temperatures and heat index readings can be found in Table 1). As seen previously (such as in Figure 28), non-event high temperature days have little effect on participants' comfort levels (small differences between red and blue bars at every temperature level), while the Power Manager full shed event caused a significant decrease in comfort ratings (large differences between red and blue bars). There overall decline in comfort ratings for Regular Event participants during events is also statistically significant (as seen previously in Table 41).

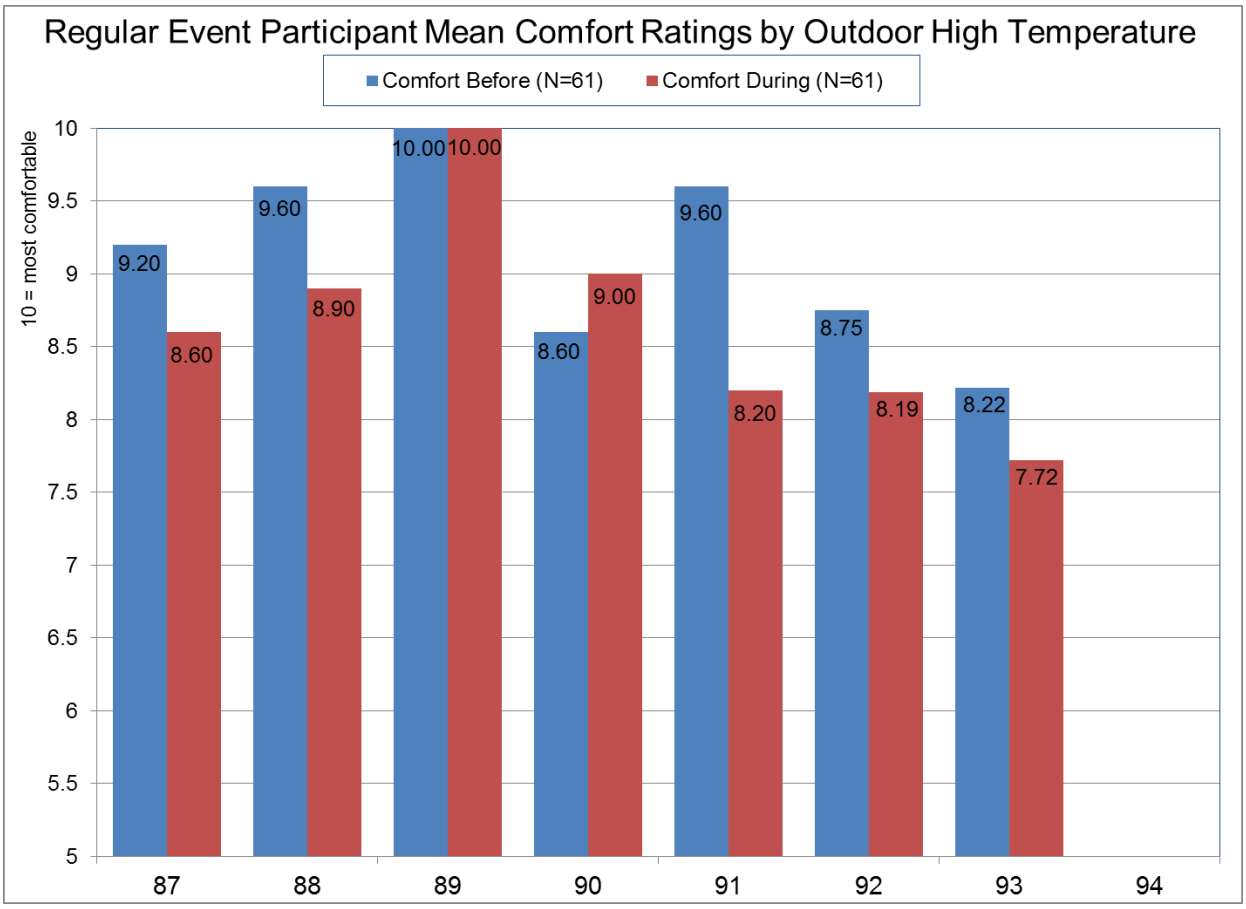


Figure 41. Comfort Ratings Before and During Regular Events by Outdoor High Temperature

Note: Only respondents who were at home during the event and who provided both comfort ratings are included in this chart.

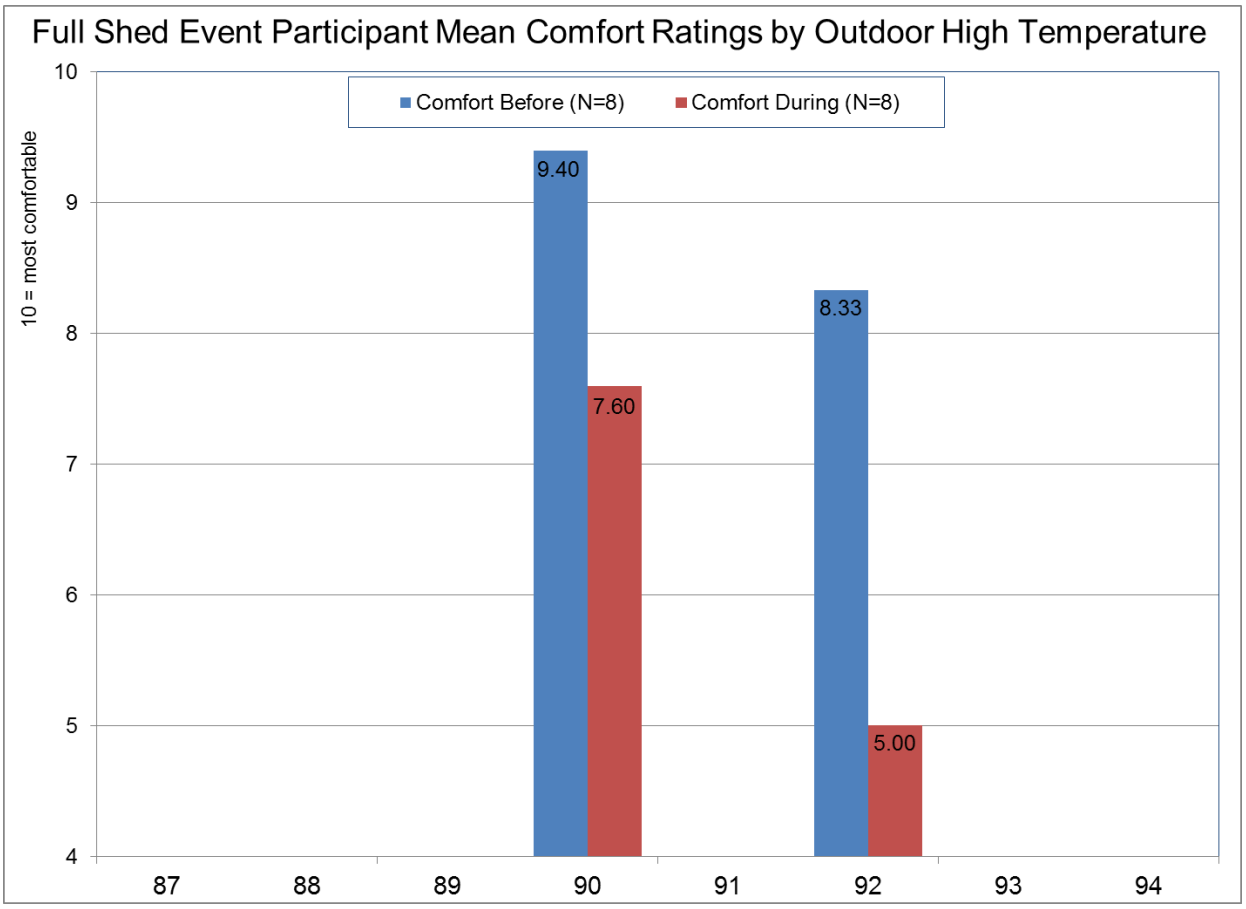


Figure 42. Comfort Ratings Before and During Full Shed Events by Outdoor High Temperature

Note: Only respondents who were at home during the event and who provided both comfort ratings are included in this chart.

