:

- Retailer B:
  - Some worry about the mercury in the bulbs, but minimally.
  - Some customers have issues with the fact that the CFLs contain mercury
  - The bulbs contain mercury.
  - Mercury in the bulbs.
  - I have heard some customers raise concerns over the mercury in the CFLs
- CFLs contain mercury (Retailer C)
- Some customers are uneasy over the fact that the CFLs contain mercury (Retailer E)

Retrieving Program Information

The interactions between program staff and retailers are working pretty well. However, one program manager suggested that it would be nice if there could be more shared information in real time about the rebate processing. It can be difficult to get information from some of the retailers either because they don't have the technology in place to give real time feedback, or they are not willing to share the data. The national retailers are getting many requests from utility companies; they may have 30-40 utilities asking them to process rebates. While standardization within the retailers about how the rebates need to be processed would be ideal, this does not seem to be a feasible venture for Duke Energy. This is a Duke Energy program that is asking the retailers for implementation assistance. To place additional costs or burdens on the retailer by asking them to adapt to a different standard approach may not be in the best interests of the program.

Program Training

Currently there is no program training mechanism associated with this program. The program's campaigns are planned and negotiated directly with the retailers. The retailers then provide training to their employees on how to process the rebates. Retailer training is not recommended; it would be very time-consuming, costly, and can be met with resistance from the retailers, each of which have their own way of running their stores.

Program Promotion

Duke Energy is working on refining their program targeting by using market information from GE and purchased customer data from the Nielson Group.

Retailer versus Manufacturer Rebate Coupons

The program could be made more efficient if it were possible to have a manufacturer's coupon that worked in any retail store. At the current time retailer's operational issues do not allow for a universal coupon, because each retailer has specific and different barcodes for the purchase transaction, for tracking sales and for stock management, and few, if any, retailers want to handle coupons without their codes used for those transactions.

All of the Kentucky Retailers feel that the coupon levels are appropriate and customers are responding to the program. Each of the retailers was asked questions pertaining to the

level of the rebate and the impact of the coupon on customer choice decisions. The retailer provided the following responses:

- Yes [the coupon amounts are fine] and yes [they change customer behavior]
- Yes, they definitely influences people buying more efficient bulbs
- Yes, it's a no brainer for them [to make this decision]
- Yes they work
- Yes, this makes the sale

All of the Ohio Retailers also feel that the coupon levels are appropriate and customers are responding to the program. They provided the following responses:

- Yes, it's a great deal for them. They are eager to save money, especially on something that will last longer than a regular bulb.
- Yes
- Yes
- Yes. It makes them more willing to try them especially if they are initially skeptical.
- I think so. They encourage them to try the product.
- Yes. Most are willing to try them out at such a cheap price
- Yes. Most buy the CFLs once they hear of the program.
- Yes. I think any rebate encourages customers to buy a product.
- Yes. I imagine they encourage them to buy the energy efficient light bulbs.
- Yes. Rebates are always encouraging.
- I think so, yes. Those initially skeptical are more willing to try something new.
- Yes. They increase the likelihood that they will buy the CFLs.

Section 2: Impact Evaluation of the Wal-Mart CFL Promotion

The savings presented in this section were calculated using Wal-Mart CFL Redeemer Survey Data and Wal-Mart In-Store Purchases Survey Data. The total gross savings based on these two surveys is 221,351 kWh/year. After adjusting for freeridership and free drivers (spillover), the net savings are 200,544 kWh/year. The findings are described below.

Free Riders and Free Drivers

Based on survey responses, 23% of purchases made by those participating in the Wal-Mart In-Store Purchases survey were due to free riders, which are people that intended to purchase CFLs before learning of the program, so they took the "free ride" by using the coupons and saving money, while 13% of purchases were made due to free drivers: purchases made beyond initial plans.

Overall Savings

Customers who returned surveys indicating their participation in the Wal-Mart CFL program (some of whom also participated in the final lighting logger study) were asked to indicate where the CFL bulbs were installed, what wattage of bulb the CFLs replaced, and approximately how many hours the bulbs were used each day. Table 4 below presents the responses from the 583 survey responses obtained from those that redeemed the CFL coupons at Wal-Mart.

Table 4. CFL Redeemer Survey: Location of Purchased Bulbs, n=583

Room	Number of Replacements in This Room	Percent of Respondents Replacing Bulb in This Room	Average Wattage of Bulb Replaced[7]	Average Self-Reported Hours bulb used[8]
Living Room	384	65.9%	70	5.09
Bedroom	262	44.9%	67	2.89
Kitchen	185	31.7%	67	5.46
Bathroom	147	25.2%	63	3.19
Basement	91	15.6%	68	4.08
Dining Room	65	11.1%	63	4.21
Outside	58	9.9%	67	9.65
Hallway	56	9.6%	64	3.92
Office	43	7.4%	73	4.44
Garage	23	3.9%	79	3.34
Utility Room	14	2.4%	75	2.29
Closet	7	1.2%	66	1.29

Additionally, those participating in the Wal-Mart In-Store Purchases Survey were asked the same questions regarding CFL installation, along with the additional questions regarding their purchases at Wal-Mart.

7 From In-Store Purchase Survey. Median wattage = 60 for all locations.
8 From In-Store Purchase Survey

The total gross savings based on these two results is 207,526 kWh/year. After adjusting for freeridership and free drivers (spillover), the net savings are 188,019 kWh/year.

Gross program savings	207,526
Gross savings per bulb	67.7 kWh/year
Freeridership level	22.6%
Freedriver (spillover) level	13.2%
Net program savings = 207,526*(1-(22.6%-13.2%))	188,019 kWh/year*
Total bulbs in gross and net savings calculations	3,067
Net savings per bulb	61.3 kWh/year
Total bulbs purchased using coupons	234,552
Total program savings	14,378,[illegible] kWh/year

Savings Grouped by Wattage and Bulb Type

Mean kWh/year savings were also calculated based on the Wal-Mart CFL Redeemer and In-Store Purchases survey responses. Based on the eight locations reported from the four wattage categories, the following were the mean energy savings for each category:

Table 5

Mean kWh/year per bulb savings by wattage of bulb replaced and bulb location					
	Wattage of Old Bulb				
Bulb Location	≤ 25	≤ 60	≤ 90	91-[illegible]	Total
basement	23	52	71	83	66
bathroom	8	33	47	58	37
bedroom		32	42	56	37
dining room	11	50	60	81	54
downstairs		59			59
kitchen	21	82	107	141	94
living room	18	83	102	139	100
other		33		54	43

A more detailed table describing frequency of bulb replacement by location and wattage can be found in Appendix 2.

Characteristics of Wal-Mart CFL Promotion Participants

A logit model analysis was also performed on demographic and usage characteristics of the customers participating in the Wal-Mart CFL promotion. The model compared characteristics of participants in the Wal-Mart CFL promotion to a random sample of equal size. The demographics of these customers are presented later in this report. The demographic variables included in the model were:

1. Head of Household Age
2. Family Income Detector

3. Likelihood Home is Owned or Rented
4. Length of Residence in Years
5. Delivery Unit Size
6. Number of Children
7. Number of Named Adults
8. Sale Price of Home
9. Early Internet Adopter Model
10. Wealthfinder Code
11. Revolver Minimum Payment Model

The usage variables included in the model were:

12-23: Electricity usage from 2007. Jan. to Dec.
24. Total sum of monthly usage
25: Average monthly usage (total usage / 12)
26: Summer total usage: sum of monthly usage from June to Sep.
27. Winter total usage: sum of monthly usage from Nov. to Feb.
28: Average summer usage
29: Average winter usage

The model used a log transformation of the dependent variable (participation in the program), and then an OLS (ordinary least squares) regression was run against the independent variables. Based on this model, nine significant drivers were found to affect the likelihood that a customer will participate in the CFL program, at a p value of .05. The significances are shown in the table below. For the distribution of customer characteristics for the significant variables (below), see Appendix 8.

A more negative estimate means a lower value of the parameter indicates a customer who may be interested in participating, while a more positive parameter means a higher value of the variable indicates a customer who may be interested in participating in the program. For example, "head of household age" has a positive estimate (0.7958) suggesting the older the head of household, the more likely a customer would be interested in participating. Meanwhile, "sale price of home" has a negative estimate (-0.00119), suggesting that the lower the sale price of a customer's home, the more likely they are to be interested in participating. Finally, an estimate closer to zero, such as "family income", suggests that even though this variable is important, higher or lower values do not as strongly indicate a customer's willingness to participate in the program.

Table 6. Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr>ChiSq	Standardized Estimate
Intercept	1	-1.6304	0.1053	239.8614	<.0001	
December Usage	1	0.000098	0.000028	11.8677	0.0006	0.0451
Head of Household Age	1	0.7968	0.0621	164.4861	<.0001	0.2103
Family Income	1	1.63E-06	6.42E-07	6.4581	0.011	0.0487

Own Home	1	0.7533	0.0616	149.2984	<.0001	0.1496
"Permanent" Resident	1	0.1275	0.0475	7.2081	0.0073	0.0326
"New" Resident	1	0.1602	0.0478	11.2301	0.0008	0.0405
Number of Adults	1	0.0984	0.0187	27.8287	<.0001	0.0605
Sale price of home	1	-0.00119	0.000272	19.0643	<.0001	-0.0662
Frequency of Internet Use	1	0.0554	0.0121	20.8766	<.0001	0.0824
Revolves Credit Card Payments	1	0.109	0.0537	4.1125	0.0426	0.03

Customers who were more interested in participating tended to exhibit one or more of the following characteristics:

1. **Higher Usage** – Customers who lived in a household with high usage in December were more likely to be interested in participating.
2. **Head of Household Age greater than 57** - Customers who were head of household and 57 or older were more likely to be interested in participating.
3. **Higher Family Income** - Customers with higher household incomes tend to be more interested in participating in the program.
4. **Owning a home** – Customers who owned their home tended to be more interested in participating in the program.
5. **Either a permanent resident or a newcomer** – Customers who had been a resident for 6 years or less, or customers who had been a resident for more than 21 years tended to be more interested in participating in the program.
6. **Higher number of adults in household** – The more adults in a customer's home, the more likely the customer would be interested in participating in the program.
7. **Lower sale price of units** – The lower the sale price of the unit, the more likely that the customer was interested in participating in the program. This indicates that energy efficiency is not a main issue for luxury/expensive homes.
8. **Frequent internet user** – Frequent internet users (suggesting users more familiar with technology) tended to be more interested in participating in the program.
9. **Revolves credit card payment** – Customers who tend to revolve credit card payment were more likely to be interested in participating in the program. (Revolving credit card payments involves making the minimum payment rather than paying in full each month. Customers are ranked from 1 (most likely) to 10 (less likely) based on their raw score for revolving monthly payments.)

Based on this information, there are many ways in which customers could be targeted for this program. For example, anyone who has just created a new account with Duke Energy could be sent an invitation to participate in this program with their confirmation of account or their first bill. Second, neighborhoods with lower sale price of units may also be the location of units with high energy usage, and customers in these neighborhoods were found to be more likely to be interested in participating in the program. Similarly, identification of customers who have a higher family income may also identify customers who have a higher number of adults in their household, both of

which were characteristics of customers who tended to be more interested in participating in the program. These are just some of the ways in which customers could be targeted for future CFL programs.

Section 3: Initial Lighting Logger Study

CFL Placement and Wattage of Bulbs Replaced

Over one third (37.5%) of the bulbs logged were GE brand. Most of the bulbs logged were randomly placed in either the bathroom, kitchen, living room, or one bedroom. Almost one third of the fixtures logged were a ceiling fixture (31.3%). Almost all (80%) of the bulbs logged were incandescent. Over one third of the bulbs logged (38.1%) were 60 watts.

Brand of Logged Bulb – 2007

	Count	%
GE	60	37.5%
Unknown	43	26.9%
Sylvania	24	15.0%
WestH	7	4.4%
Phillips	6	3.8%
Marathon	4	2.5%
Nvision	3	1.9%
DuraMax	2	1.3%
Miser	2	1.3%
Niagra	2	1.3%
Comm Serv	1	.6%
Do It	1	.6%
Greenlite	1	.6%
Mini Spiral	1	.6%
Polaroid	1	.6%
Sunbeam	1	.6%
Supreme	1	.6%
Total	160	100.0%

Location of Bulb – 2007

	Count	%
Bathroom	29	18.1%
Kitchen	23	14.4%
Living Room	22	13.8%
Bedroom 1	21	13.1%
Family Room	15	9.4%
Hall	13	8.1%
Basement	9	5.6%
Bedroom 2	6	3.8%
Office	5	3.1%
Dining Room	3	1.9%
Entryway	3	1.9%
Laundry Room	3	1.9%
Bedroom 3	2	1.3%
Bathroom/Basement	1	.6%
Closet	1	.6%
Front Porch	1	.6%
Master Bedroom Closet	1	.6%
Porch	1	.6%
Rear Entry	1	.6%
Entry Way	0	.0%
Total	160	100.0%

Type of Fixture Logged – 2007

	Count	%
Ceiling	50	31.3%
Table lamp	40	25.0%
Wall	25	15.6%
Ceiling Fan	22	13.8%
Floor lamp	9	5.6%
Ceiling Can	7	4.4%
Track	3	1.9%
Can	1	.6%
Chandelier	1	.6%
End Table	1	.6%

Outdoor Wall	1	.6%
Total	160	100.0%

Wattage – 2007

	Count	%
60	61	38.1%
40	27	16.9%
75	21	13.1%
100	12	7.5%
50-100-150	6	3.8%
13	5	3.1%
23	5	3.1%
65	5	3.1%
25	4	2.5%
14	3	1.9%
26	3	1.9%
30-70-100	2	1.3%
Unknown	2	1.3%
15	1	.6%
50	1	.6%
120	1	.6%
50-75-100	1	.6%
Total	160	100.0%

Bulb Type – 2007

	Count	%
Incandescent	128	80.0%
CFL	17	10.6%
Fluorescent	7	4.4%
Flood	7	4.4%
Candle	1	.6%
Total	160	100.0%

Initial Lighting Logger Study – Premeasure Survey

This survey was given to participants in the November 2007 lighting logger study after the loggers were in place. There were 41 participants in the November lighting logger study, and the same number of surveys returned. This survey was given at the very start of the Wal-Mart CFL promotion.