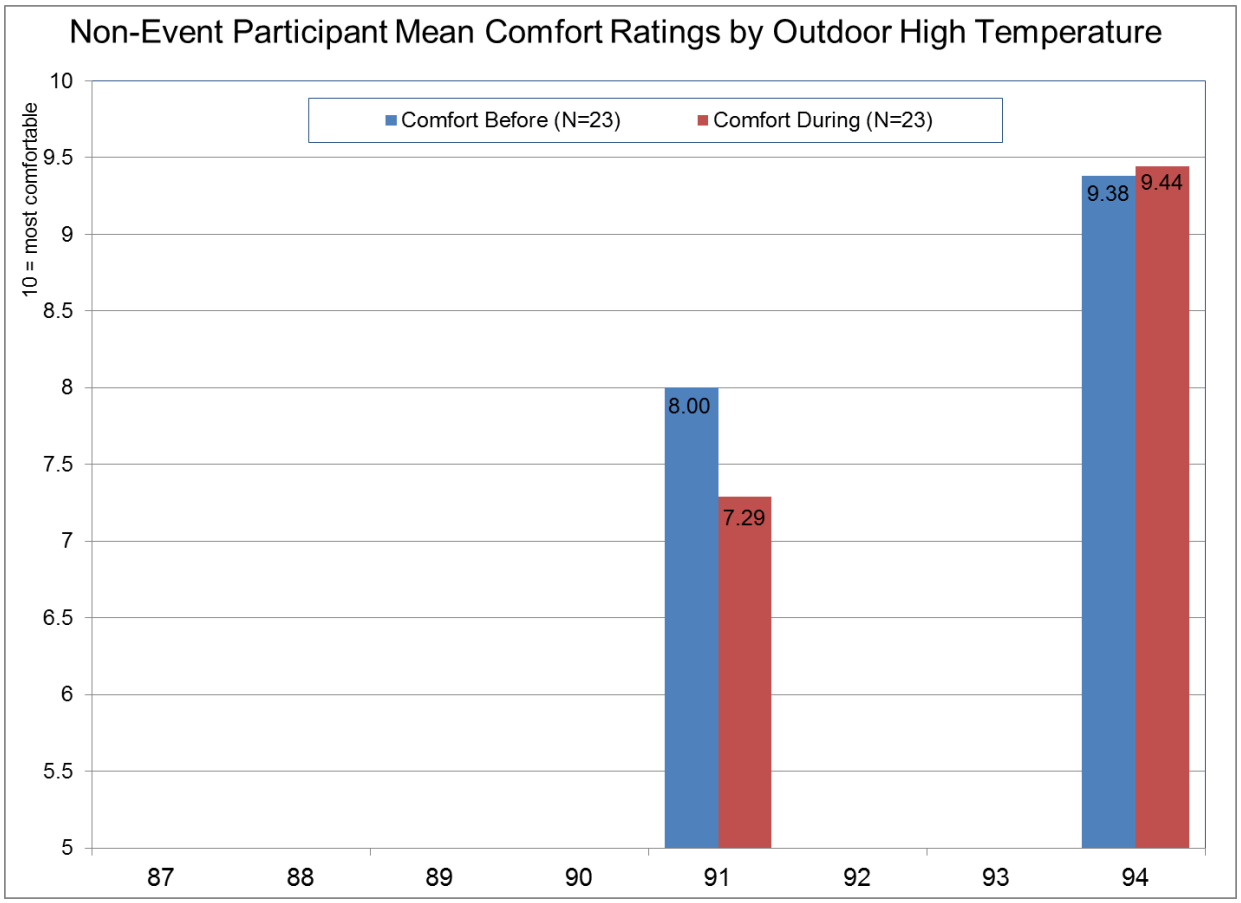


Figure 43. Comfort Ratings Before and During Non-Events by Outdoor High Temperature
Note: Only respondents who were at home during the event and who provided both comfort ratings are included in this chart.

Figure 44 through Figure 46 shows the same mean comfort ratings by three outdoor high temperature ranges. Both Full Shed Event participants and Regular Event participants report a decrease in comfort ratings for every temperature category, and these comfort ratings tend to be lower (before and during events) when the outdoor temperature is higher. For Regular Event participants, the difference between "before" and "during" comfort levels is statistically significant overall at the $p<.05$ level (as reported in Table 41), however it is not significant at any of the specific temperature categories shown in Figure 44. Similarly, though Full Shed Event participants report a significant decrease in comfort ratings overall, the differences are not significant for the specific temperature categories shown in Figure 45 (this lack of significance is largely due to sample size: Only five Full Shed participants who were at home and gave comfort ratings were surveyed on days when the temperature peaked at 90 or lower, and only three were surveyed on days when the temperature was 91 or 92 degrees). The differences between "before" and "during" comfort ratings for Non-Event participants are not statistically significant at any temperature level (as shown in Figure 46).

There are no statistically significant differences in comfort ratings by Event groups when the outdoor high temperature peaks at 90 or lower (there were no Non-Events surveyed on days of this temperature range). On survey days when the temperature was 91 or 92 degrees, Full Shed

Event participants give significantly lower ratings during activation events (5.00) than Regular Event participants (8.19; significant at p<.05 using ANOVA), though neither group differs significantly from Non-Event participants' comfort ratings (7.29 based on seven respondents). On days when the outdoor high temperature reached 93 degrees or higher, Non-Events give higher comfort ratings before (9.38) and during (9.44) compared to Regular Events (8.22 before and 7.72 during; these differences between groups are significant at p<.10 or better using ANOVA). There were no Full Shed Event surveys on days when the temperature peaked at 93 degrees or higher.

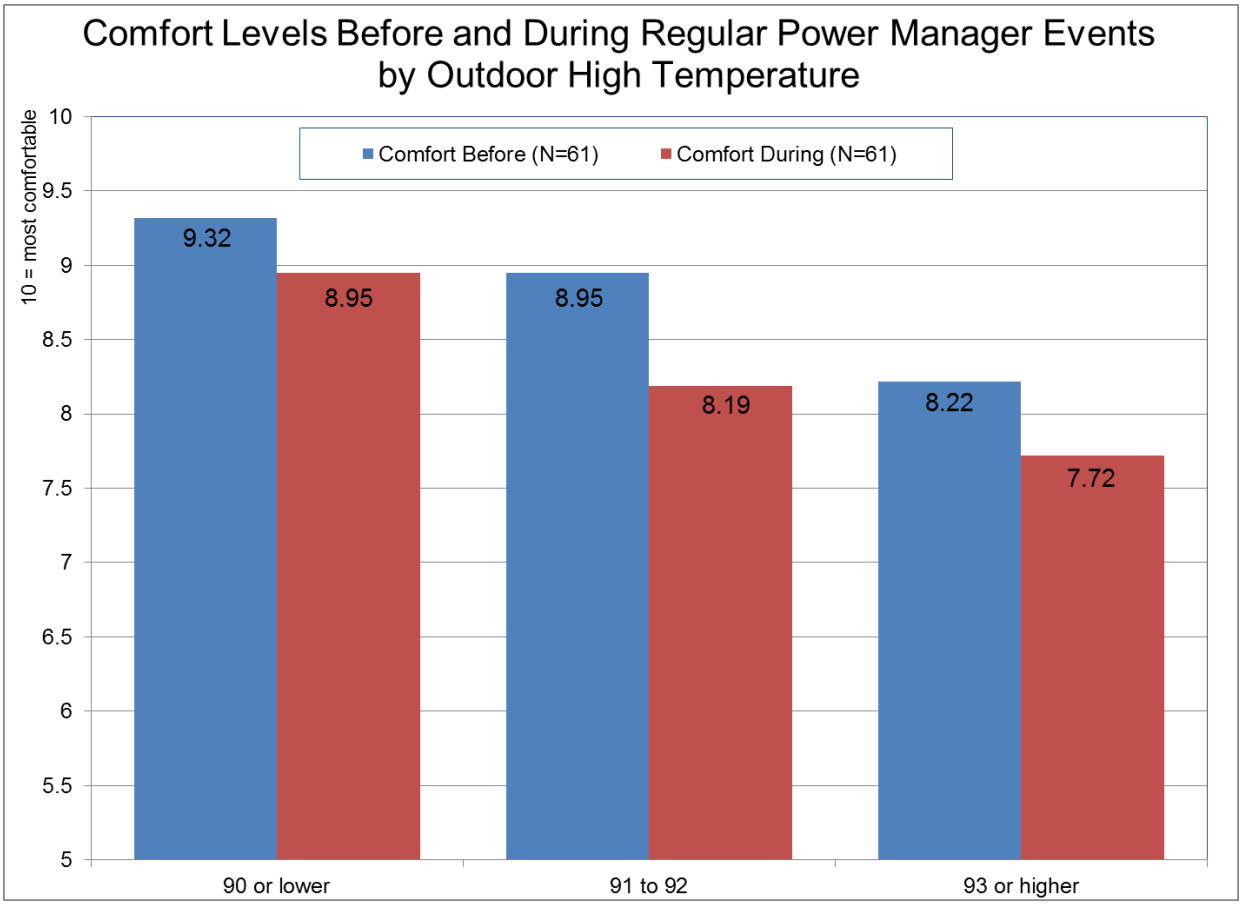


Figure 44. Comfort Ratings Before and During Regular Events by Outdoor High Temperature

Note: Only respondents who were at home during the event and who provided both comfort ratings are included in this chart.

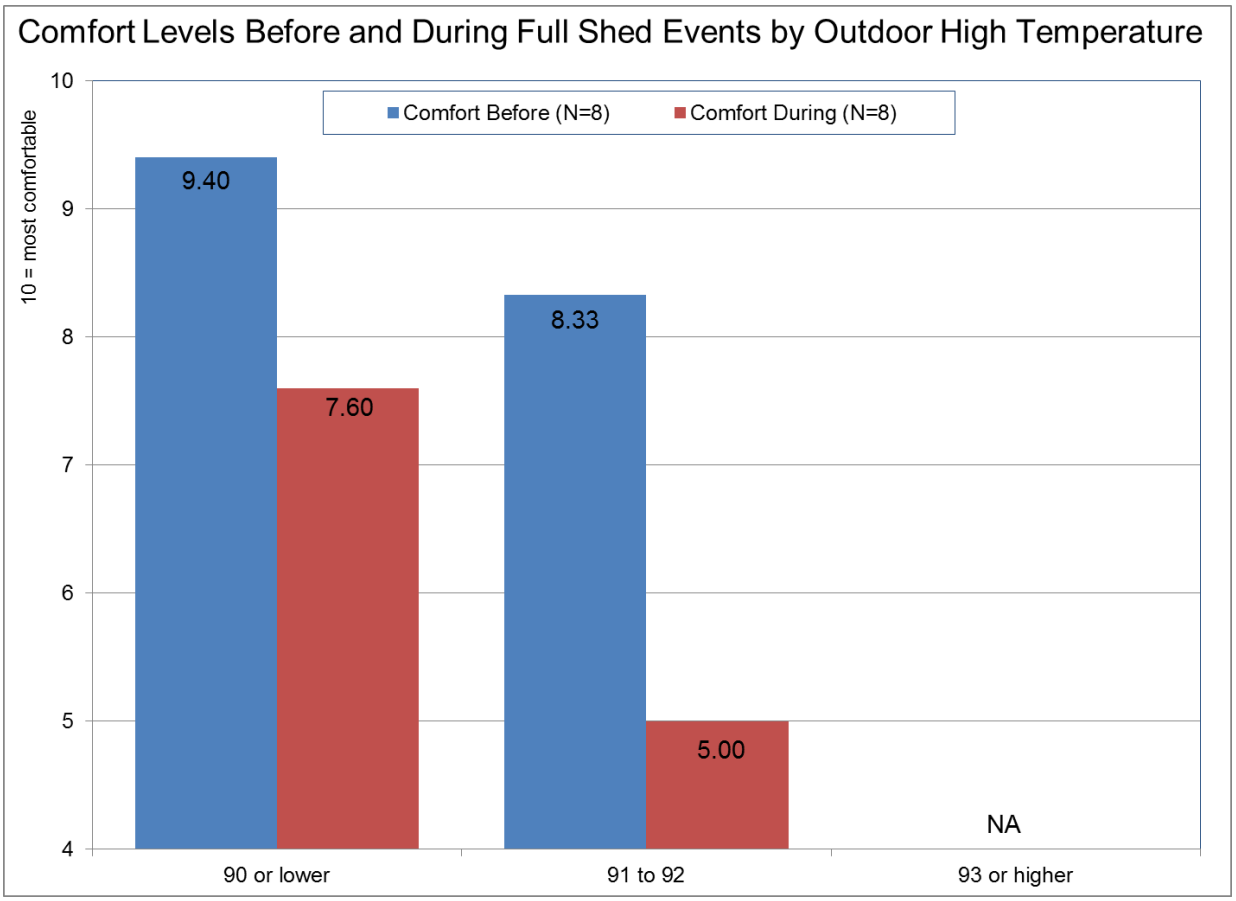


Figure 45. Comfort Ratings Before and During Full Shed Events by Outdoor High Temperature

Note: There were no Full Shed Event days in the Carolina System where the outdoor temperature was 93 degrees or higher. Only respondents who were at home during the event and who provided both comfort ratings are included in this chart.

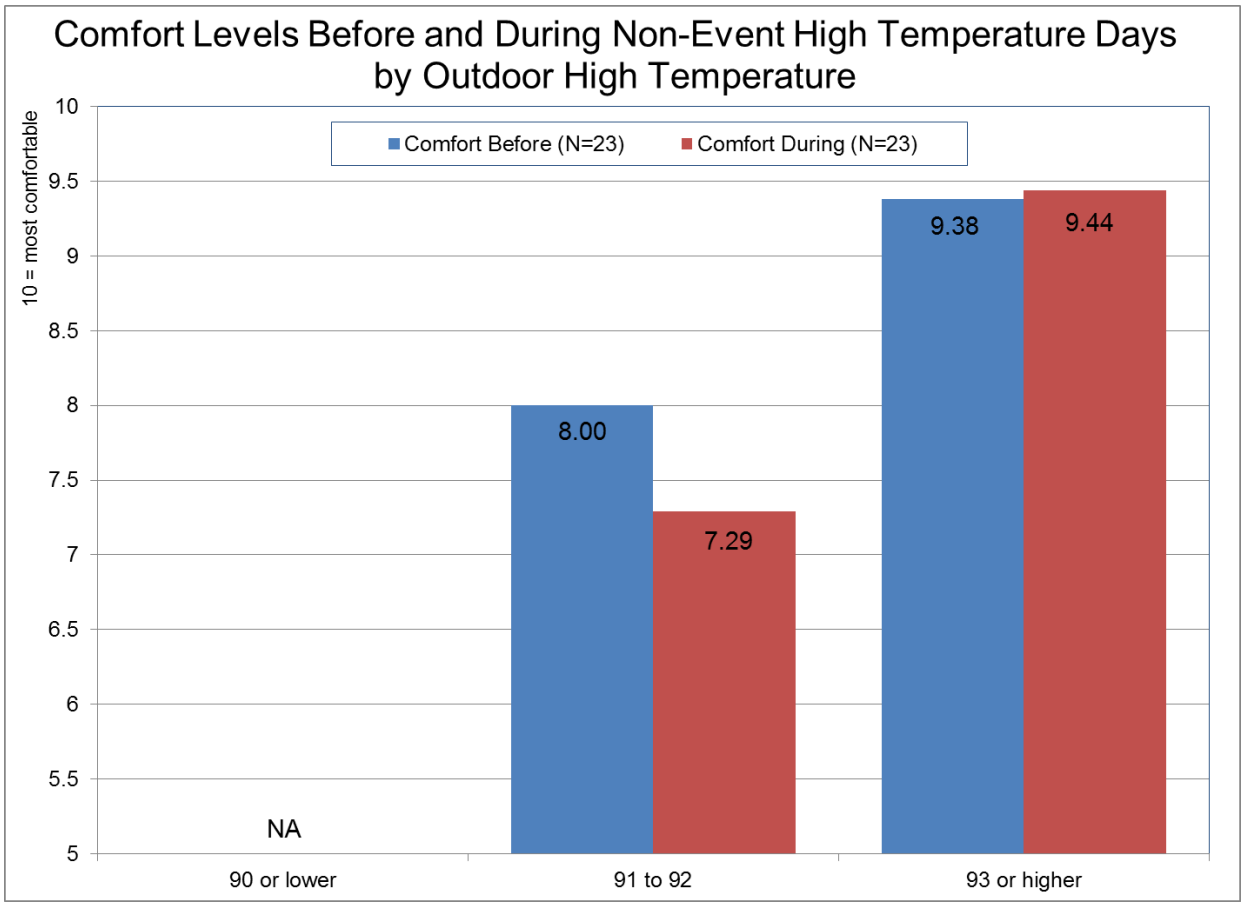


Figure 46. Comfort Ratings Before and During Non-Events by Outdoor High Temperature
Note: There were no non-event high temperature days in the Carolina System where the outdoor temperature was 90 degrees or lower. Only respondents who were at home on the non-event high temperature day and who provided both comfort ratings are included in this chart.