Performance Ratings

Over half (52.5%) of the participants surveyed stated they received coupons in the mail. As is described in Section 1 and Appendix 6, the mailer contains 4 coupons each good for a 3-pack of GE CFL bulbs. Nearly all of the respondents DID NOT purchase any CFLs with the coupon (91.2%), but only 54.8% state they would have purchased 0 CFLs without the coupon. This suggests that some customers were not motivated by the coupon to purchase CFLs, but were planning on purchasing CFLs regardless of receiving the coupon, possibly at another store.

	No	Yes	Total
Did you receive coupons in the mail from Duke/GE/Wal-Mart for CFL bulbs?	19 47.5%	21 52.5%	40 100.0%

	0	1-2	3	4	5	6	7-11	12+	Total
How many CFLs did you purchase with the coupon?	31 91.2%	1 2.9%	0 .0%	1 2.9%	0 .0%	0 .0%	0 .0%	1 2.9%	34 100.0%

	0	1-2	3	4	5	6	7-11	12+	Total
How many bulbs would you have purchased without the coupon?	17 54.8%	2 6.5%	1 3.2%	0 .0%	0 .0%	3 9.7%	4 12.9%	4 12.9%	31 100.0%

Continued purchase of CFLs after the coupon promotion has ended may be dependent on the actual cost of the CFL. Bulb cost seems to significantly decrease a customer's willingness to purchase a CFL if the bulb costs between $1 and $2 more than a standard bulb. Over twice as many customers will not purchase a bulb that is $2 more than a standard bulb than will not purchase a bulb that is $1 more than a standard bulb. Raising the price to $3 more than a standard bulb does not seem to have an additional significant effect. In addition, about ¾ of customers would be willing to purchase one or more CFLs if the bulbs were free with a mail-in rebate.

How many CFLs would you purchase if they were:

	0	1-2	3	4	5	6	7-11	12+	Total
... the same price as a standard	4	3	0	5	1	3	5	14	35

bulb	11.4%	8.6%	.0%	14.3%	2.9%	8.6%	14.3%	40.0%	100.0%

	0	1-2	3	4	5	6	7-11	12+	Total
... $1.00 more than a standard bulb	5	6	0	4	4	4	4	6	33
	15.2%	18.2%	.0%	12.1%	12.1%	12.1%	12.1%	18.2%	100.0%

	0	1-2	3	4	5	6	7-11	12+	Total
... $2.00 more than a standard bulb	11	5	3	2	2	3	2	4	32
	34.4%	15.6%	9.4%	6.3%	6.3%	9.4%	6.3%	12.5%	100.0%

	0	1-2	3	4	5	6	7-11	12+	Total
... $3.00 more than a standard bulb	14	7	2	2	1	2	0	3	31
	45.2%	22.6%	6.5%	6.5%	3.2%	6.5%	.0%	9.7%	100.0%

	0	1-2	3	4	5	6	7-11	12+	Total
... free with mail-in rebate	8	2	1	2	2	4	3	13	35
	22.9%	5.7%	2.9%	5.7%	5.7%	11.4%	8.6%	37.1%	100.0%

Bulb Installation

Of the customers who bought bulbs, almost 40% state that they did not install any of the bulbs they purchased. Over 2/3 of customers (68%) replaced a standard bulb with a CFL. The most frequent wattage of the bulb replaced was 60 watts.

Of the bulbs you bought:

	0	1-2	3	4	5	6	7-11	12+	Total
How many did you install?	11	4	2	2	1	1	4	4	29
	37.9%	13.8%	6.9%	6.9%	3.4%	3.4%	13.8%	13.8%	100.0%

	No	Yes	Total
Did you replace a standard bulb with a CFL?	8	17	25
	32.0%	68.0%	100.0%

	40	60	75	100 or g	Total
What was the typical wattage of the bulb that was replaced?	2	10	8	1	21
	9.5%	47.6%	38.1%	4.8%	100.0%

No customers stated they changed their usage since installing the CFLs, but one customer stated that his or her usage was decreased.

	No	Yes	Total
Did you change the hours of use since installing the CFLs?	22 100.0%	0 .0%	22 100.0%

	Decrease	Increase	Total
If yes – how did your usage change?	1 100.0%	0 .0%	1 100.0%

Over 40% of customers stated that the bulbs they installed get 3 – 4 average hours of use. Almost all (86.4%) customers did not remove the CFLs they installed, but those that did stated equally that they did not like the light, or had some other concern (42.9% each), with one customer noting the bulb was too slow to start. Although customers did not feel brightness was an issue for them, informing customers either through enclosures with the coupon or in-store advertising about the hotter and cooler shades of CFL bulbs available may help customers to choose a type of CFL light that they prefer.

	<1	1-2	3-4	5-9	10-12	13-24	Total
On average, about how many hours do you use each bulb?	2 9.1%	4 18.2%	9 40.9%	5 22.7%	1 4.5%	1 4.5%	22 100.0%

	No	Yes	Total
Did you remove any of the CFLs you installed?	19 86.4%	3 13.6%	22 100.0%

	0	1-2	3	4	5	6	7-11	12+	Total
If yes, how many did you remove?	7 70.0%	3 30.0%	0 .0%	0 .0%	0 .0%	0 .0%	0 .0%	0 .0%	10 100.0%

	Did not like the light	Not bright enough	Too slow to start	Other	Total
Why did you remove them?	3 42.9%	0 .0%	1 14.3%	3 42.9%	7 100.0%

Of the bulbs purchased, 57.1% of customers stated that they stored 1-2 bulbs for later use.

	1-2	3	4	5	6	7-11	12+	Total

Of the bulbs purchased, how many did you store for a later time?	8	2	1	0	2	0	1	14
	57.1%	14.3%	7.1%	.0%	14.3%	.0%	7.1%	100.0%

95% of customers have NOT bought additional CFLs at retail price since buying CFLs through the Duke Energy program. This suggests that the coupons were a motivating factor in encouraging customers to purchase the CFLs, which is supported by the previous finding that 54.8% of customers would have purchased 0 bulbs without the coupon. As previously stated, the retail price of the CFL as compared to the standard bulb may have had an effect on the customer's willingness to purchase additional bulbs as well. The single customer that did buy additional bulbs purchased 7-11 bulbs.

	No	Yes	Total
Have you bought any CFLs for retail price after buying these CFLs through the Duke program?	23	1	24
	95.8%	4.2%	100.0%

	0	1-2	3	4	5	6	7-11	12+	Total
If yes, how many did you purchase?	0	0	0	0	0	0	1	0	1
	.0%	.0%	.0%	.0%	.0%	.0%	100.0%	.0%	100.0%

	Not at a	Somewhat	Very Sat	Total
Overall, how satisfied are you with the CFLs?	2	7	11	20
	10.0%	35.0%	55.0%	100.0%

Over half (55%) of respondents state that they were very satisfied with the CFLs, and even more respondents (60%) stated that they had CFLs previously in their home. One third (33.3%) of these respondents had 4 CFLs in their home previously.

	No	Yes	Total
Did you have any CFLs in your house before you bought these discounted CFLs?	8	12	20
	40.0%	60.0%	100.0%

	0	1-2	3	4	5	6	7-11	12+	Total
If yes, how many?	0	3	0	4	0	2	1	2	12
	.0%	25.0%	.0%	33.3%	.0%	16.7%	8.3%	16.7%	100.0%

Three quarters of customers (75%) had knowledge of CFLs before receiving the coupon. Over half (55.6%) of customers were planning on buying CFLs before learning of the promotion. A majority of the customers stated that the promotion did not lead them to buy any more CFLs than they were already planning on purchasing.

	No	Yes	Total
Were you aware of CFLs before you received your coupons?	7 25.0%	21 75.0%	28 100.0%

	No	Yes	Total
If yes, were you planning on buying CFLs before you saw the promotion?	12 44.4%	15 55.6%	27 100.0%

	No	Yes	Total
If yes, did the promotion lead you to buy more CFLs than you were planning?	15 65.2%	8 34.8%	23 100.0%

	0	1-2	3	4	5	6	7-11	12+	Total
If yes, how many more did you purchase?	0 .0%	0 .0%	1 25.0%	1 25.0%	0 .0%	1 25.0%	1 25.0%	0 .0%	4 100.0%

General Lighting Characteristics and Usage Estimates

Customers also stated the characteristics of the lighting in their homes, including fixture type, number of fixtures, and hours used. The room lighted most often on average was the kitchen, with an average estimated fixture use of 5.85 hours. The room lighted least often on average was the entryway, with an average estimated fixture use of 1.11 hours.

Descriptive Statistics

	Mean	N	Minimum	Maximum	Std. Deviation
Bathroom Hours	2.73	39	0.5	15	2.64
Bathroom Fixtures	1.75	37	0	6	1.47
Basement Hours	3.20	29	.0	18	3.57
Basement Fixtures	3	27	0	8	2.02
Bedroom Hours 1	2.85	41	0.5	10	2.19
Bedroom Fixtures 1	1.79	38	0	4	0.99
Bedroom Hours 2	2.07	28	0	8	2.20
Bedroom Fixtures 2	1.48	25	1	3	0.65
Bedroom Hours 3	2.36	16	0	8	2.43

Bedroom Fixtures 3	1.5	14	1	3	0.76
Bedroom Hours 4	3.63	8	0	12	4.20
Bedroom Fixtures 4	1.5	8	1	3	0.76
Dining Room Hours	3.55	29	0	15	3.59
Dining Room Fixtures	1.19	26	1	3	0.49
Entryway Hours	3.14	30	0	24	4.44
Entryway Fixtures	1.11	28	0	3	0.50
Hall Hours	2.46	31	0	12	3.03
Hall Fixtures	1.54	28	0	6	1.23
Kitchen Hours	5.85	39	1	24	7.32
Kitchen Fixtures	2.35	37	0	10	2.06
Family Room Hours	5.21	28	0	16	6.65
Family Room Fixtures	3.27	26	0	14	2.96
Porch Hours	4.20	27	0	24	5.93
Porch Fixtures	1.15	26	0	4	0.73
Other Hours 1	4.93	7	0	12	5.10
Other Fixtures 1	1.43	7	0	3	0.98
Other Hours 2		0			
Other Fixtures 2		0			

Hours of Use By Room

Customers were asked to "please state below the number of hours, on average, you use your lighting in the following rooms":

Bathroom:

The bathroom was lighted most frequently for 2 hours (30.8%), with just over half of the bathrooms (54.1%) having one fixture.

Bathroom Fixtures		
Hours Used	Count	%
.5	2	5.1%
1	10	25.6%
2	12	30.8%
3	6	15.4%
3.5	1	2.6%
4	4	10.3%
5	1	2.6%
8	2	5.1%
15	1	2.6%
Total	39	100.0%

Bathroom Fixtures		
Number	Count	%
0	1	2.7%
.25	1	2.7%
1	20	54.1%
2	11	29.7%
5	1	2.7%
5.5	1	2.7%
6	2	5.4%
Total	37	100.0%

Basement:

25.9% of customers stated that they use their basement lighting for two hours. Almost a quarter (24.1%) of customers had one fixture in their basement.

Basement Fixtures		
Number	Count	%
0	2	7.4%
1	4	14.8%
2	7	25.9%
3	5	18.5%
4	3	11.1%
5	3	11.1%
6	1	3.7%
7	1	3.7%
8	1	3.7%
Total	27	100.0%

Basement Fixtures		
Hours Used	Count	%
0	3	10.3%
.25	1	3.4%
.5	4	13.8%
1	7	24.1%
2	2	6.9%
3	1	3.4%
4	2	6.9%
4.5	1	3.4%
5	2	6.9%
6	1	3.4%
7	1	3.4%
8	2	6.9%
12	1	3.4%
13	1	3.4%
Total	29	100.0%

Bedroom 1:
Fixtures in the first bedroom listed were utilized for two hours in nearly one quarter of the cases (24.4%). Almost half of customers (47.4%) only have one fixture in their bedroom.

Bedroom 1		
Number	Count	%
0	1	2.6%
1	18	47.4%
2	9	23.7%
3	8	21.1%
4	2	5.3%
Total	38	100.0%

Bedroom 1		
Hours Used	Count	%
.5	3	7.3%
1	8	19.5%
1.5	3	7.3%
2	10	24.4%
3	5	12.2%
3.5	1	2.4%
4	2	4.9%
4.5	1	2.4%
5	3	7.3%
6	2	4.9%
7	1	2.4%
8	1	2.4%
10	1	2.4%
Total	41	100%

Bedroom 2:
Fixtures in the second bedroom listed were utilized for 1 hour in almost one third of the cases (28.6%). Almost two thirds of customers reported having only one fixture in the second bedroom they listed (60.0%)

Bedroom 2		
Hours Used	Count	%
0	5	17.9%
.5	3	10.7%
1	8	28.6%
1.5	1	3.6%
2	2	7.1%
2.5	1	3.6%
3	1	3.6%
3.5	1	3.6%
4	2	7.1%
6	3	10.7%
8	1	3.6%
Total	28	100.0%

Bedroom 2 Fixtures		
Number	Count	%
1	15	60.0%
2	8	32.0%
3	2	8.0%
Total	25	100.0%

Bedroom 3:
The third bedroom listed by customers was used for one hour by nearly one third of customers (31.3%). Almost two thirds of customers also reported having 1 fixture in the third bedroom listed (64.3%).

Bedroom 3 Fixtures		
Hours Used	Count	%
0	2	12.5%
.25	1	6.3%
.5	1	6.3%
1	5	31.3%
2.5	1	6.3%
3	2	12.5%
3.5	1	6.3%
6	2	12.5%
8	1	6.3%
Total	16	100.0%

Bedroom 3 Fixtures		
Number	Count	%
1	9	64.3%
2	3	21.4%
3	2	14.3%
Total	14	100.0%

Bedroom 4:
The fourth bedroom listed by customers typically had one fixture (63.5%), which was not consistently used for any particular length of time (12.5% for all).

Bedroom 4 Fixtures		
Hours Used	Count	%
0	1	12.5%
.5	1	12.5%
1	1	12.5%
2	1	12.5%
2.5	1	12.5%
3	1	12.5%
8	1	12.5%
12	1	12.5%
Total	8	100.0%

Bedroom 4 Fixtures		
Number	Count	%
1	5	62.5%
2	2	25.0%
3	1	12.5%
Total	8	100.0%

Dining Room:
The dining room was reported to be used between .5 and one hour by 34.4% of respondents (17.2% each). Almost all respondents (84.6%) reported having one fixture in the dining room.