Figure 47 shows the percentage of participants who reported a decline in comfort ratings during an event or non-event high temperature day. On surveyed days when the high temperature was 90 degrees or lower, Full Shed Event respondents are significantly more likely to report a decline in comfort (80% or 4 out of 5) compared to Regular Event respondents (22.7% or 5 out of 22; significant at $p<.05$ using Student's t-test). On days when the temperature peaked at 91 or 92 degrees, Full Shed Events are more likely to report a decline in comfort (100% or 3 out of 3) than either Regular Events (33.3% or 7 out of 21) or Non-Events (28.6% or 2 out of 7; differences significant at $p<.05$ using Student's t-test). When the temperature was 93 or 94 degrees (the hottest outdoor high temperatures of 2013 in the Carolina System), significantly more Event participants (38.9% or 7 out of 18) than Non-Event participants (0.0% out of 16) reported a decline in comfort (significant at $p<.05$ using Student's t-test).

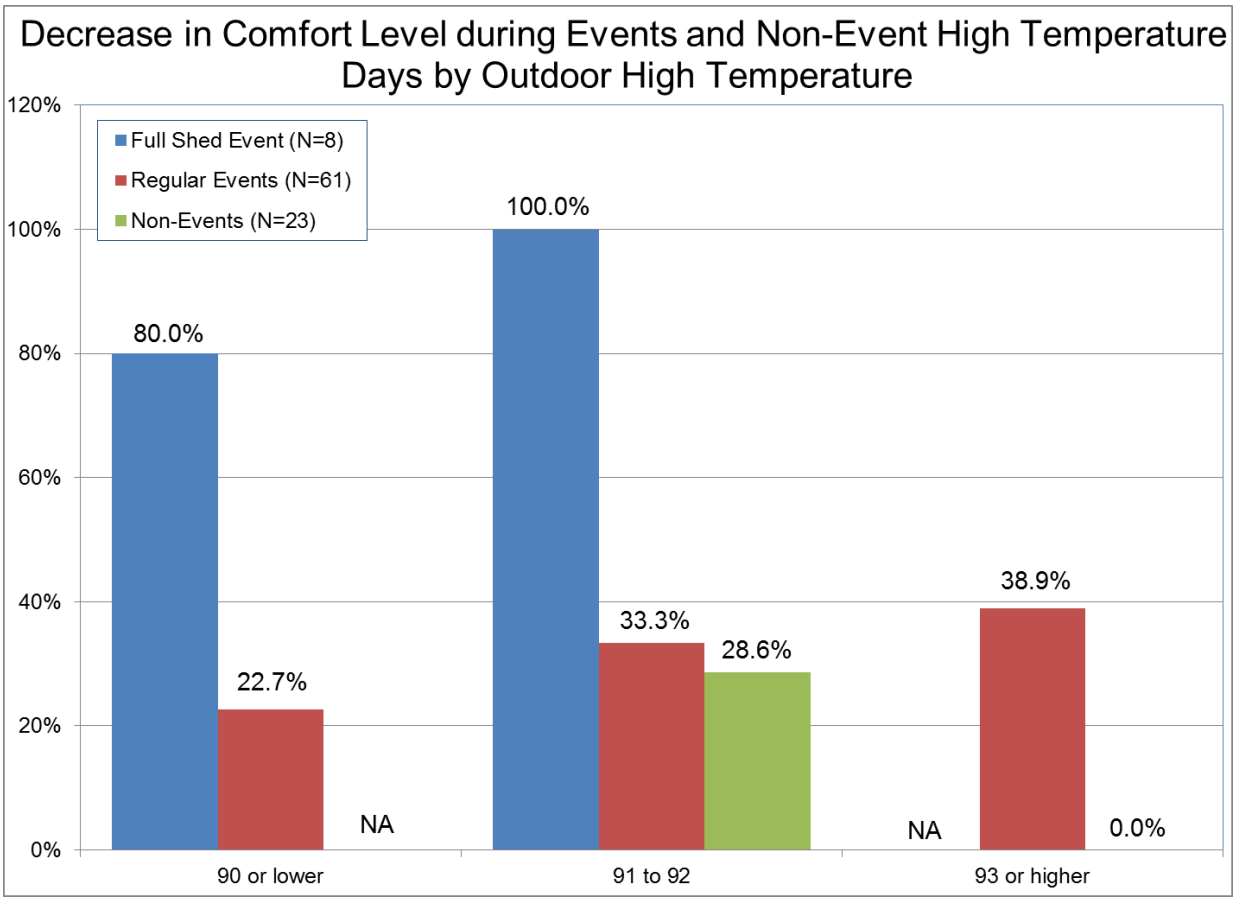


Figure 47. Decrease in Comfort by Outdoor High Temperature
Note: There was only one surveyed non-event high temperature day in the Carolina System during the 2013 cooling season (June 28); on this date the outdoor high temperature was 91 degrees in North Carolina and 94 degrees in South Carolina. During the only full shed event of the season (on July 17), the outdoor high temperature was 90 degrees in North Carolina and 92 degrees in South Carolina.

Comfort Ratings by Thermostat Settings

Full Shed and Regular Event participants are more likely to notice a change in comfort during Power Manager activation events than Non-Event participants are to notice a change in comfort on a high temperature non-event day. Comfort ratings before and after events are shown by thermostat settings in Figure 48. Comfort ratings did not decline (they actually increased) for the seven Regular Event participants who had their thermostats set to 79 degrees or higher, while ratings declined somewhat for all of the thermostat setting categories for 78 degrees or lower. However, the magnitude of the change in comfort ratings for Regular Event participants is not statistically significant at any of the thermostat setting ranges shown, just as the change in comfort ratings for this group during events is not significant overall (see Table 41 and accompanying text).