Dining Room Fixtures		
Hours Used	Count	%
0	1	3.4%
.5	5	17.2%
1	5	17.2%
1.5	2	6.9%
2	2	6.9%
3	1	3.4%
4	4	13.8%
5	1	3.4%
5.5	1	3.4%
6	3	10.3%
8	2	6.9%
10	1	3.4%
15	1	3.4%
Total	29	100.0%

Dining Room Fixtures		
Number	Count	%
1	22	84.6%
2	3	11.5%
3	1	3.8%
Total	26	100.0%

Entryway:
Almost a quarter of participants (23.3%) reported using their entryway lighting for one hour. Nearly all participants (85.7%) reported having only one fixture in their entryway.

Entryway Fixtures		
Hours Used	Count	%
.17	1	3.3%
.5	3	10.0%
0	2	6.7%
1	7	23.3%
2	4	13.3%
24	1	3.3%
3	3	10.0%
3.5	1	3.3%
4	4	13.3%
5	2	6.7%
7	1	3.3%
8	1	3.3%
Total	30	100.0%

Entryway Fixtures		
Number	Count	%
0	1	3.6%
1	24	85.7%
2	2	7.1%
3	1	3.6%
Total	28	100.0%

Hall:
Approximately one quarter (25.8%) of customers stated that they use their hall fixtures for one half hour, and just over two thirds of customers reported having one fixture in their hall.

Hall Fixtures		
Hours Used	Count	%
0	1	3.2%
.25	3	9.7%
.5	8	25.8%
1	6	19.4%
2	3	9.7%
3	4	12.9%
4	1	3.2%
4.5	1	3.2%
7	1	3.2%
8	1	3.2%
12	2	6.5%
Total	31	100.0%

Hall Fixtures		
Number	Count	%
0	1	3.6%
1	19	67.9%
2	5	17.9%
4	2	7.1%
6	1	3.6%
Total	28	100.0%

Kitchen:

Respondents' use of kitchen fixtures varied, with 35.8% of customers reporting that they use their fixtures for 2 hours or 6 hours (17.9% each). Over one third of respondents (37.8%) report having one fixture in their kitchen, while almost one third of respondents (29.7%) having two fixtures in their kitchen.

Kitchen Fixtures		
Hours Used	Count	%
1	1	2.6%
1.5	1	2.6%
2	7	17.9%
3	4	10.3%
4	4	10.3%
5	2	5.1%
5.5	1	2.6%
6	7	17.9%
7	2	5.1%
8	4	10.3%
9	1	2.6%
10	2	5.1%
12	1	2.6%
15	1	2.6%
24	1	2.6%
Total	39	100.0%

Kitchen Fixtures		
Number	Count	%
0	1	2.7%
1	14	37.8%
10	1	2.7%
2	11	29.7%
3	6	16.2%
4	2	5.4%
7	1	2.7%
8	1	2.7%
Total	37	100.0%

Family Room:
Approximately two thirds of customers reported having two or three fixtures in their family room (30.8% and 34.6% respectively), and over half (60.7%) of customers report using their family room fixtures between 2 and 6 hours.

Family Room Fixtures		
Hours Used	Count	%
.5	1	3.6%
0	1	3.6%
1	1	3.6%
10	1	3.6%
12	1	3.6%
15	1	3.6%
2	3	10.7%
2.5	1	3.6%
3	3	10.7%
4	4	14.3%
5	3	10.7%
6	3	10.7%
7	1	3.6%
8	2	7.1%
9	2	7.1%
Total	28	100.0%

Family Room Fixtures		
Number	Count	%
0	2	7.7%
1	2	7.7%
2	8	30.8%
3	9	34.6%
5	2	7.7%
6	1	3.8%
10	1	3.8%
14	1	3.8%
Total	26	100.0%

Porch:
Almost one fifth (18.5%) of customers report never using their porch fixture, with a similar number of customers (14.8%) reporting one hour of use. A large number of customers (76.9%) have one fixture on their porch.

Porch Fixtures		
Hours Used	Count	%
0	5	18.5%
.25	2	7.4%
.5	2	7.4%
1	4	14.8%
2	3	11.1%
4	2	7.4%
5	1	3.7%
6	1	3.7%
8	3	11.1%
11	1	3.7%
12	2	7.4%
24	1	3.7%
Total	27	100.0%

Porch Fixtures		
Number	Count	%
0	2	7.7%
1	20	76.9%
2	3	11.5%
4	1	3.8%
Total	26	100.0%

Other Fixtures:
Over one fourth of respondents report using other fixtures for 12 hours, and almost half of participants mentioned one other fixture. These fixtures included "table, driveway, backyard, lamp, overhead, table lamp" and one unnamed, unused fixture.

Other Fixtures		
Hours Used	Count	%
0	1	14.3%
.5	1	14.3%
2	1	14.3%
3	1	14.3%
5	1	14.3%
12	2	28.6%
Total	7	100.0%

Other Fixtures		
Number	Count	%
0	1	14.3%
1	3	42.9%
2	2	28.6%
3	1	14.3%
Total	7	100.0%

Customers were also asked to describe the type of lighting fixture in each room. The question was open-ended, so the responses were wide and varied. The most frequent responses are in the table below.

Bathroom Fixture Type	Wall, Ceiling
Basement Fixture Type	Ceiling
Bedroom 1 Fixture Type	Lamps
Bedroom 2 Fixture Type	Ceiling
Bedroom 3 Fixture Type	Ceiling, Lamps
Bedroom 4 Fixture Type	Lamps

Dining Room Fixture Type	Chandelier
Entryway	Ceiling
Hall	Ceiling
Kitchen	Ceiling
Family Room	Lamps
Porch	Sensor, various
Other Fixture 1	Table, various

General Information About Participant Homes

Most of the participants (63.4%) lived in a detached single family home. Over half (55.3%) of the participants' homes were built before 1959. Almost one third of the participants (30.6%) were unsure of the square footage of their home, with the most frequently reported square footage value being less than 1200 square feet (19.4%). Over half (60%) of the participants had one or two people living in their home. Three quarters of the homes (75%) use a central heating system, while almost two thirds of participants' homes (65.9%) use a central cooling system. Three quarters of participants use gas to heat their homes (75%), while even more participants (82.9%) use electric to cool their homes. Finally, almost two thirds (65.9%) of participants stated that they own their home rather than rent.

	Apartment	Condominium	Detached single family	Manufactured home	Townhouse	Total
How would you best describe the type of house in which you live?	7	4	26	2	2	41
	17.1%	9.8%	63.4%	4.9%	4.9%	100.0%

	Before 1959	1960-1979	1980-1989	1990-1997	1998 - 2000	2001 or later	Total
In what year was your home built?	21	8	6	1	0	2	38
	55.3%	21.1%	15.8%	2.6%	.0%	5.3%	100.0%

	< 1200	1201-1600	1601 - 1900	1901-2400	2401 - 3000	>=3001	Don't know	Total
What is the approximate square footage (heated area) of your home?	7	6	5	4	0	3	11	36
	19.4%	16.7%	13.9%	11.1%	.0%	8.3%	30.6%	100.0%

	1	2	3	4	5	6	7	8 or more	Total
How many people live in your home?	12	12	3	6	7	0	0	0	40
	30.0%	30.0%	7.5%	15.0%	17.5%	.0%	.0%	.0%	100.0%

	Central	Electric	Geo-thermal	Heat pump	Other	Total
Type of heating system?	30	3	0	3	4	40
	75.0%	7.5%	.0%	7.5%	10.0%	100.0%

	Central	Geo-thermal	Heat pump	Window unit	Other	Total
Type of cooling system?	27	0	2	10	2	41
	65.9%	.0%	4.9%	24.4%	4.9%	100.0%

	Electric	Gas	Other	Total
Primary heating fuel?	9	30	1	40
	22.5%	75.0%	2.5%	100.0%

	Electric	Gas	Other	Total
Primary cooling fuel?	34	5	2	41
	82.9%	12.2%	4.9%	100.0%

	Own	Rent	Total
Do you own or rent your home?	27	14	41
	65.9%	34.1%	100.0%

Section 4: Wal-Mart CFL Promotion – Redeemer Survey

This survey focused on customers who, according to program tracking records, did redeem Wal-Mart CFL coupons that they received. The survey was mailed out to 1000 customers who redeemed Wal-Mart CFL coupons. 576 surveys were returned, for a 57.6% response rate.

Nearly all customers responding to the survey (99.5%) recall receiving CFL coupons in the mail. Similarly, almost all the customers did not give their coupons away (97.9%), and did use at least one coupon themselves (98.2%).

	Yes	No	Total
Do you recall receiving CFL bulb coupons from Duke Energy, for use in Wal-Mart GE bulbs?	568	3	571
	99.5%	.5%	100.0%

	Yes	No	Total
Did you give all of your coupons to someone else to use?	12	549	561
	2.1%	97.9%	100.0%

	Yes	No	Total
Did you use at least one coupon?	560	10	570
	98.2%	1.8%	100.0%

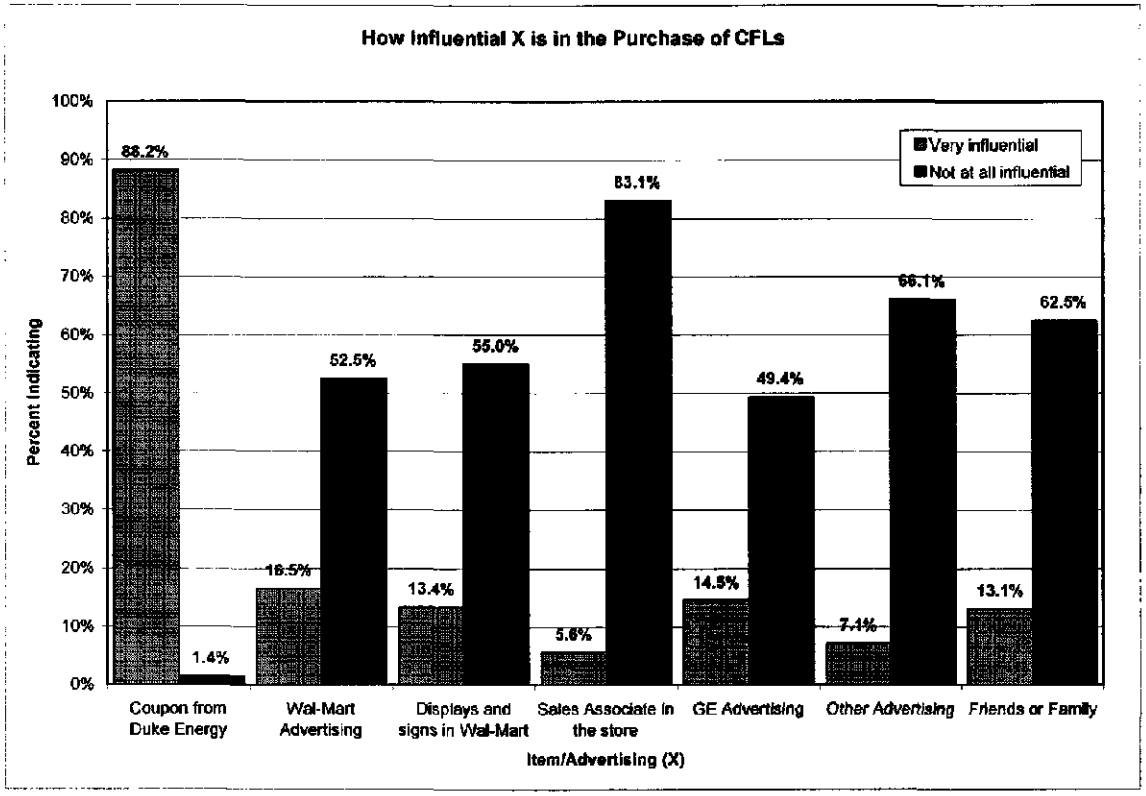
Customers found receiving the coupon from Duke Energy to be the most influential in their decision to purchase CFLs (88.2%). Over half of the customers did not find advertising, including Wal-Mart advertising, in-store advertising, sales associates, GE advertising, other advertising, and the influence of friends/family, to be influential in their decision, and rated these categories as not at all influential. The table below presents the responses, and Figure 1 shows which are not at all influential, and which were very influential in their purchase decisions.

How influential were the following in your decision to purchase CFL(s)?

	Very influential	Somewhat influential	Not at all influential	Total
Coupon from Duke Energy	491	58	8	557
	88.2%	10.4%	1.4%	100.0%
Wal-Mart Advertising	80	151	255	486
	16.5%	31.1%	52.5%	100.0%

Displays and signs in Wal-Mart	64	151	263	478
	13.4%	31.6%	55.0%	100.0%
Sales Associate in the store	26	52	384	462
	5.6%	11.3%	83.1%	100.0%
GE Advertising	68	170	232	470
	14.5%	36.2%	49.4%	100.0%
Other Advertising	33	125	308	466
	7.1%	26.8%	66.1%	100.0%
Friends or Family	62	116	297	475
	13.1%	24.4%	62.5%	100.0%

Figure 1. Influences on the Purchase of CFLs



CFL Installation

Customers purchased between 1 and 4 packs of CFLs, with the most customers stating that they purchased 2 packs (32.0%). With three bulbs in a pack, the majority of customers purchased between 6 and 10 bulbs in total (47.8%). A majority of customers state that they would not have bought any CFLs without the coupon (52.8%), and an even larger number of customers (69.8%) state that they have not purchased any additional CFLs since using the coupon. These two statements corroborate the previous statement made by customers that receiving the coupon in the mail was most influential in a participant's decision to purchase CFLs.

	0	1	2	3	4	5	6-10	11+	Total
How many CFL packs did you purchase with the Duke Energy Coupon?	0	82	180	131	108	7	45	9	562
	.0%	14.6%	32.0%	23.3%	19.2%	1.2%	8.0%	1.6%	100.0%

	0	1	2	3	4	5	6-10	11+	Total
How many CFL bulbs did you purchase in total?	1	8	30	66	40	11	266	134	556
	.2%	1.4%	5.4%	11.9%	7.2%	2.0%	47.8%	24.1%	100.0%

	0	1	2	3	4	5	6-10	11+	Total
How many CFL bulbs would you have bought without the coupon?	292	46	71	60	26	12	33	13	553
	52.8%	8.3%	12.8%	10.8%	4.7%	2.2%	6.0%	2.4%	100.0%

	0	1	2	3	4	5	6-10	11+	Total
How many CFL bulbs have you since purchased without coupons?	392	29	48	22	26	10	25	10	562
	69.8%	5.2%	8.5%	3.9%	4.6%	1.8%	4.4%	1.8%	100.0%

Close to one third of customers (29.7%) state that they currently have 6-10 CFLs installed in their homes. Nearly all customers state that they have not changed their hours of use since installing the CFLs (92.7%). Those that did change their usage state that their usage tended to increase (71.4%). Almost all customers have left their CFLs installed in their home (93.7%), and those that did remove bulbs on average removed 1-2 bulbs (86.7%).

	0	1	2	3	4	5	6-10	11+	Total
How many CFLs are now installed?	25	27	72	92	79	42	166	56	559
	4.5%	4.8%	12.9%	16.5%	14.1%	7.5%	29.7%	10.0%	100.0%

	Yes	No	Total
Did you change the hours of use since installing the CFLs?	37	472	509
	7.3%	92.7%	100.0%

	Increased usage	Decreased usage	Total
If yes, how did your usage change?	25	10	35

	71.4%	28.6%	100.0%

	Yes	No	Total
Have you removed any of the CFLs you installed?	32	474	506
	6.3%	93.7%	100.0%

	1-2	3	4	5	6	7-11	12+	Total
If yes, how many did you remove?	26	2	1	1	0	0	0	30
	86.7%	6.7%	3.3%	3.3%	.0%	.0%	.0%	100.0%

Customers most frequently stated that they removed the CFLs they installed because the light was not bright enough. The second most frequent response was that the bulbs did not work at all or did not work with a particular fixture type. Although customers stated that in-store and other advertising was not influential in their decision to purchase CFLs, these reasons for removing the CFLs suggest that some type of additional education regarding how to choose a CFL that is at the level of brightness that the customer prefers, as well as how to choose a type of CFL that is appropriate for a particular fixture, may encourage these customers to reconsider purchasing CFLs.

Why did you remove them?		Count
	Bulb broke	1
	Light flickered	2
	Burned out replaced	4
	changed 60 to 75 to make brighter	1
	did not like the light it gave off compared to regular light	1
	Bulbs did not work/Bulbs did not work with my type of fixture	7
	Not bright enough	9
	how do i dispose	1
	I plan to remove the basement light because i do not like the type of light	1
	Installed 50 first 2 wouldn't dim so I took them out	1
	removed am radio static	1
	Too bright	1

About half of the customers stated that they had CFLs in their house previously, and half stated that they did not have CFLs in their house previously. Of those that did have CFLs in their home, almost 40% had just 1-2 bulbs, while the rest of the customers were using anywhere from 3 to more than 12 bulbs.

	Yes	No	Total
Did you have any CFLs in your house before you bought these discounted CFLs?	248	271	519

	47.8%	52.2%	100.0%

	1-2	3	4	5	6	7-11	12+	Total
If yes, how many?	94	38	30	17	21	31	16	247
	38.1%	15.4%	12.1%	6.9%	8.5%	12.6%	6.5%	100.0%

Overall, customers are very satisfied with their CFLs (76.4%). Approximately half of the customers had never purchased a CFL before receiving the coupon (49.8%), again suggesting that receiving the coupon in the mail may be a strong motivating factor in the decision to purchase a CFL.

	Very satisfied	Somewhat satisfied	Not at all satisfied	Total
Overall, how satisfied are you with the CFLs?	391	108	13	512
	76.4%	21.1%	2.5%	100.0%

	Never purchased a CFL until now	A year ago	2 to 3 years ago	4 or more years ago	Total
How long have you been using CFL light bulbs?	256	134	82	42	514
	49.8%	26.1%	16.0%	8.2%	100.0%

Energy Star Awareness

Over three quarters of customers state that they do not use the Duke Energy website (76.1%). A similar number of customers (76.4%) state that they have not added any electrical appliances in the past year. 50.6% of respondents state that they are aware of ENERGY STAR, but 50.6% of respondents also state that they do not look for the ENERGY STAR label when purchasing an appliance.

	Often	Sometimes	Never	Total
Do you use the Duke Energy website?	18	106	395	519
	3.5%	20.4%	76.1%	100.0%

	Yes	No	Total
Have you added any electrical appliances to your home in the past year?	121	392	513
	23.6%	76.4%	100.0%

	Yes	No	Total
Are you aware of ENERGY STAR?	256	250	506
	50.6%	49.4%	100.0%

	Yes	No	Total
Do you look for the ENERGY STAR label when purchasing an appliance?	244	250	494
	49.4%	50.6%	100.0%

General Information About Redeemers' Homes

Most customers who used the CFL coupons live in a detached single-family home. These customers also tend to live in homes that were built before 1980 (33.7% before 1959, 29.7% 1960-1979). Customers' home size varied widely, with the fewest number of customers living in a home greater than 3000 square feet (4.3%).

	Detached single-family	Townhouse	Condominium	Duplex/2-family	Apartment	Manufactured home	Multi-Family (3 or more units)	Total
How would you best describe the type of home in which you live?	406	10	43	10	24	16	12	521
	77.9%	1.9%	8.3%	1.9%	4.6%	3.1%	2.3%	100.0%

	Before 1959	1960-1979	1980-1989	1990-1997	1998-2000	After 2001	Total
In what year was your home built?	174	153	66	48	38	37	516
	33.7%	29.7%	12.8%	9.3%	7.4%	7.2%	100.0%

	Less than 1200	1201-1600	1601-1900	1901-2400	2401-3000	Greater than 3000	Don't know	Total
What is the approximate square footage (heated area) of your home?	67	106	69	98	61	22	87	510
	13.1%	20.8%	13.5%	19.2%	12.0%	4.3%	17.1%	100.0%

Participants who purchased CFLs tended to have at least completed high school, with one quarter of customers having graduated college, and about 12% of customers having completed a graduate degree. Almost half of the customers surveyed were 65 years old or older. Over a third of the respondents stated their household income was between $25,000 and $50,000, while approximately one quarter of customers stated their income was over $75,000. Over half of customers had two people living in their home (54.9%), and nearly all of the respondents stated that they own their home (90.1%).

	Some high school	Completed high school	Some college	Graduated college	Some grad school	Grad school degree	Total
Last year of schooling?	25	169	113	130	14	61	512
	4.9%	33.0%	22.1%	25.4%	2.7%	11.9%	100.0%

	18 to 35	36 to 45	46 to 55	56 to 65	65 or over	Total
What range best describes your age group?	39	55	107	118	241	560
	7.0%	9.8%	19.1%	21.1%	43.0%	100.0%

	Less than 25000	25000 to 50000	50000 to 75000	Over 75000	Total
What range best describes your household income?	94	193	97	132	516
	18.2%	37.4%	18.8%	25.6%	100.0%

	1	2	3	4	5	6	7	more than 7	Total
How many people live in your home?	115	306	70	49	12	3	2	0	557
	20.6%	54.9%	12.6%	8.8%	2.2%	.5%	.4%	.0%	100.0%

	Own	Rent	Total
Do you own or rent your home?	500	55	555
	90.1%	9.9%	100.0%

A large number of participants had a central furnace (78.0%) and central air (76.6%). Over half of participants stated that their primary heating fuel was gas (64.0%), while nearly all of the customers (93.5%) use electric as their primary cooling fuel.

	Central furnace	Electric baseboard	Heat pump	Geo-thermal	Other	Total
Type of heating system?	432	15	84	2	21	554
	78.0%	2.7%	15.2%	.4%	3.8%	100.0%

	Central air	Window/Room unit air conditioner	Heat pump	Geo-thermal	Other	No cooling system	Total
Type of cooling system?	430	60	61	2	3	5	561
	76.6%	10.7%	10.9%	.4%	.5%	.9%	100.0%

	Electric	Gas	Other	Total
Primary heating fuel?	142	357	59	558
	25.4%	64.0%	10.6%	100.0%

	Electric	Gas	Other	Total
Primary cooling fuel?	507	26	9	542
	93.5%	4.8%	1.7%	100.0%

Wal-Mart CFL Non-Redeemer Survey

This survey focused on customers who according to program tracking records did not redeem CFL coupons, and was mailed out to 1000 respondents who did not redeem coupons. 302 surveys were returned, for a 30.2% response rate.

Awareness of Advertising

42.3% of respondents do not remember receiving any CFL coupons, and of those who did receive the coupons, 78.0% stated that they did not use any of the coupons. Nearly half of customers stated that they had heard about the CFL program (49.6%). Almost 40% of customers stated that they did not redeem the coupons because they do not shop at Wal-Mart (37.7%). These customers might be interested in participating in a CFL program located at another store.

	YES	NO	Total
Do you recall ever receiving CFL coupon?	169	124	293
	57.7%	42.3%	100.0%

	NO	YES	Total
Did you use any of these coupons?	216	61	277
	78.0%	22.0%	100.0%

	YES	NO	Total
Had you heard anything about the CFL coupons from Duke Energy, for use in Wal-Mart for GE bulbs?	128	130	258
	49.6%	50.4%	100.0%

	Too much hassle	Do not use CFLs	Do not shop at WalMart	Did not understand program	Thought there was a catch	Couldn't be bothered	Other	Total
Why did you decide NOT to use these coupons?	4	10	52	10	6	0	56	138
	2.9%	7.2%	37.7%	7.2%	4.3%	.0%	40.6%	100.0%

Summary of text of "Other" write-in responses Note: some customers included multiple responses.		
	No response	241
	Already had enough bulbs/already had CFLs	17
	CFL seemed to affect grandsons epilepsy condition	1
	Coupons expired	7
	Unable or unwilling to shop at Wal-Mart	3
	Did not receive any coupons/Unaware of program	12
	Do not like fluorescent lighting	1
	Expense/cost/hidden cost	6
	Forgot about the coupons	2
	Lost coupon	4
	Out of stock	3

Risk of Mercury Contamination	2
Unable to go to store/haven't had time to shop	3
Try not to buy merchandise made in China	1
Total	303

Over half of participants stated that the CFL coupons neither increased their awareness of how to save energy using CFLs (50.7%), nor inspired them to purchase CFLs somewhere else without the coupon (65.5%). This reflects the findings of the redeemer survey that the CFL coupon itself, and the associated discount are the most influential factors in a customer's decision to purchase the CFLs. Of those who did purchase bulbs elsewhere, almost one third purchased 4 bulbs (31.6%).

	Yes	NO	Somewhat	Total
Did the CFL coupons increase your awareness of how you could save energy by using CFL bulbs?	45	73	26	144
	31.3%	50.7%	18.1%	100.0%

	NO	YES	Total
Did the CFL bulb coupons inspire you to purchase CFL bulbs without using the coupon somewhere else?	95	50	145
	65.5%	34.5%	100.0%

	1	2	3	4	5	6	More than 6	Total
If yes, how many did you buy without the coupon?	4	3	10	18	4	10	8	57
	7.0%	5.3%	17.5%	31.6%	7.0%	17.5%	14.0%	100.0%

For those respondents who purchased bulbs without the coupon, the coupon from Duke Energy and other advertising were found to be "somewhat influential" (42.2% and 44.9% respectively). Nearly all did not find Wal-Mart advertising or displays/signs in Wal-Mart to be influential (81.3% and 86.1% respectively), possibly because they purchased bulbs at a store other than Wal-Mart. An even greater number did not find the sales associate at the store to be influential (94.9%).

How influential were the following in your decision to purchase CFL(s) without the coupon?

	Very Influential	Somewhat Influential	Not at all Influential	Total
The coupon from Duke Energy	24	38	28	90
	26.7%	42.2%	31.1%	100.0%
Wal-Mart advertising	4	11	65	80
	5.0%	13.8%	81.3%	100.0%
Displays and signs in Wal-Mart	6	5	68	79
	7.6%	6.3%	86.1%	100.0%
Sales Associate at the store	2	2	75	79
	2.5%	2.5%	94.9%	100.0%

GE advertising	10	30	41	81
	12.3%	37.0%	50.6%	100.0%
Other advertising	18	40	31	89
	20.2%	44.9%	34.8%	100.0%
Friends or family	19	31	35	85
	22.4%	36.5%	41.2%	100.0%

Almost 1/3 of respondents stated that they have 0 CFLs in their house (29.1%). Of those who do have CFLs in their house, nearly 20% of customers state that they have 6 to 10 CFLs in their house. The high number of installed bulbs reflects customers' earlier statements that they did not purchase bulbs using the coupons because they already had enough bulbs in their home.

	0	1	2	3	4	5	6-10	11+	Total
How many CFLs are in your house?	76	19	36	22	22	16	52	18	261
	29.1%	7.3%	13.8%	8.4%	8.4%	6.1%	19.9%	6.9%	100.0%

	Very Satisfied	Somewhat Satisfied	Not at all Satisfied	Total
Overall, how satisfied are you with the CFLs?	104	77	16	197
	52.8%	39.1%	8.1%	100.0%

	Never	3-6 months	6-9 months	9-12 months	1-2 years ago	2-3 years ago	More than 3 years ago	Total
How long have you been using CFL light bulbs?	63	72	35	17	31	17	15	250
	25.2%	28.8%	14.0%	6.8%	12.4%	6.8%	6.0%	100.0%

Energy Star Awareness

Almost two thirds of customers (61.1%) have not added any electrical appliances to their homes, but a large number of those that have state that the appliances are energy efficient (85.3%). Over half of respondents state that they are aware of ENERGY STAR (59.2%), and over half of customers look for the ENERGY STAR label when purchasing an appliance (57.9%). Nearly equal numbers of participants state that they have never used the Duke Energy website (70.1%) and do not feel that Duke Energy has influenced them to use energy efficient products (70.0%). The responses to these questions are similar to the responses given in the Wal-Mart CFL Redeemer survey.

	YES	NO	Total
Have you added any electrical appliances to your home in the past year?	103	162	265
	38.9%	61.1%	100.0%

	YES	NO	Total

If yes, are the appliances energy efficient?	87	15	102
	85.3%	14.7%	100.0%

	YES	NO	Total
Are you aware of ENERGY STAR?	157	108	265
	59.2%	40.8%	100.0%

	YES	NO	Total
Do you look for the ENERGY STAR label when purchasing an appliance?	147	107	254
	57.9%	42.1%	100.0%

	Often	Sometimes	Never	Total
Do you use the Duke Energy website?	22	58	188	268
	8.2%	21.6%	70.1%	100.0%

	YES	NO	Total
Has Duke Energy influenced your decision to purchase energy efficient products?	60	140	200
	30.0%	70.0%	100.0%

General Information About Non-Redeemers' Homes

Almost three quarters of respondents (75%) live in a detached single family home. Nearly one third of participants stated that their home was built before 1959 (32.7%). Approximately 20.4% of customers state that their home is between 1500 and 1999 square feet in heated area.