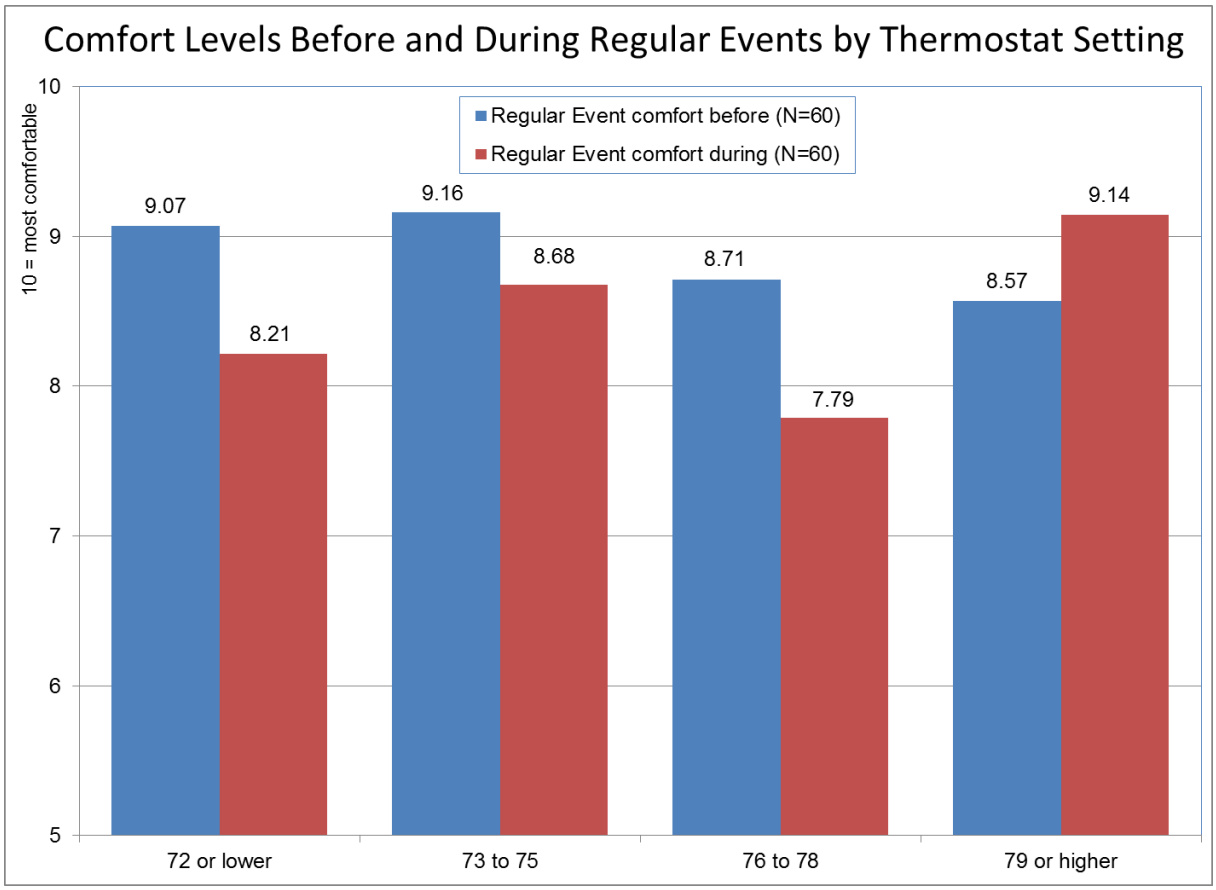


Figure 48. Changes in Comfort by Thermostat Settings During Power Regular Manager Events (Not Including Full Shed Event)

There were only seven participants in the Carolinas System who were surveyed after the full shed event of July 17, 2013, who were at home and who answered both comfort ratings questions and also the question about thermostat settings. Their ratings by thermostat setting are shown in Figure 49 and further illustrate that Full Shed Event participants reported the greatest decrease in comfort, as seen previously in Figure 28. However, the sample size of seven participants (split across three categories) is too small for statistical significance testing.

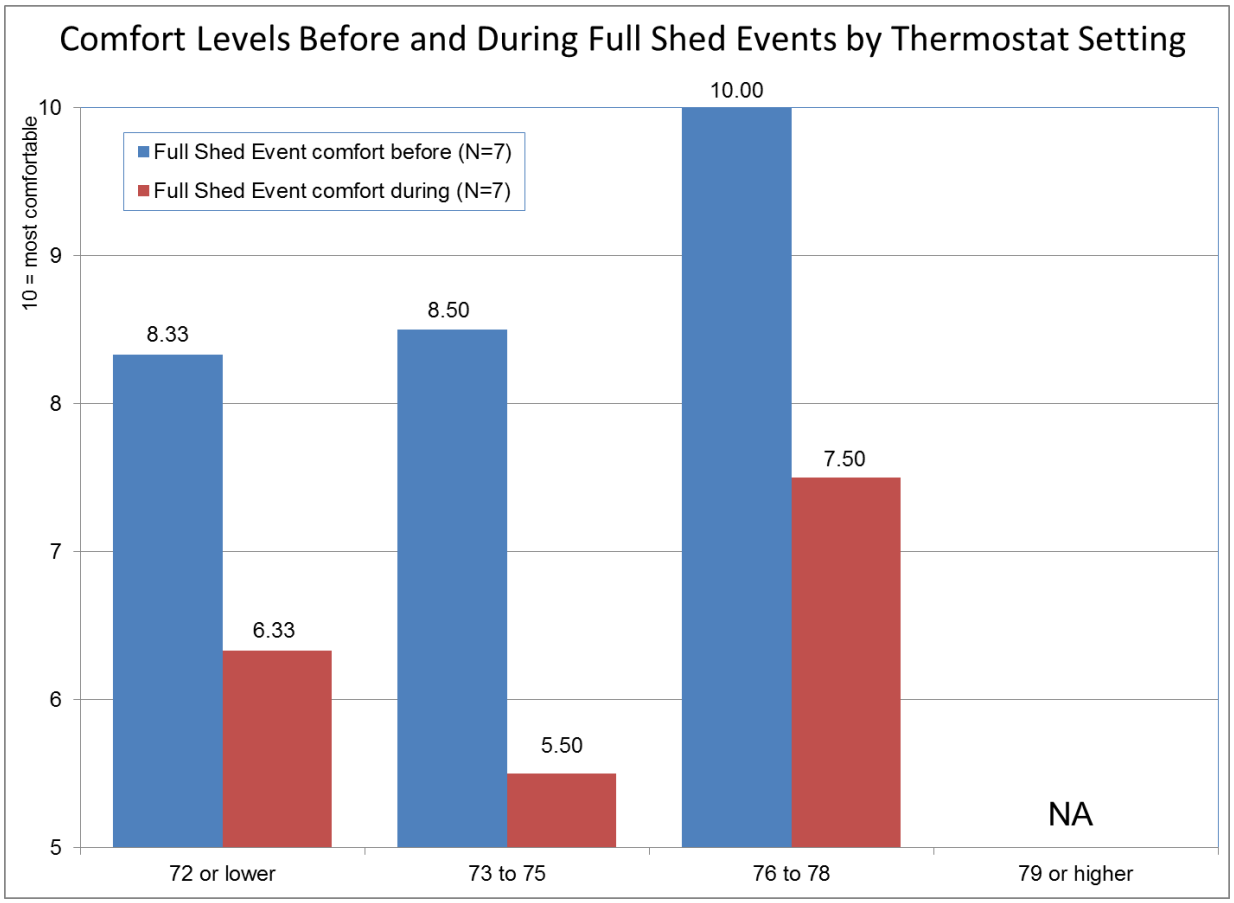


Figure 49. Changes in Comfort by Thermostat Settings During Power Manager Full Shed Event (July 17, 2013)

Changes in comfort ratings by thermostat setting for Non-Event participants on high temperature days are shown in Figure 50. For these participants, there were no significant changes in comfort ratings from "before" to "during" at any thermostat level.

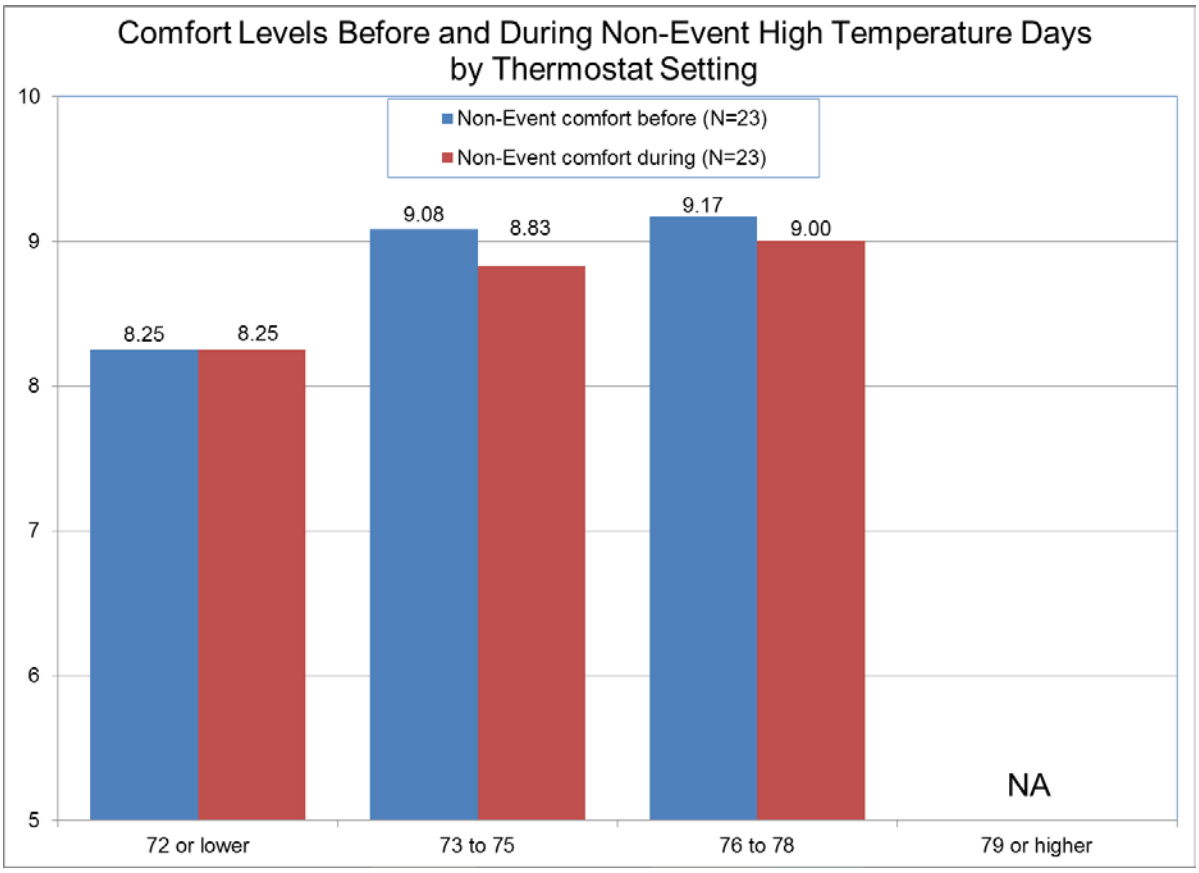


Figure 50. Changes in Comfort by Thermostat Settings During High Temperature Non-Event Days