	Detached single-family	Mobile Home	Condo	Duplex/2-family	Multi-Family	Townhouse	Total
How would you describe the type of home in which you live?	200	4	20	17	25	6	272
	73.5%	1.5%	7.4%	6.3%	9.2%	2.2%	100.0%

	Before 1959	1960-1979	1980-1989	1990-1997	1998-2000	2001-2007	Don't know	Total
In what year was your home built?	89	76	24	25	12	25	21	272
	32.7%	27.9%	8.8%	9.2%	4.4%	9.2%	7.7%	100.0%

	Less than 500	500-999	1000-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	4000 or more	Don't know	Total
What is the approximate square footage (heated area) of your home?	2	25	49	54	37	32	14	7	7	38	265
	.8%	9.4%	18.5%	20.4%	14.0%	12.1%	5.3%	2.6%	2.6%	14.3%	100.0%

70.7% of customers stated that they have completed high school, had some college, and/or graduated college. Nearly one quarter of those surveyed were 65 years old or older. Nearly 40% of participants stated they make over $75,000 in combined household income. Almost one half (44.3%) of participants had two people living in their home, and 83.5% stated that they own their home.

	Some high school	Completed high school	Some College	Graduated college	Some grad school	Grad school degree	Total
Last year of schooling?	13	56	63	72	21	45	270
	4.8%	20.7%	23.3%	26.7%	7.8%	16.7%	100.0%

	18-35	36-45	46-55	56-65	65 or over	Total
What range best describes your age group?	48	46	55	56	67	272
	17.6%	16.9%	20.2%	20.6%	24.6%	100.0%

	Less than 25000	25000-50000	50000-75000	Over 75000	Total
What range best describes your combined household income?	35	65	50	96	246
	14.2%	26.4%	20.3%	39.0%	100.0%

	1	2	3	4	5	6	7	More than 7	Total
How many people live in your home?	62	121	38	29	15	8	0	0	273
	22.7%	44.3%	13.9%	10.6%	5.5%	2.9%	.0%	.0%	100.0%

	Own	Rent	Total
Do you own or rent your home?	228	45	273
	83.5%	16.5%	100.0%

A large number of respondents (71.8%) use a central furnace for heat, and a larger number (76.3%) use central air for cooling. Almost two thirds of participants use gas as their primary heating fuel (60.2%) and a very large number of customers (89.0%) use electric as their primary cooling fuel.

	Central furnace	Electric baseboard	Heat pump	Geo-thermal Heat Pump	Hot water or steam boiler	Other	Total
Type of heating system?	199	18	32	2	19	7	277
	71.8%	6.5%	11.6%	.7%	6.9%	2.5%	100.0%

	Central air	Window/Room unit air conditioner	Heat pump	Geo-thermal Heat Pump	Other	No cooling system	Total
Type of cooling system?	209	33	22	1	1	8	274
	76.3%	12.0%	8.0%	.4%	.4%	2.9%	100.0%

	Electric	Gas	Oil	Propane	Other	Total
Primary heating fuel?	78	157	9	10	7	261

	29.9%	60.2%	3.4%	3.8%	2.7%	100.0%

	Electric	Gas	Other	Total
Primary cooling fuel?	218	24	3	245
	89.0%	9.8%	1.2%	100.0%

Final Lighting Logger Study

CFL Placement and Wattage of Bulbs Replaced

About three quarters (75.4%) of bulbs logged were GE brand. Just over one quarter (27.6%) of the bulbs logged were in table lamps, with one quarter of bulbs installed in a ceiling fixture (25.1%). Nearly one fourth of bulbs were 13 watts (22.6%), and almost equal numbers of CFLs (44.7%) and incandescents (43.7%) were logged. The most frequent locations for logged bulbs were bathroom, kitchen, living room, and family room. The higher frequencies of GE brand bulbs, CFL bulbs, and low-watt bulbs is likely due to the characteristics of the Wal-Mart CFL Promotion, which featured GE brand CFLs.

Brand of Logged Bulb – 2008

	Count	%
GE	150	75.4%
Phillips	21	10.6%
Sylvania	12	6.0%
Unknown	7	3.5%
Nvison	4	2.0%
Lights of America	2	1.0%
Feit	1	.5%
Halco	1	.5%
Satco	1	.5%
Total	199	100.0%

Type of Fixture Logged - 2008

	Count	%
Table Lamp	55	27.6%
Ceiling	50	25.1%
Wall Light	44	22.1%
Ceiling Fan	20	10.1%
Floor	18	9.0%
Under Cabinet	7	3.5%
Can	2	1.0%
Desk Lamp	1	.5%
Torchier	1	.5%
Track	1	.5%
Total	199	100.0%

Wattage of Logged Bulb – 2008

	Count	%
13	45	22.6%
60	31	15.6%
40	27	13.6%
23	15	7.5%
26	13	6.5%
20	11	5.5%
75	11	5.5%
25	10	5.0%
100	10	5.0%
50-100-150	9	4.5%

Bulb Type – 2008

	Count	%
CFL	89	44.7%
Flood	5	2.5%
Fluorescent	18	9.0%
Incandescent	87	43.7%
Total	199	100.0%

15	3	1.5%
30	2	1.0%
50	2	1.0%
150	2	1.0%
12-23-29	2	1.0%
10	1	.5%
14	1	.5%
32	1	.5%
45	1	.5%
120	1	.5%
12-23-32	1	.5%
Total	199	100.0%

Location of Bulb - 2008		
	Count	%
Bathroom	46	23.1%
Kitchen	36	18.1%
Living Room	32	16.1%
Family Room	28	14.1%
Bedroom 1	15	7.5%
Dining Room	11	5.5%
Hall	8	4.0%
Laundry Room	8	4.0%
Office/Den	8	4.0%
Basement	2	1.0%
Bedroom 2	2	1.0%
Closet	1	.5%
Play Room	1	.5%
Workout/Gym	1	.5%
Total	199	100.0%

Section 5: Wal-Mart In-Store Purchases Survey

This evaluation is based on surveys conducted with customers who were mailed a Wal-Mart CFL coupon in the mail. According to program tracking records, these customers redeemed Wal-Mart CFL coupons. Customers received $10 for filling out the survey.

The survey was mailed out to 1,000 customers that received the coupons. There were 583 responses received for a 58.3% response rate.

Awareness of Advertising

	Yes	No	Total
Do you recall receiving CFL bulb coupons from Duke Energy, for use in Wal-Mart?	565	7	572
	98.8%	1.2%	

	Yes	No	Total
Did you give all of your coupons to someone else to use?	32	520	552
	5.8%	94.2%	

	Yes	No	Total
Did you use at least one coupon?	552	19	571
	96.7%	3.3%	

Customers found receiving the coupon from Duke Energy to be the most influential in their decision to purchase CFLs (83.2% very influential). This is the same result as was found in both the Wal-Mart CFL Redeemer and Non-Redeemer surveys. More than half of the customers found the other program marketing methods "not influential at all", including advertising, etc., at Wal-Mart, as well as other advertising methods and friends/family.

How influential were the following in your decision to purchase CFL(s)?

	Very influential	Somewhat influential	Not at all influential	Total
The coupon from Duke Energy	454	87	5	546
	83.2%	15.9%	.9%	
Wal-Mart Advertising	85	140	233	458
	18.6%	30.6%	50.9%	

Display and signs in Wal-mart	56	146	250	452
	12.4%	32.3%	55.3%	
Sales Associate at the store	22	33	391	446
	4.9%	7.4%	87.7%	
GE Advertising	70	155	229	454
	15.4%	34.1%	50.4%	
Other Advertising	52	99	297	448
	11.6%	22.1%	66.3%	
Friends or Family	71	107	281	459
	15.5%	23.3%	61.2%	

Additional Purchases from Wal-Mart

Almost all customers (90.6%) who shopped for the CFLs at Wal-Mart already shop at that store, and a slightly lower number (82.9%) shopped there soon after redeeming the coupon, with over half (54.3%) making 1 to 2 visits per month. Overall, the frequency of customers' visits to Wal-Mart before and after participating in the Wal-Mart CFL Light Bulb Program are similar. Most participants (88.1%) bought other items from Wal-Mart while they were shopping for their CFLs, and nearly all of those spent $10 or more.

	Never	1-2	3-4	5 or more	Total
How often did you visit a Wal-Mart store before your recent visit to redeem the CFL coupon?	52	293	128	85	558
	9.3%	52.5%	22.9%	15.2%	

	Yes	No	Total
Did you purchase additional items on your visit to Wal-Mart?	480	65	545
	88.1%	11.9%	

	< $10	$10-25	$26-50	>$50	Total
If yes, What was the estimated amount you spent on those additional items?	36	175	161	121	493
	7.3%	35.5%	32.7%	24.5%	

	Yes	No	Total

Have you returned to Wal-Mart since redeeming the CFL coupon?	344	71	415
	82.9%	17.1%	

	1-2	3-4	5 or more	Total
If yes, How many visits a month?	261	143	77	481
	54.3%	29.7%	16.0%	

Use of CFL packs

Almost half (46.8%) of the participants purchased between 6 and 10 CFLs with the coupon, and a similar number state they would have purchased no bulbs without the coupon. These results coincide with the results of the Wal-Mart CFL Redeemer survey.

	0	1	2	3	4	5	6-10	11+	Total
How many CFL packs did you purchase with the Duke Energy coupon?	0	85	167	149	109	12	27	9	558
	0%	15.2%	29.9%	26.7%	19.5%	2.2%	4.8%	1.6%	
How many CFL bulbs did you purchase in TOTAL?	1	13	20	65	53	10	260	134	556
	.2%	2.3%	3.6%	11.7%	9.5%	1.8%	46.8%	24.1%	
How many CFL bulbs would you have bought without the coupon?	268	69	72	53	36	6	33	17	554
	48.4%	12.5%	13.0%	9.6%	6.5%	1.1%	6.0%	3.1%	
How many CFL bulbs have you purchased without coupons?	386	34	43	28	26	6	25	10	558
	69.2%	6.1%	7.7%	5.0%	4.7%	1.1%	4.5%	1.8%	

Just over one third of respondents (33.9%) installed between 6 and 10 CFL bulbs, and 90% of participants have not removed the CFLs they installed. Of those who did remove the bulbs they installed, many stated that the type or brightness of light was also a factor. In addition, many customers also experienced some type of defective bulb. Again, some type of education regarding the different types of CFLs as well as the different levels of brightness and types of lighting available may encourage customers to continue to use CFLs in the future.

Of the bulb packs you bought with Duke Energy/Wal-Mart coupons:

	0	1	2	3	4	5	6-10	11+	Total
How many CFLs are now	17	36	65	77	70	39	189	65	558

installed?	3.0%	6.5%	11.6%	13.8%	12.5%	7.0%	33.9%	11.6%	

	Yes	No	Total
Did you change the hours of use since installing the CFLs?	50	470	520
	9.6%	90.4%	

	Increase	Decrease	Total
If yes, how did your usage change?	35	20	55
	63.6%	36.4%	

	Yes	No	Total
Have you removed any of the CFLs you installed?	52	466	518
	10.0%	90.0%	

	1-2	3	4	5	6	7-11	12+	Total
If yes, How many did you remove?	39	5	4	2	4	2	2	58
	67.2%	8.6%	6.9%	3.4%	6.9%	3.4%	3.4%	

Why did you remove them?

	Frequency
CHANGED READING LAMP	1
DEFECTIVE	1
Flickering and dimming. Not functioning properly.	1
LAMP SHADE WOULD NOT HOLD BULB	1
Less desirable light for reading.	1
Light too bright when looking at it. Also made horrible buzz in ceiling fan fixture.	1
light was too yellow.	1
NOT BRIGHT ENOUGH FOR OLDER PERSON	1
noticed brown stain on light bulb	1
One burnt out the other has low lighting.	1
Replaced 60 with 75 because the 60 was not enough light	1
Stopped working	1
Switched sizes in ceiling fan to shorter length bulbs.	1
They did please me Too long for shades	1
TOO LARGE FOR LIGHT FIXTURE	1
Unsatisfactory	1
Wanted to use dimmer.	1
Would not work/Didn't turn on	2

Burnt Out	10

Just over half of the customers responding stated they did not have any CFLs in their house before they bought these bulbs. Almost three quarters of customers are "very satisfied" with their CFLs (70.5%), and almost half of customers (47.3%) had not been using CFLs before now.

	Yes	No	Total
Did you have any CFLs in your house before you bought these discounted CFLs?	250	281	531
	47.1%	52.9%	

	1-2	3	4	5	6	7-11	12+	Total
If yes, about how many?	96	41	40	17	27	19	15	255
	37.6%	16.1%	15.7%	6.7%	10.6%	7.5%	5.9%	

	Very Satisfied	Somewhat Satisfied	Not at All Satisfied	Total	Mean
Overall, how satisfied are you with the CFLs?	375	146	11	532	2.7
	70.5%	27.4%	2.1%		

	Never before now	A year ago	2-3 years ago	4 or more years ago	Total
How long have you been using CFL light bulbs?	248	141	99	36	524
	47.3%	26.9%	18.9%	6.9%	100.0%

Energy Star Awareness

Almost three quarters of customers stated that they never use the Duke Energy website (71.6%) and have not added any electrical appliances to their home in the past year (72.9%). Over half of the customers are aware of ENERGY STAR (57.8%) and look for the ENERGY STAR label when purchasing an appliance (54.0%). These responses are similar to those given by customers responding to the Wal-Mart CFL Redeemer survey.

	Often	Sometimes	Never	Total
Do you use the Duke Energy Website?	42	114	394	550
	7.6%	20.7%	71.6%	

	Yes	No	Total

Have you added any electrical appliances to your home in the past year?	151 27.1%	406 72.9%	557

	Yes	No	Total
Are you aware of ENERGY STAR?	319 57.8%	233 42.2%	552

	Yes	No	Total
Do you look for the ENERGY STAR label when purchasing an appliance?	288 54.0%	245 46.0%	533

General Information about Responders' Homes

Almost all respondents live in a detached single family home (79.2%). Almost two thirds of customers state that their home was built in 1979 or earlier (65.7%). Just over one fifth of customers (22.4%) have a square footage between 1201 and 1600.

How would you best describe the type of home in which you live?

Detached single family	Townhouse	Condo	Duplex	Apartment	Manufactured home	Multi family 3 or more units	Total
462	14	27	11	35	27	7	583
79.2%	2.4%	4.6%	1.9%	6.0%	4.6%	1.2%	

In what year was your home built?

Before 1959	1960-1979	1980-1989	1990-1997	1998-2000	After 2001	Total
188	185	59	59	29	48	568
33.1%	32.6%	10.4%	10.4%	5.1%	8.5%	

What is the approximate square footage (heated area) of your home?

Less than 1200	1201-1600	1601-1900	1901-2400	2401-3000	Greater than 3000	Don't know	Total
72	127	78	89	61	40	100	567
12.7%	22.4%	13.8%	15.7%	10.8%	7.1%	17.6%	

Nearly three quarters of participants have completed high school, started college, and/or graduated college (74.9%). Over one third of the customers surveyed were 65 years old or over (36.9%). Almost half of customers (48.4%) have two people living in their home, and 90.0% own their home.

Last year of schooling?

Some high school	Completed high school	Some college	Graduated college	Some grad school	Grad school degree	Total
26	164	130	137	33	86	576
4.5%	28.5%	22.6%	23.8%	5.7%	14.9%	

What range best describes your age group?

18-35	36-45	46-55	56-65	65 or over	Total
53	78	114	121	214	580
9.1%	13.4%	19.7%	20.9%	36.9%	

What range best describes your household income?

Less than $25,000	$25,000-50,000	$50,000-75,000	Over $75,000	Total
80	160	117	167	524
15.3%	30.5%	22.3%	31.9%	

How many people live in your home?

1	2	3	4	5	6	7	Total
105	279	84	67	31	9	2	577
18.2%	48.4%	14.6%	11.6%	5.4%	1.6%	.3%	

	Own	Rent	Total
Do you own or rent your home?	521	58	579
	90.0%	10.0%	

Almost all customers have a central furnace (80.4%) and central air (80.9%). Over two thirds of customers use gas as their primary heating fuel (68.3%), while nearly all customers use electric as their primary cooling fuel (88.7%).

Type of Heating System?

Central furnace	Electric baseboard	Heat pump	Geothermal	Other	Total
465	27	64	2	20	578
80.4%	4.7%	11.1%	.3%	3.5%	

Type of Cooling System?

Central air	Window units	Heat pump	Other	No cooling system	Total
469	46	45	2	18	580
80.9%	7.9%	7.8%	.3%	3.1%	

Primary heating fuel?

Electric	Gas	Other	Total
132	395	51	578
22.8%	68.3%	8.8%	

Primary cooling fuel?

Electric	Gas	Other	Total
501	52	12	565
88.7%	9.2%	2.1%	

Section 6: Comparison of Survey Results

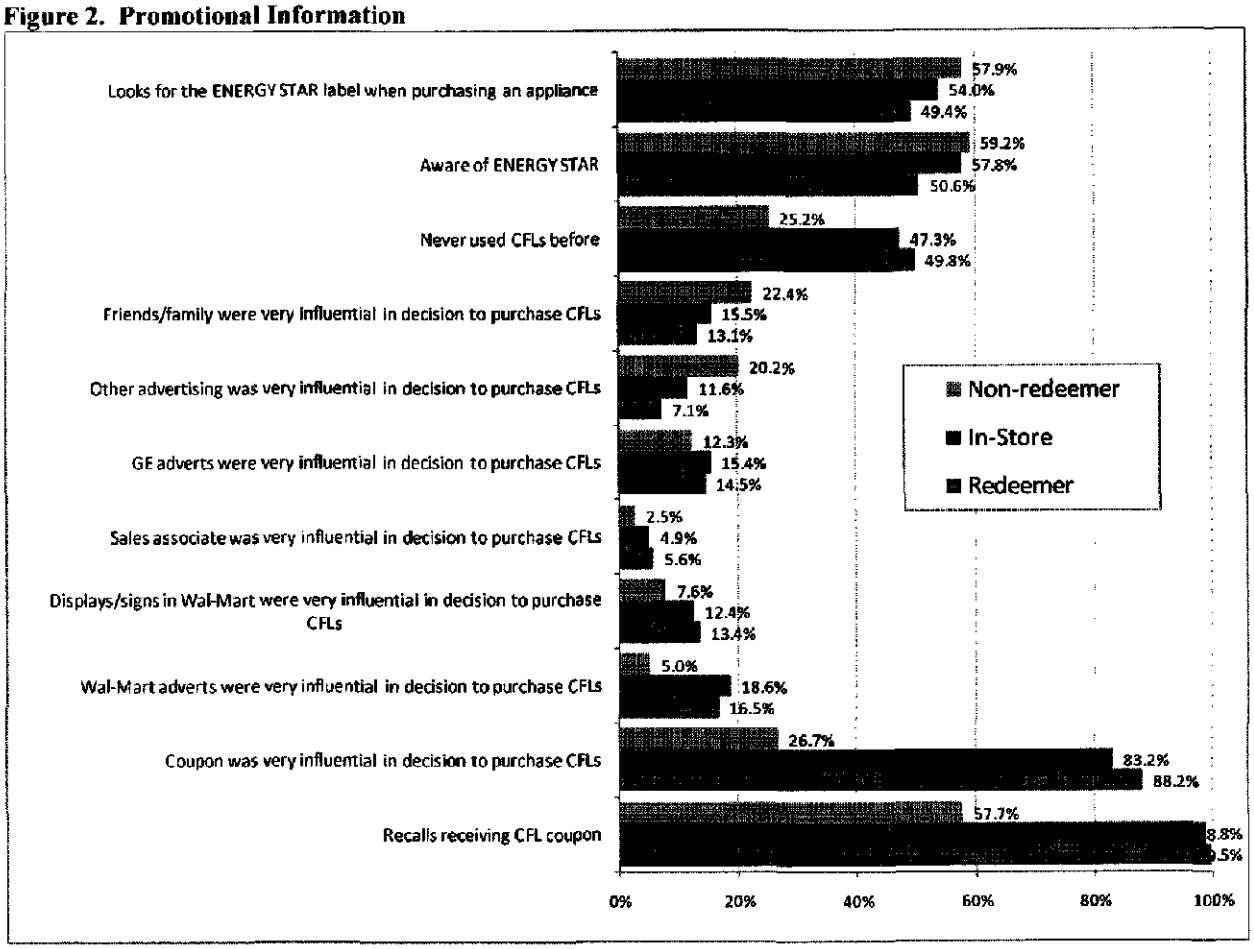
This section of the report presents the results of portions of the surveys that are directly comparable. The following figures show results from those that redeemed the Wal-Mart coupons and those that did not. The "In-Store" responses are part of the redeemer group, but were surveyed in the store.

Promotional Information

Figure 2 below shows the percent of responders that are aware of the Energy Star label, their lack of experience with CFLs, and what promotional materials were "very influential" in their decision to purchase CFLs.

From the survey responses, it is interesting to note that the Non-redeemers are more likely to be aware of Energy Star and to look for the Energy Star label when purchasing an appliance. They are also the least likely to have never used CFLs before. This indicates that the non-redeemers are aware of energy efficiency measures that are available to them, and probably did not have the need to use the CFL coupon that was sent to them through the CFL program.

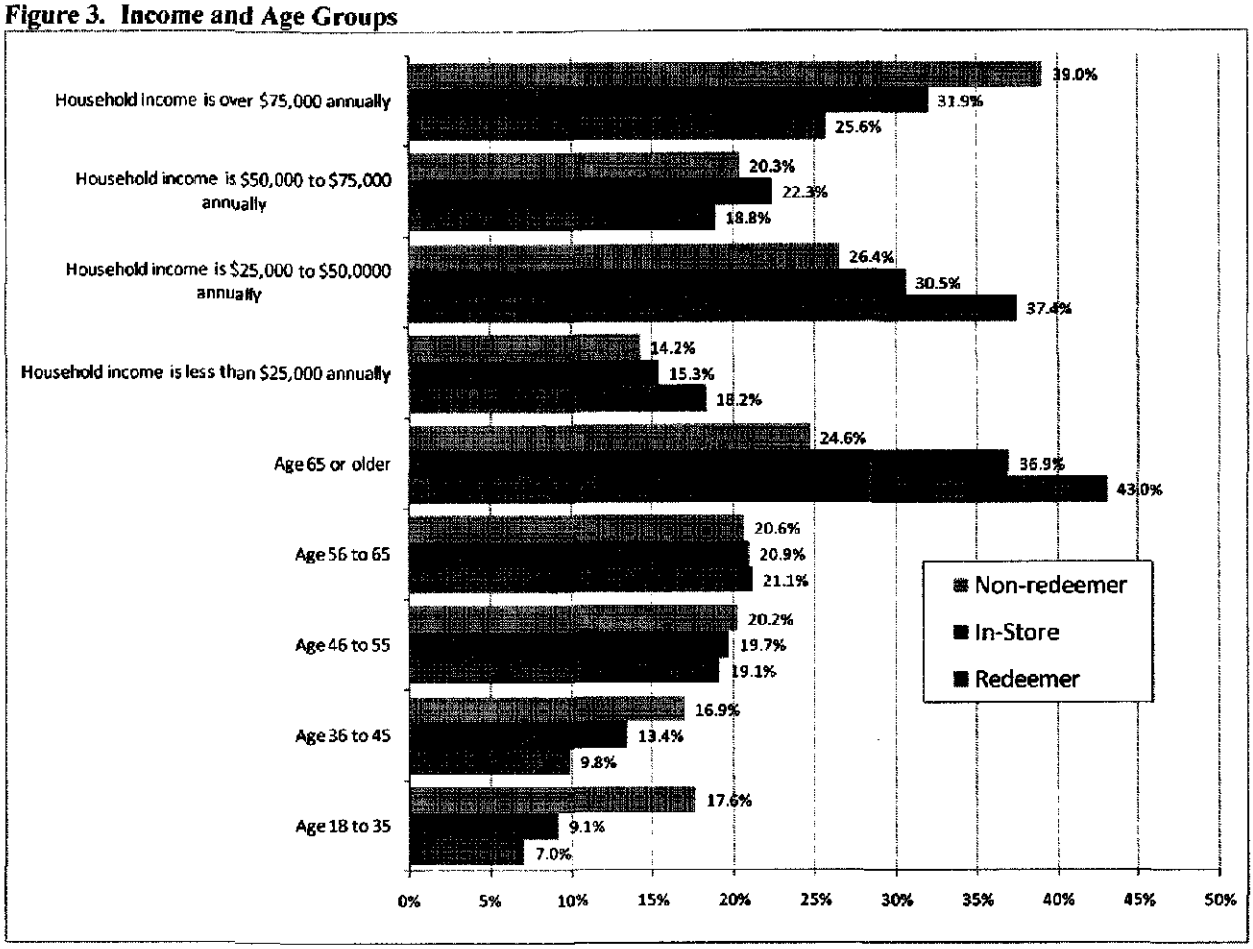
Figure 2. Promotional Information



Income and Age

The Non-Redeemers stand out again in the figure below. The non-redeemers are more likely to have higher incomes (over $75,000 annually) and be younger than those that redeemed the coupons. The largest age group to redeem the coupons are those 65 years of age or older.

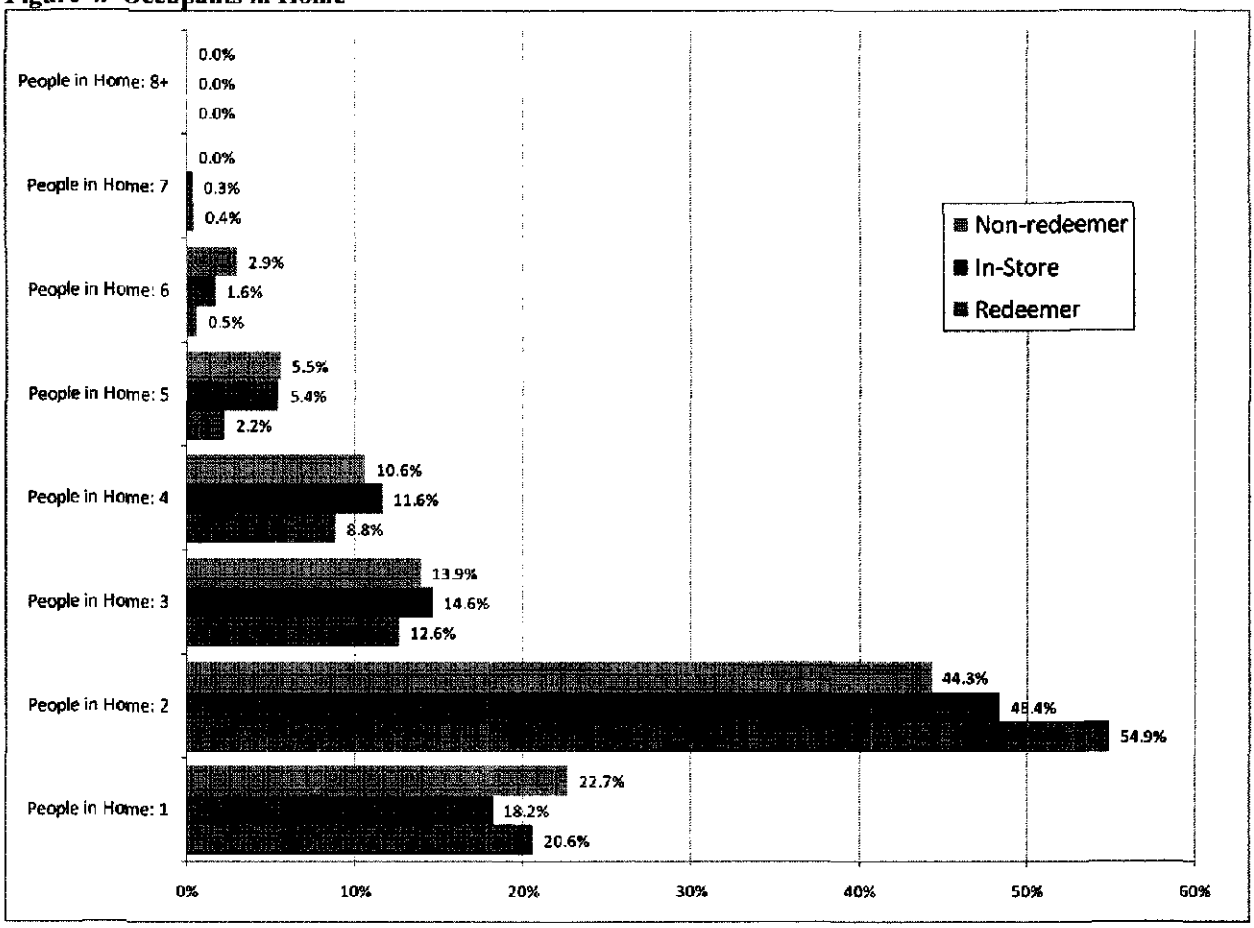
Figure 3. Income and Age Groups



Number of Occupants

The number of occupants in the home doesn't seem to have much of an impact on whether or not the coupons were redeemed.