Thermostat Settings by Age of Air Conditioner

There is one set of statistically significant differences in terms of the temperature participants had their thermometers set to during an event or non-event high temperature day by the age of their air conditioning unit: Compared to other groups, Carolina System participants with A/C units that are between 7 and 12 years old are much more likely to set their thermostats to 76 to 78 degrees (47.6% or 20 out of 42) and much less likely to set their thermostats to 72 degrees or lower (2.4% or 1 out of 42; both differences significant at $p<.05$ using Student's t-test). A clear majority of participants (ranging from 62.5% to 85.7%) set their thermostats between 73 and 78 degrees regardless of the age of their air conditioning unit, as seen in Figure 51.

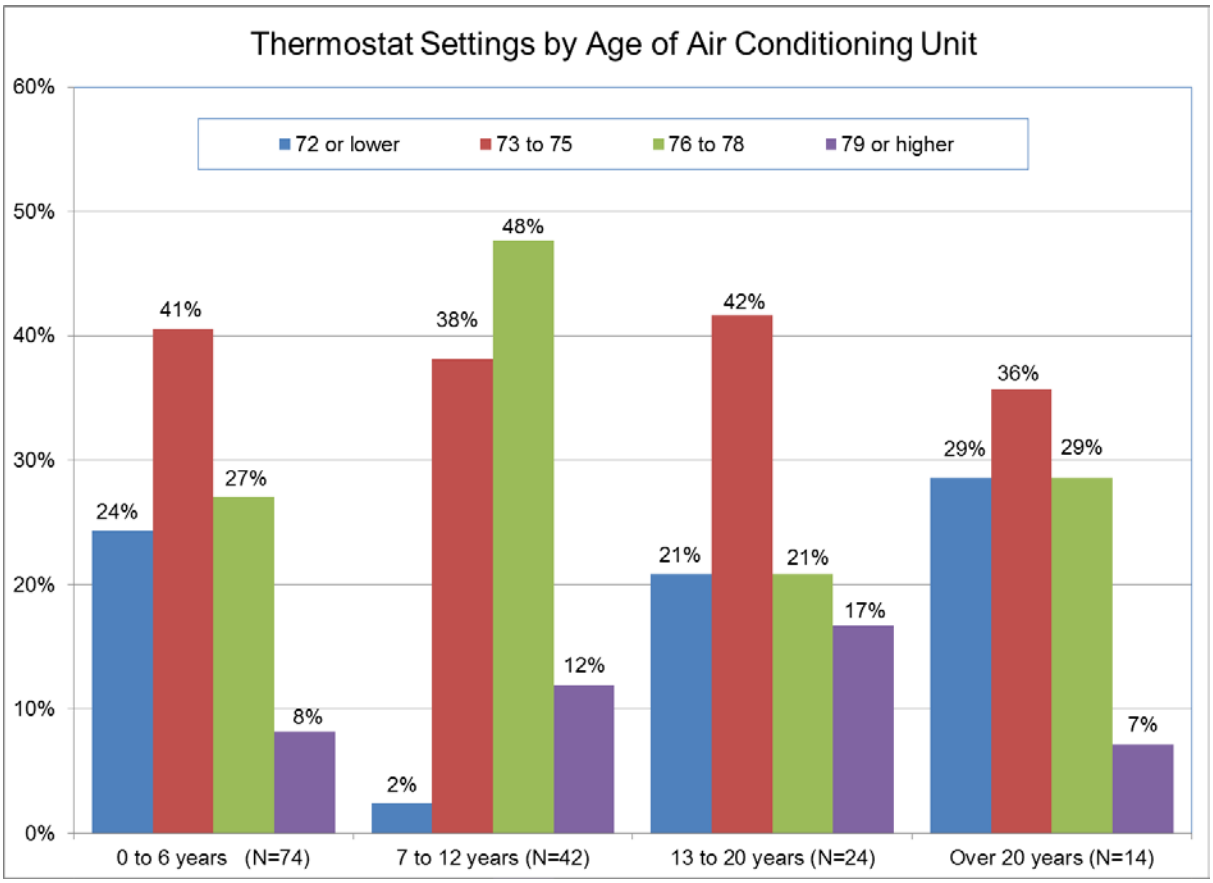


Figure 51. Thermostat Settings by Age of Air Conditioning Unit (Event and Non-Event Participants Combined)

Note: Only respondents who were able to specify thermostat settings and ages of air conditioning units are included in this chart (total N=154).

Appendix A: Management Interview Instrument

Name: _____

Title: _____

Position description and general responsibilities:

_____

_____

_____

We are conducting this interview to obtain your opinions about and experiences with the Power Manager program. We'll talk about the Power Manager Program and its objectives and your thoughts on improving the program. The interview will take about one hour to complete.

Background

1. Please describe your role and scope of responsibility in detail. When did you take on this role?

2. Can you please give me some history of the Power Manager program in _____, and tell me about the energy market in _____.

3. Are there any major differences between Power Manager in _____ and the other states in Duke Energy's service territory?

Program Implementation and Customers

Please explain how the Power Manager program works: Walk us through the participatory steps starting with a customer who knows nothing about the program.

Targeting and marketing

4. How does Duke determine the best target markets or customer segments to focus on? Do you use any type of strategic targeting of customers in order to market to those that have the size of home and AC unit that is capable of providing load reductions?

5. Do you use other Duke Energy EE programs to generate leads for PM?

6. Are there any market information, research or market assessments that you are using to identify market barriers, or to target customers?

Enrollment

7. What are the options for enrolling?

8. What is the enrollment process?

Event calls

9. Under what conditions would you call an event? Who is involved in the call?

10. How do you coordinate event calls between your residential and non-residential DR programs?

11. Please explain the customer's options for opting out of events

Demand Response Capacity

12. What is the current enrollment in Power Manager?

13. What is the current dropout rate for Power Manager? What are some of the typical reasons for dropping out?

14. What is the current demand response capacity you have with Power Manager, assuming you have 100% switch operability?

15. Is Duke Energy planning to increase this capacity in the next few years? Why or why not?

16. If yes, do you think the incentives offered through the Power Manager program are adequate enough to entice the residential customer to enroll in the program? Why or why not?

Program Objectives

17. In your own words, please briefly describe the Power Manager Program's objectives as a program?

18. What are Power Manager's objectives as a part of Duke Energy's demand response portfolio?

19. In your opinion, how well are the energy impact objectives being met? How do you know if the objectives are met or not?

20. Have these objectives changed in the last year or so, and if so how? Why?

21. I understand that Duke Energy's Retail Energy Desk has responsibility for conducting the two main studies. Can you share with me what has found with the AC duty cycle study and the switch operability study?

22. Are there other studies that Duke Energy has been carrying out to better understand the response of the market?

23. Are there any new internal or external influences on the program since the objectives were developed, that might be affecting program operations? How is Duke Energy responding to those objectives?

Analysis and Technology

24. How do you verify load shed? What is the quality control, tracking and accounting process for determining how well control strategies work?

25. (for post-season interview) Please tell me about the events that were called in 2013. How many events were called? Why were they called (what type of call event)?

26. Where there any surprises or problems with the process? Are there changes that you would recommend to the event call process?

27. (for post-season interview) Did you achieve the load shift you needed for these events? How do you know this?

28. (for post-season interview) How well did the payment accounting and application process operate this last year? Did the program staff come across any issues or problems with payment? How were they resolved?