Figure 4. Occupants in Home



Characteristics of Redeeming Population

Customers who redeemed Wal-Mart CFL coupons were compared to a random population of equal size. A regression model shows that customers over the age of 57, are the head of the household, own a home, and have been a resident in their current home for 6 years or less are the customers who would be more interested in participating in the program.

Other indications a customer was more likely to redeem Wal-Mart CFL Program coupons include if they had a higher income, higher energy usage in December, frequent internet usage, revolved their credit cards, had a higher number of adults in their home, had a lower sale price of their home, or were a long-time resident (21 years or more). More details are in Section 2 of the report.

Section 7: Assessment of Potential Freeriders from Repeat Redemption of CFL Discount Coupons

This analysis was conducted to determine if the distribution of additional Duke Energy CFL Coupons to customers who have already received and redeemed coupons will result in excessive freerider purchases. A freerider is a person who would have purchased the bulb without the coupon, but who took advantage of the coupon to lower the cost. The conclusion of this analysis is that when the retail price of a CFL bulb begins to drop significantly below the $3.00 range, freeridership may begin to erode net energy impacts for the redeemers.

Analysis of the survey results indicates that about 50% of the redeemers are likely to begin buying CFLs on their own when the price reaches $3.00 a bulb and increases to 80% when the price reaches $2.00 or less. This means that in hardware stores, where bulbs are normally $3.00 and above per bulb, the coupons are likely to be more effective. In discount and big box stores, where the bulb prices are beginning to approach $2.00 to $3.00 a bulb, freeridership will begin to potentially erode net savings for the program.

This conclusion is based on customer responses to Duke Energy's CFL Survey conducted in August of 2008.

1. **Coupon users appear to be bargain-hunters:** Redeemers generally appear to be price sensitive and require a lower priced bulb than non-redeemers. They need the coupons to buy bulbs within their price range. From this perspective, the coupons are being used by customers who either need the discount to buy or are free riders. Non-redeemers need to see the per-bulb price below an average of $3.67. Redeemers like to see the price below $2.95. Non-redeemers will, on average, pay $0.76 more per bulb than redeemers. As the price of the CFL drops, more of the redeemers are likely to buy more bulbs without an incentive.

2. **Redeemers want more bulbs:** By almost a 2 to 1 margin redeemers are interested in buying and using CFLs more than non-redeemers, both now and in the future. Redeemers purchase, on average, about 11 CFLs. Non-redeemers purchase a little less than 6 bulbs. Eighty percent of the redeemers still want to buy more bulbs compared to 43.7% of non-redeemers.

3. **Redeemers install and use more bulbs.** Coupon redeemers have already installed 4.9 of the 6.45 bulbs that they said they purchased with their Duke Energy coupons, and 6.4 bulbs that they have obtained via sources other than through the coupon. This totals 11.3 bulbs installed in the homes of the redeemers. Non-redeemers have installed 5.2 bulbs on average, of the 5.7 bulbs that they have purchased through other means.

4. **Both groups want 6 more bulbs this year:** Both redeemers and non-redeemers want more bulbs. Both groups said that they will buy, on average, 6.1 more bulbs over the next 12 months if they can find them at a price below an average of $3.66 for non-redeemers and $2.95 for redeemers.

5. **Discount CFL are available in the market:** Both redeemers and non-redeemers have found ways to buy discounted CFLs. Nine percent of the redeemers have obtained a free bulb compared to 6% of the non-redeemers. This is essentially the same number from a statistical perspective. However, twenty-three percent of the redeemer have purchased CFLs at a discount price compared to most all of the non-redeemers. We do not know what kind of a discount was obtained or the price that was paid.

6. **Both groups use most of the bulbs they buy:** Redeemers have installed the bulbs they have purchased and want more. Redeemers have purchased 10.8 CFLs in the last 12 months, and have installed all of these bulbs in their homes. Likewise, non-redeemers have installed 5.2 of the 5.7 bulbs they have purchased. They also use the bulbs they buy. The very small fraction of the bulbs not used are typically stored for later use.

It is clear in this analysis that redeemers will take advantage of more Duke Energy coupons. If the Duke Energy coupon allows them to buy more bulbs by dropping the price so that it is within their price range, it is likely to be effective at moving these purchases without significantly increasing freeridership.

It is expected that if the redeemers obtain more bulbs, they will install them. However, because they have already installed the bulbs they have purchased, the remaining bulbs may go into lower hours-of-use sockets, or moved into storage. However, at this time they essentially have no CFL storage and they are looking for more bulbs to install. If Duke Energy is interested in achieving high savings quickly, it would be better to get the coupons in the hands of new future coupon redeemers who have not already redeemed the Duke Energy Coupons. New coupons to past coupon redeemers would achieve savings as well, but will eventually saturate these homes.

The following table reflects the results of the Duke Energy CFL survey that was used in the above analysis.

Table 1. Survey Responses

Valid number *used for analysis*	Have Used Duke Coupon	# CFLs Purchaed in last 12 months	Purchased with coupon	How many Duke bulbs installed	Bought more because of Duke	Non-Duke bulbs installed	At what price do CFLs become too expensive	If priced this way, how many would you buy next 12 months	Interested in buying more if below this cost
44	Yes	10.85	6.45	4.9	36.40%	6.4	$2.95	6.1	80%
16	No	5.7	N/A	N/A	N/A	5.2	$3.66	6.1	43.70%

Table 2. Redeemer Price Sensitivity

Percent of users who will buy a CFL at this price.	Coupon Users	Percent of users who will buy a CFL at this price.	Coupon Users	Percent of users who will buy a CFL at this price.	Coupon Users	Percent of users who will buy a CFL at this price.	Coupon Users
4%	$ 7.00	29%	$ 4.00	54%	$ 2.50	79%	$ 2.00
7%	$ 6.00	32%	$ 3.50	57%	$ 2.00	82%	$ 1.50
11%	$ 5.00	36%	$ 3.00	61%	$ 2.00	86%	$ 1.50
14%	$ 5.00	39%	$ 3.00	64%	$ 2.00	89%	$ 1.00
18%	$ 5.00	43%	$ 3.00	68%	$ 2.00	93%	$ 1.00
21%	$ 5.00	46%	$ 3.00	71%	$ 2.00	96%	$ 1.00
25%	$ 4.00	50%	$ 3.00	75%	$ 2.00	100%	$ 0.50

In future freerider assessments it will be very important to consider the influence of the coupon discount to the specific purchase and use conditions, including purchase intent relative to price sensitivity and the installation and bulb use conditions. Redeemers already have a pre-existing intent to buy. However, for this group, the intent to buy is controlled by price sensitivity, among possibly other conditions. Redeemers are looking for discounts to the retail price. If Duke Energy provides that incentive, then Duke Energy would be the primary cause of that purchase decision.

Ceasing or decreasing the incentive jeopardizes the program. However Duke Energy should initiate new customer offers that tap into non-price motivators or barriers (e.g. point of purchase displays, neighborhood handouts, school boosters). In addition, the program should consider targeting coupons more to non-box retailers, as well as offering non-price promotions to non-box retailers. The program should also consider limiting or decreasing incentives slightly for box retailers.

Appendix 1 – Detailed kWh Savings by Location and Wattage from Wal-Mart CFL Redeemer Survey.

Mean Savings kWh per Year By Wattage of Old Bulb and Bulb Location – Wal-Mart CFL Redeemer Survey																
Bulb Location	Wattage of Old Bulb															
	10.00	20.00	25.00	30.00	40.00	50.00	60.00	65.00	70.00	75.00	80.00	90.00	100.00	120.00	150.00	Total
attic													648.24			648.24
basement	1051.20				1033.68		907.24			1182.60		1121.28	1269.58			1139.07
bathroom		219.00		170.82	1053.56		1303.69			1426.87		560.64	1692.63	779.64		1258.01
bedroom				227.76	1367.04	893.52	1099.93		1314.00	1426.66	946.08	1681.92	1928.10			1262.90
ceiling											1892.16					1892.16
cellar										963.60						963.60
closet							770.88			662.48			3889.44			1254.51
den				170.82		1191.36	1841.55			2615.49			3025.12			2158.09
dining room					2440.63		1647.45		1314.00	2208.25			4472.86			2114.70
downstairs					1033.68		1541.76									1414.74
dressing room					1808.94		770.88									1549.43
entryway							1349.04	788.40								1268.95
family room				1024.92	1744.34		2489.02			2134.74			3154.77		4730.40	2627.60
game room							578.16						648.24			613.20
garage							2201.05			505.89			1592.00			1621.68
great room							1541.76						3241.20			2674.72
hallway					1389.01		2312.64			541.76	946.08		1742.15			1882.38
kitchen	1051.20		766.50	341.64	931.39		2129.40	1419.12	2628.00	3034.04			3489.77	1559.28		2292.99
lamp							1830.84						3241.20			2112.91
laundry					387.63		546.04			843.15			1379.83			919.08
living room	175.20	109.50		1195.74	1046.60	1787.04	1854.93		3504.00	2450.90			3693.18		3311.28	2386.62
loft													3889.44			3889.44
office					516.84		1498.93			1124.20			3270.67			2025.68
other							1614.03									1614.03
outside					2953.37		4951.42			883.30			6536.42		3784.32	4356.49
parlor					1162.89								324.12			743.51
porch				85.41	1593.59		3533.20			2409.00			3565.32			3154.43
shed							0.00									0.00
stairway							2505.36			1686.30			2592.96			2195.26
sunroom					1292.10		1734.48									1587.02
tv room					1550.52		2042.83			2890.80			3306.02			2435.28

Mean kWh per Year By Wattage of Old Bulb and Bulb Location continued – Wal-Mart CFL Redeemer Survey																
Bulb Location	Wattage of Old Bulb															
	10.00	20.00	25.00	30.00	40.00	50.00	60.00	65.00	70.00	75.00	80.00	90.00	100.00	120.00	150.00	Total
utility							1284.80			120.45						1118.46
vanity					1808.94											1808.94
wall							2312.64									2312.64
light																
Total	759.20	175.20	766.50	504.70	1383.16	1489.20	1754.03	1314.00	2190.00	1856.74	1261.44	981.12	2731.30	1039.52	3784.32	1941.97

Appendix 2 – Program Surveys

Initial Lighting Logger Study – Premeasure Survey

Name: _____

_____

Address: _____

_____

Acct. # _____

PLEASE ANSWER THE QUESTIONS BELOW RELATED TO THE FALL 2007 LIGHTING LOGGER STUDY.
FILL IN THE CIRCLES COMPLETELY USING BLUE OR BLACK INK.

General Information About Your Home

To be able to group your responses, please respond to the following categories.

How would you best describe the type of home in which you live?

- Detached single-family
- Townhouse
- Condominium
- Apartment
- Manufactured home

In what year was your home built?

- Before 1959
- 1960 - 1979
- 1980 - 1989
- 1990 - 1997
- 1998 – 2000
- >=2001

What is the approximate square footage (heated area) of your home?

- <1,200
- 1,201 – 1,600
- 1,601 – 1,900
- 1,901 – 2,400
- 2,401 – 3,000
- >=3,001
- Don't know

How many people live in your home?

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- >=8

Type of heating system? Central furnace Electric baseboard Heat pump Geo-thermal Other

Type of cooling system? Central air Window unit air conditioner Heat pump Geo-thermal Other

Primary heating fuel? Electric Gas Other

Primary cooling fuel? Electric Gas Other

Do you own or rent your home? Own Rent

Please state below the **number of hours**, on average, you use your lighting in the following rooms.

	# of Hours	# of Fixtures	Type of Fixtures in Room (table lamp, torchiere, chandelier, sensor, etc.)
Bathroom			
Basement			
Bedroom 1			
2			
3			
4			
Dining Room			
Entryway			
Hall			
Kitchen			
Family Room			
Porch			
Other			
Other			

Performance Ratings

In this section of the survey, we would like to understand how you have used Compact Flouresecent Lightbulbs (CFL) you have purchased

	0	1-2	3	4	5	6	7-11	12+
Did you receive coupons in the mail from Duke/GE/Wal-Mart for CFL bulbs?		Yes		No				
How many CFLs did you purchase with the coupons received? 1 package = 3 bulbs								
How many bulbs would you have purchased without the coupon?								

How many CFL bulbs would you purchase if...

	0	1-2	3	4	5	6	7-11	12+
They were the same price as a standard bulb?								
They were $1.00 more than standard bulbs?								
They were $2.00 more than standard bulbs?								
They were $3.00 more than standard bulbs?								
They were free but you had to mail in a rebate form to get your money back?								

Bulb Installation

Of the bulbs you bought...

	0	1-2	3	4	5	6	7-11	12+
How many did you install?								

Did you replace a standard bulb with a CFL? ☐ Yes ☐ No ☐ No, replaced a CFL

For each of those bulbs that you installed, what was the typical wattage of the bulb that was replaced?

☐ 25 ☐ 40 ☐ 60 ☐ 75 ☐ 100 or greater

Did you change the hours of use since installing the CFLs? ☐ Yes ☐ No

If you answered yes, how did your usage change ? ☐ Increased usage ☐ Decreased usage

	<1	1-2	3-4	5-9	10-12	13-24
On average, about how many hours do you use each bulb?						

Did you remove any of the CFLs you installed? ☐ Yes ☐ No

	0	1-2	3	4	5	6	7-11	12+
If yes, how many did you remove?								

Why did you remove them?

☐ Not bright enough ☐ Did not like the light ☐ Too slow to start ☐ Other

More on Back ☞

	1-2	3	4	5	6
7-11 12+					
Of the CFLs that you purchased, how many did you store for a later time?					

Have you bought any CFLs for retail price after buying these CFLs through the Duke program?

Yes No

	1-2	3	4	5	6
7-11 12+					
If yes, how many did you purchase?					

	Very Satisfied	Somewhat Satisfied	Not at all Satisfied
Overall, how satisfied are you with the CFLs?			

Did you have any CFLs in your house before you bought these discounted CFLs?

Yes No

	1-2	3	4	5	6
7-11 12+					
If yes, how many?					

Were you aware of CFLs before you received your coupons?

Yes No

If yes…

Were you planning to buy CFLs before you saw the promotion?

Yes No

If yes…

Did the promotion lead you to buy more CFLs than you were planning?

Yes No

	1-2	3	4	5	6
7-11 12+					
If yes, how many more did you purchase?					