29. (summer interview) During the last process evaluation of Power Manager, Duke Energy was in the process of addressing some problems in communication with the switches and failure rates. Can you describe this so that we understand it well? Are you experiencing the same problems in 2013? What is being done to deal with this issue? Do you have any suggestions for improving this in addition to the approaches being taken?

30. How are the event calls transmitted to the participants? Is there anything that you would like to change about this process?

31. We understand there is an IT project that allows better administration of the customers' participation or opt out status. Could you please explain this to me in detail?

Program Planning and Design

32. Do you use any vendors to help implement the program? Please tell me their roles and responsibilities for Power Manager

33. Do you currently use any smart grid technologies in your DR programs? Do you have any plans to do so in the future? What do you hope that smart grid technology would provide?

Program Successes and Challenges

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

35. In what ways do you think the Power Manager Program's operations could be improved?

36. If you could change any part of the program what would you change first?

37. What would you say are the program's biggest successes?

38. We've covered a lot of areas today, but are there any other issues or topics you think we should know about and discuss for this evaluation?

39. Do you have any questions for me, about this interview or this process evaluation?

Thank you for your time.

Appendix B: Participant Survey Instrument

Use four 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. EPT, Monday through Saturday. No calls on Sunday. Note: Only read words in bold type, italics are instructions.

Survey ID _____
Surveyor Name _____

State

( ) Kentucky
( ) Ohio
( ) South Carolina
( ) North Carolina

for answering machine 1st through penultimate attempts:
Hello, my name is _____ and I am calling with a survey about Duke Energy's Power Manager Program. I'm sorry I missed you. I'll try again another time.
for answering machine - Final Attempt:
Hello, my name is _____ and I am calling with a survey about Duke Energy's Power Manager Program. This is my last attempt at reaching you, my apologies for any inconvenience.
if person answers:
Hello, my name is _____, and I'm calling on behalf of Duke Energy. According to our information, you presently participate in Duke Energy's Power Manager Program. This program allows Duke Energy to cycle your air conditioner when there is a critical need for electricity in the region. We are conducting this survey to obtain your opinion about the program. If you qualify, we will send you a check for $20 for completing the survey. This survey will take 25 minutes or less to complete, and the information you provide will be confidential and will help to improve the program.

1. **Are you aware of your participation in the Power Manager program?**

( ) Yes
( ) No
( ) DK/NS

If no,
May I please speak to the person who would be most familiar with your household's participation in the Power Manager program?
If not available, try to schedule a callback time. If transferred, begin survey from beginning.

We would like to collect some information on why you agreed to participate in the program and how you heard about it.

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

( ) Yes
( ) No
( ) It was already installed when I moved in
( ) DK/NS

if No, DK/NS or Already Installed, skip to question 7

3. **Do you recall how you first heard about the program?**
( ) Yes
( ) No
( ) DK/NS

If yes,
3a. **How did you hear about the Power Manager Program?**
[ ] Utility bill insert
[ ] Direct mail offer from Duke Energy
[ ] Utility website
[ ] Word-of-mouth (friend/neighbor/landlord)
[ ] Newspapers
[ ] Social network _____
[ ] DK/NS
[ ] Other _____

4. **To the best of your ability, could you please tell me what the promoted benefits of the program were?**
( ) *benefits* _____
( ) DK/NS

5. **What was the <u>main</u> reason why you chose to participate in the program?**
( ) For the bill credits
( ) Helping Duke avoid power shortages/outages
( ) To save energy
( ) To save money (through lower utility bills)
( ) To help the environment
Please explain: (to reduce carbon or GHG, etc.) _____
( ) I don't use the air conditioner much
( ) I'm usually not home when the events are supposed to occur
( ) DK/NS
( ) Other _____

5a. **Do you recall reading about this benefit in the program brochure or materials sent to you?**
( ) Yes
( ) No
( ) DK/NS
( ) Did not get brochure
( ) Do not remember brochure

6. **What were your other reasons for choosing to participate in this program?**

[ ] No other reasons
[ ] For the bill credits
[ ] Helping Duke avoid power shortages/outages
[ ] To save energy
[ ] To save money (through lower utility bills)
[ ] To help the environment
Please explain: (to reduce carbon or GHG, etc…) _____
[ ] I don't use the air conditioner much
[ ] I'm usually not home when the events are supposed to occur
[ ] DK/NS
[ ] Other _____

Repeat question 6a to 6e for all benefits checked in q6
But, if Customer answered "Did not get brochure" or "Do not remember brochure" above in 5a. DO NOT ASK 6a to 6e:

6a. **Do you recall reading anything about "bill credits" in the program brochure or materials sent to you?**

( ) Yes
( ) No
( ) DK/NS

6b. **Do you recall reading anything about "Helping Duke avoid power shortages or outages" in the program brochure or materials sent to you?**

( ) Yes
( ) No
( ) DK/NS

6c. **Do you recall reading anything about "saving energy" in the program brochure or materials sent to you?**

( ) Yes
( ) No
( ) DK/NS

6d. **Do you recall reading anything about "saving money (through lower utility bills)" in the program brochure or materials sent to you?**

( ) Yes
( ) No
( ) DK/NS

6e. **Do you recall reading anything about "helping the environment" in the program brochure or materials sent to you?**
if asked, Please explain: (to reduce carbon or greenhouse gases, etc…)

( ) Yes
( ) No
( ) DK/NS

7. **Generally speaking, how important are environmental issues to you? Would you say they are…**
read answers in bold aloud until they reply
( ) **Very Important**
( ) **Important**
( ) **Neither Important nor Unimportant**
( ) **Unimportant, or**
( ) **Very Unimportant**
( ) DK/NS

8. **How important are climate change issues to you? Would you say they are…**
( ) **Very Important**
( ) **Important**
( ) **Neither Important nor Unimportant**
( ) **Unimportant, or**
( ) **Very Unimportant**
( ) DK/NS

9. **How important is reducing air pollution to you? Would you say it is…**
( ) **Very Important**
( ) **Important**
( ) **Neither Important nor Unimportant**
( ) **Unimportant, or**
( ) **Very Unimportant**
( ) DK/NS

10. **How important is the need to reduce the rate of building new power plants? Would you say it is…**
( ) **Very Important**
( ) **Important**
( ) **Neither Important nor Unimportant**
( ) **Unimportant, or**
( ) **Very Unimportant**
( ) DK/NS

11. **Are you a member of any groups or clubs that have environmental missions?**
( ) Yes *ask* **Which ones? _____**
( ) No
( ) DK/NS

12. **Before you enrolled in the program, you received program information from Duke Energy that described how the program works. Using a scale of 1 to 10 where 1 indicates**

"Very Dissatisfied" and 10 indicates "Very Satisfied", how satisfied were you with this information in helping you to understand how the program works?

( ) 1
…
( ) 10
( ) I did not enroll/It was already installed when I moved in
( ) DK/NS

If 7 or below,
12b. **Why were you less than satisfied with this information? _____**

13. **How often per year did Duke Energy say it would activate the Power Manager device on your air conditioner? _____**

14. **What's your best estimate of how many dollars you will receive in yearly bill credits from Duke Energy for participating in the Power Manager program?**

( ) $ _____
( ) DK/NS

15. **Have you received any bill credits this year from Duke Energy for participating in this program?**

( ) Yes
( ) No
( ) DK/NS

If yes,
15a. **How many times have you noticed the Power Manager credits on your bill this summer?**

( ) Every bill this summer
( ) Once
( ) Twice
( ) Three
( ) Four or more times
( ) Other
( ) DK/NS

16. **Is anything unclear to you about how the program works?**

( ) Yes **16a. What is unclear to you? _____**
( ) No
( ) DK/NS

17. **Did you ever contact Duke Energy to find out more about the Power Manager Program?**

( ) Yes
( ) No
( ) DK/NS

If yes,
17a. **What method did you use to contact Duke Energy?**
(check all that apply)
[ ] Phone
[ ] Email
[ ] In person
[ ] Other _____
[ ] DK/NS

If yes,
17b. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", how satisfied were you with the ease of reaching a Duke Energy representative?**
( ) 1
…
( ) 10
( ) DK/NS

If 7 or below,
17c. **Why were you less than satisfied? _____**

17d. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", how satisfied were you with how the Duke Energy representative responded to your questions?**
( ) 1
…
( ) 10
( ) DK/NS

If 7 or below,
17e. **Why were you less than satisfied with this information?**
[ ] Didn't respond to my questions/ concerns
[ ] Unable to answer/address my questions/concerns
[ ] Not professional/courteous
[ ] Other _____
[ ] DK/NS

18. **Has Duke Energy activated the Power Manager device since you joined the program?**
[If they ask what this means, respond with:
*"***Duke Energy has the ability to send a signal to activate the device to cycle your central air conditioner on and off during an event***." Repeat the question.*
( ) Yes
( ) No
( ) DK/NS

19. **How do you know when the device has been activated?**

[ ] A/C shuts down
[ ] Home temperature rises
[ ] The light on the meter is on
[ ] Light on AC unit flashes
[ ] Fan goes into cycling mode
[ ] Bill credits
[ ] Lower bill
[ ] Contact or notification from Duke Energy (other than bill)
[ ] Other _____
[ ] DK/NS

20. **About how many times did Duke Energy activate your Power Manager device in 2013?**

_____

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

( ) Yes
( ) No
( ) DK/NS

If no or don't know, skip to question 28.