THANK YOU FOR YOUR RESPONSES

Wal-Mart CFL Redeemer Survey

Duke Energy®

Dear Customer,

Duke Energy is continuously trying to improv services for you. To help us improve the **Com Fluorescent Light bulb** program, we would li your input. Please let us know what you think the compact fluorescent light bulbs (CFLs) yo purchased through our coupon promotion. If y have any questions, please contact Amanda G 513-287-3177.

You will receive a check for $10 for your participation.

WE WOULD LIKE YOUR OPINION ABOUT OUR LIGHTBULB COUPON PROGRAM FOR COMPACT FLOURESCENT LIGHTBULBS (CFLs). FILL IN THE CIRCLES COMPLETELY USING BLUE OR BLACK INK.

Do you recall receiving Compact Fluorescent Light bulb coupons from Duke Energy, for use in Wal-Mart for GE bulbs ? ○ Yes ○ No

Did you give all of your coupons to someone else to use? ○ Yes ○ No

Did you use at least one coupon? ○ Yes – Continue this survey ○ No – Thank you. Please return survey.

How influential were the following in your decision to purchase CFL(s)?

	Very Influential		Somewhat Influential	Not at all Influential
The Coupon from Duke Energy	○	○	○	
Wal-Mart Advertising	○	○	○	
Displays and signs in Wal-Mart	○	○	○	
Sales Associate at the store	○	○	○	
GE Advertising	○	○	○	
Other Advertising	○	○	○	
Friends or Family	○	○	○	

In this section of the survey, we would like to understand how you have used the CFL packs you purchased with the coupon?

	0	1	2	3	4	5	6-10	11+
How many CFL packs did you purchase with the Duke Energy coupon?	○	○	○	○	○	○	○	○
How many CFL bulbs did you purchase in TOTAL?	○	○	○	○	○	○	○	○

How many CFL bulbs would you have bought without the coupon? 0 1 2 3 4 5 6-10 11+

How many CFL bulbs have you since purchased without coupons ? 0 1 2 3 4 5 6-10 11+

Of the bulb packs you bought with Duke Energy/ Wal-Mart coupons:

How many CFLs are now installed? 0 1 2 3 4 5 6-10 11+

Please write in WHERE the CFL went, WHAT it replaced, and HOW MUCH you use that light.

	WHERE	WHAT WAS REPLACED	HOW MUCH ITS USED (Each Day)
Example	Living Room	60W Floor Lamp	6 Hours Per Day (average)
Bulb 1			
Bulb 2			
Bulb 3			
Bulb 4			
Bulb 5			
Bulb 6			

Any More? Please summarize briefly below.

Did you change the hours of use since installing the CFLs? ▲ Yes ▲ No

If you answered yes, how did your usage change? ▲ Increased usage ▲ Decreased usage

Have you removed any of the CFLs you installed? ▲ Yes ▲ No

	1-2	3	4	5	6	7-11	12+
If yes, how many did you remove? ▲	▲	▲	▲	▲	▲	▲	▲

Why did you remove them?_____

Did you have any CFLs in your house before you bought these discounted CFLs? ▲ Yes ▲ No

	1-2	3	4	5	6	7-11	12+
If yes, about how many? ▲	▲	▲	▲	▲	▲	▲	▲

	Very Satisfied	Somewhat Satisfied	Not at all Satisfied
Overall, how satisfied are you with the CFLs? ▲	▲	▲	

How long have you been using CFL light bulbs ? ▲ Never purchased a CFL until now ▲ A year ago ▲ 2 to 3 years ago ▲ 4 or more years

	Often	Sometimes	Never
Do you use the Duke Energy Website?	▲	▲	▲

Have you added any electrical appliances to your home in the past year? ▲ Yes ▲ No

Are you aware of ENERGY STAR? ▲ Yes ▲ No

Do you look for the ENERGY STAR label when purchasing an appliance? ▲ Yes ▲ No

General Information About Your Home

How would you best describe the type of home in which you live?

▲ Detached single-family ▲ Townhouse ▲ Condominium ▲ Duplex/2-family

▲ Apartment ▲ Manufactured home ▲ Multi-Family (3 or more units)

In what year was your home built?

▲ Before 1959 ▲ 1960 - 1979 ▲ 1980 - 1989

▲ 1990 - 1997 ▲ 1998 – 2000 ▲ After 2001

What is the approximate square footage (heated area) of your home?

▲ Less than 1,200 ▲ 1,201 – 1,600 ▲ 1,601 – 1,900

▲ 1,901 – 2,400 ▲ 2,401 – 3,000 ▲ Greater than 3,000

▲ Don't know

Last year of schooling?

▲ Some high school ▲ Completed high school ▲ Some college

▲ Graduated college ▲ Some grad school ▲ Grad School degree

What range best describes your age group?

▲ 18 to 35 ▲ 36 to 45 ▲ 46 to 55

▲ 56 to 65 ▲ 65 or over

What range best describes your household income?

▲ Less than $25,000 ▲ $25,000 to $50,000

▲ $50,000 to $75,000 ▲ Over $75,000

How many people live in your home?

▲ 1 ▲ 2 ▲ 3 ▲ 4 ▲ 5 ▲ 6 ▲ 7 ▲ more than 7

Do you own or rent your home?

Own Rent

Type of heating system?

Central furnace Electric baseboard Heat pump Geo-thermal
Other

Type of cooling system?

Central air Window/Room Heat pump unit air conditioner Geo-thermal
Other
No cooling system

Primary heating fuel? Electric Gas Other

Primary cooling fuel? Electric Gas Other

Thank you for your help with this study. Your $10.00 incentive check will be mailed within 6 – 8 weeks. Please verify your address on the front page of this survey.

Yes, my address on the front page of this survey is correct
No, please mail my check to:

_____

_____

_____

HAVE A CHANCE TO PARTICIPATE IN THE DUKE ENERGY LIGHTING STUDY

Would you be interested in participating in a lighting study in January, 2008? A Duke Energy representative would place small lighting monitors on 4 or 5 light fixtures and will remain in place for 2 to 3 weeks. The monitors are smaller than the size of a bar of soap and help us measure how often lights are turned on and off during the week. The first 100 returned surveys indicating interest will be selected. Eligible customers that are selected will receive $50 for participating.

Yes No

If yes, you may receive a follow-up phone call about this lighting study in early January.

THANK YOU FOR YOUR RESPONSES

Wal-Mart CFL Non-Redeemer Survey

Dear Customer,

Duke Energy is continuously trying to improve our services for you. To help us improve the **Compact Fluorescent Light bulb** program, also known as **CFL**, we would like your input. Please let us know what you think about the compact fluorescent light bulbs (CFLs). If you have any questions, please contact Amanda Goins, 513-287-3177.

You will receive a check for $10 for your participation.

WE WOULD LIKE YOUR OPINION ABOUT OUR LIGHTBULB COUPON PROGRAM AND COMPACT FLOURESCENT LIGHTBULBS (CFLs). FILL IN THE CIRCLES COMPLETELY USING BLUE OR BLACK INK.

Do you recall ever receiving Compact Fluorescent Light bulb coupons from Duke Energy, for use in Wal-Mart for GE bulbs ? ▲ Yes ▲ No

Did you use any of these coupons? ▲ No – Continue this survey ▲ **Yes – Thank you. Please return survey.**

Had you heard anything about the Compact Fluorescent Light bulb coupons from Duke Energy, for use in Wal-Mart for GE bulbs ? ▲ **Yes** ▲ **No – skip to section 2**

Why did you decide NOT to use these coupons?

▲ Too much hassle ▲ Do not use CFLs ▲ Do not shop at Wal-Mart

▲ Did not understand program ▲ Thought there was a catch ▲ Couldn't be bothered

▲ Other _____

Did the Compact Fluorescent Light bulb **coupons increase your awareness** of how you could save energy by using compact fluorescent light bulbs

▲ Yes ▲ No - I was aware of the energy savings already

▲ Somewhat- I was already aware, but it did help me understand their benefits better

Did the Compact Fluorescent Light bulb coupons inspire you to purchase compact fluorescent light bulbs **without** using the coupon somewhere else?

▲ No ▲ Yes 1 2 3 4 5 6 More than 6

If Yes, How many did you buy without the coupon? ▲ ▲ ▲ ▲ ▲ ▲ ▲

How influential were the following in your decision to purchase CFL(s) without the coupon?

	Very Influential	Somewhat Influential	Not at all Influential
The Coupon from Duke Energy	☐	☐	☐
Wal-Mart Advertising	☐	☐	☐
Displays and signs in Wal-Mart	☐	☐	☐
Sales Associate at the store	☐	☐	☐
GE Advertising	☐	☐	☐
Other Advertising	☐	☐	☐
Friends or Family	☐	☐	☐

Section 2:

In this section of the survey, we would like to understand how you use CFLs and other energy efficiency appliances?

	0	1	2	3	4	5	6-10	11+
How many CFLs are in use in your house?	☐	☐	☐	☐	☐	☐	☐	☐

	Very Satisfied	Somewhat Satisfied	Not at all Satisfied
Overall, how satisfied are you with the CFLs?	☐	☐	☐

How long have you been using CFL light bulbs ? ☐ Never ☐ 3 – 6 months ☐ 6 – 9 months ☐ 9 – 12 months ☐ 1 – 2 years ago ☐ 2 – 3 years ago ☐ More than 3 years ago

Have you added any electrical appliances to your home in the past year?	☐ Yes	☐ No
If Yes, is the appliance energy efficient?	☐ Yes	☐ No
Are you aware of ENERGY STAR?	☐ Yes	☐ No
Do you look for the ENERGY STAR label when purchasing an appliance?	☐ Yes	☐ No

	Often	Sometimes	Never
Do you use the Duke Energy Website?	☐	☐	☐

More on Back☞

Litho

Has Duke Energy influenced your decision to purchase energy efficient products? ▲ Yes ▲ No

Section 3: General Information About Your Home

How would you best describe the type of home in which you live?

▲ Detached single-family ▲ Mobile Home ▲ Condominium ▲ Duplex/2-family

▲ Multi-Family (3 or more units) ▲ Townhouse

In what year was your home built?

▲ Before 1959 ▲ 1960 - 1979 ▲ 1980 – 1989 ▲ 1990 - 1997

▲ 1998 – 2000 ▲ 2001-2007 ▲ Don't know

What is the approximate square footage (heated area) of your home?

▲ Less than 500 ▲ 500-999 ▲ 1,000-1,499 ▲ 1,500 – 1,999 ▲ 2,000 – 2,499 ▲ 2,500-2,999 ▲ 3,000-3,499 ▲ 3,500-3,999 ▲ 4,000 or more ▲ Don't know

Last year of schooling?

▲ Some high school ▲ Completed high school ▲ Some college

▲ Graduated college ▲ Some grad school ▲ Grad School degree

What range best describes your age group?

▲ 18 to 35 ▲ 36 to 45 ▲ 46 to 55

▲ 56 to 65 ▲ 65 or over

What range best describes your combined household income?

▲ Less than $25,000 ▲ $25,000 to $50,000

▲ $50,000 to $75,000 ▲ Over $75,000

How many people live in your home?

▲ 1 ▲ 2 ▲ 3 ▲ 4 ▲ 5 ▲ 6 ▲ 7 ▲ more than 7

Do you own or rent your home?

▲ Own ▲ Rent

Type of heating system?

▲ Central furnace ▲ Electric baseboard ▲ Heat pump ▲ Geo-thermal Heat Pump

▲ Hot water or steam boiler ▲ Other

Type of cooling system?

▲ Central air ▲ Window/Room ▲ Heat pump unit air conditioner ▲ Geo-thermal Heat Pump ▲ Other ▲ No cooling system

Primary heating fuel? ▲ Electric ▲ Gas ▲ Oil ▲ Propane ▲ Other

Primary cooling fuel? ▲ Electric ▲ Gas ▲ Other

Thank you for your help with this study. Your $10.00 incentive check will be mailed within 6 – 8 weeks. Please verify your address on the front page of this survey.

▲ Yes, my address on the front page of this survey is correct

▲ No, please mail my check to:

_____

_____

_____

THANK YOU FOR YOUR RESPONSES

Litho

Wal-Mart In-Store Purchases Survey

Dear Customer,

Duke Energy is continuously trying to deliver improved services to you, our customer. We would like your input on the company's recent Wal-Mart **Compact Fluorescent Light bulb** coupon promotion. If you have any questions, please contact Amanda Goins, 513-287-3177.

You will receive a check for $10 for your participation.

WE WOULD LIKE YOUR OPINION ABOUT OUR COUPON PROGRAM FOR COMPACT FLOURESCENT LIGHTBULBS (CFLs). FILL IN THE CIRCLES COMPLETELY USING BLUE OR BLACK INK.

Section I. Awareness of Advertising

Do you recall receiving Compact Fluorescent Light bulb coupons from Duke Energy, for use in Wal-Mart ? ▲ Yes ▲ No

Did you use at least one coupon? ▲ Yes – Continue this survey ▲ No – Please skip to section IV on the back ☞

How influential were the following in your decision to purchase CFL(s)?

	Very Influential	Somewhat Influential	Not at all Influential
The Coupon from Duke Energy	▲	▲	▲
Wal-Mart Advertising	▲	▲	▲
Displays and signs in Wal-Mart	▲	▲	▲
Sales Associate at the store	▲	▲	▲
GE Advertising	▲	▲	▲
Other Advertising	▲	▲	▲

Friends or Family

Section II Additional Purchases From Walmart

How often did you visit a Wal-Mart store before your recent visit to redeem the CFL coupon ?

Never 1-2 visits a month 3-4 visits a month 5 or more visits a month

Did you purchase additional items on your visit to Wal-Mart ? Yes No

If yes, What was the estimated amount you spent on those additional items?

< $10.00 $10.00-25.00 $26.00-50.00 >$50.00

Have you returned to Wal-Mart since redeeming the CFL coupon? Yes No

If yes, How often? 1-2 visits a month 3-4 visits a month 5 or more visits a month

Section III Use of CFL Packs

In this section of the survey, we would like to understand how you have used the CFL packs you purchased with the coupon?

	0	1	2	3	4	5	6-10	11+
How many CFL packs did you purchase with the Duke Energy coupon?								
How many CFL bulbs did you purchase in TOTAL?								
How many CFL bulbs would you have bought without the coupon?								
How many CFL bulbs have you since purchased without coupons ?								

Of the bulb packs you bought with Duke Energy/ Wal-Mart coupons:

	0	1	2	3	4	5	6-10	11+
How many CFLs are now installed?								

More on the back ☞