22. **During this activation, using a scale of 1 to 10 where 1 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort before the control event?**

( ) 1
…
( ) 10
( ) DK/NS

23. **Using the same scale of 1 to 10 where 1 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort during the control event?**

( ) 1
…
( ) 10
( ) DK/NS

If score from Q23 is lower than score from Q22:

24. **What do you feel caused your decrease in comfort?**

[ ] No Change *(q22 = q23)*
[ ] Power Manager
[ ] Rising Temperature
[ ] Rising Humidity
[ ] Power Outage
[ ] Other _____
[ ] DK/NS

25. **When Duke Energy activated your Power Manager device, did you or any other members of your household adjust the settings on your thermostat?**

( ) Yes
( ) No
( ) DK/NS

If yes,

25a. **At what temperature was it originally set, and what temperature did you set it to during the control event?**

Original temperature setting: degrees F _____
Adjusted temperature setting: degrees F _____

26. **Thinking about this summer, how many times do you think the activation of the Power Manager program affected your level of comfort? _____**

27. **When Duke Energy activated your Power Manager device, did you or any other members of your household turn on any fans to keep cool?**

( ) Yes
( ) No
( ) DK/NS
( ) Already had fans running.

27a. **What else did you or other members of your household do to keep cool?**

[ ] Continued normal activities/ Didn't do anything different
[ ] Turned on room/window air conditioners
[ ] Closed blinds/shades
[ ] Moved to a cooler part of the house
[ ] Left the house and went somewhere cool
[ ] Wore less clothing
[ ] Drank more water/cool drinks
[ ] Cooled off with water (shower, bath, sprinkler, hose, pool)
[ ] Turned on fans
[ ] Opened windows
[ ] Other _____
[ ] DK/NS

28. **When Duke Energy activates your Power Manager device, it usually does so on summertime afternoons. Is someone usually home on weekday afternoons during the summertime?**

( ) Yes
( ) No
( ) DK/NS

29. **Why do you think Duke Energy activates your Power Manager device on summertime weekdays during the afternoon as opposed to other times of the day or year? _____**

30. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", how satisfied were you with the process of enrolling in the program?**

( ) 1
…
( ) 10
( ) I did not enroll/It was already installed when I moved in
( ) DK/NS

If 7 or below,
30b. **Why were you dissatisfied with this enrollment process? _____**

31. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", how satisfied are you with the Power Manager program in general?**

( ) 1
…
( ) 10
( ) DK/NS

If 7 or below,
31b. **Why were you less than satisfied with Power Manager?**

( ) They activated my Power Manager device more often than I would like
( ) The bill credits/incentives were not large enough
( ) I was uncomfortable when my Power Manager device was activated
( ) Other _____
( ) DK/NS

If 7 or below,
31c. **Were there any other reasons you were less than satisfied with Power Manager?**

[ ] No other reasons
[ ] They activated my Power Manager device more often than I would like
[ ] The bill credits/incentives were not large enough
[ ] I was uncomfortable when my Power Manager device was activated
[ ] Other _____
[ ] DK/NS

32. **Using a scale of 1 to 10, where 1 means "Extremely Unlikely" and 10 means "Extremely Likely", how likely is it that you would recommend this program to a friend, neighbor, or co-worker?**

( ) 1
…
( ) 10
( ) DK/NS

If 7 or below,

32a. **Why would you not recommend the program? _____**

33. **What, if any, Duke Energy programs or services have you heard of that help customers save energy? Any others?**

[ ] Smart Saver (other than CFL)
[ ] Personalized Energy Report
[ ] Home Energy House Call
[ ] Home Energy Comparison Report
[ ] CFL Program
[ ] Energy Star Homes
[ ] Low Income, Weatherization, or Low Income Weatherization
[ ] K12, NEED, or "Get Energy Smart"
[ ] Other _____
[ ] DK/NS or None

Now I'm going to ask you some questions about your air conditioning use.

34. **How often do you use your central air conditioner? Would you say you use it ...**
Read answers aloud until they reply

( ) **Not at all**
( ) **Only on the hottest days**
( ) **Frequently during the cooling season**
( ) **Most days during the cooling season**
( ) **Every day during the cooling season**
( ) DK/NS

If customer did use AC
34a. **About how many days would you estimate that you had your air conditioner on so far this year?**

( ) Fewer than 10 days
( ) 10 to 20 days
( ) 21 to 30 days
( ) 31 to 40 days
( ) 41 to 50 days
( ) 51 to 60 days
( ) 61 to 70 days
( ) 71 to 80 days
( ) 81 to 90 days
( ) 91 to 100 days
( ) More than 100 days
( ) every day
( ) DK/NS

35. **Have you had your air conditioner tuned-up or serviced since you enrolled in the Power Manager program?**

( ) Yes

( ) No
( ) DK/NS
( ) Other _____

If yes,

35a. **Did the performance of your air conditioner improve after you had it serviced?**

( ) Yes
( ) No
( ) DK/NS

35b. **Who serviced your air conditioner?**

( ) Air conditioning contractor
( ) Duke Energy
( ) Electrician
( ) Other _____
( ) DK/NS

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

'someone' includes pets, if applicable

( ) Yes
( ) No
( ) DK/NS

37. **Is the air conditioner typically used to keep someone at home comfortable during summer weekdays after 5 P.M.?**

'someone' includes pets, if applicable

( ) Yes
( ) No
( ) DK/NS

38. **When you think of a typical hot and humid summer day, at what outside temperature do you tend to feel uncomfortably warm?**

( ) <65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) 79-81 degrees
( ) 82-84 degrees
( ) 85-87 degrees
( ) 88-90 degrees
( ) 91-94 degrees
( ) 95-97 degrees
( ) 98-100 degrees
( ) >100 degrees

( ) DK/NS

39. **At what outside temperature do you tend to turn on the air conditioner?**
( ) It is programmed into the thermostat.
( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) 79-81 degrees
( ) 82-84 degrees
( ) 85-87 degrees
( ) 88-90 degrees
( ) 91-94 degrees
( ) 95-97 degrees
( ) 98-100 degrees
( ) greater than 100 degrees
( ) DK/NS

If "It's programmed into the thermostat",
39a. **Do you set your thermostat seasonally or when the weather gets hot?**
( ) I program the thermostat seasonally
( ) When the weather gets hot
( ) Other _____

40. **I am going to read a list of time periods. For each time period, please tell me the temperature that your thermostat is typically set to on a hot summer weekday when you are using the air conditioner, or if it is turned off.**

40a**. On a hot weekday morning from 6 am to noon.**
( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) greater than 78 degrees
( ) OFF
( ) DK/NS

40b**. On a hot weekday afternoon from noon to 5 pm**
( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) greater than 78 degrees

( ) OFF
( ) DK/NS

40c**. On a hot weekday evening from 5 pm to 10pm.**
( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) greater than 78 degrees
( ) OFF
( ) DK/NS

40d**. During a hot weekday night from 10pm to 6am.**
( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) greater than 78 degrees
( ) OFF
( ) DK/NS

41. **I would now like to know the thermostat temperature setting for those same time periods but on a hot summer weekend.**

41a. **On a hot weekend morning from 6 am to noon.**
( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) greater than 78 degrees
( ) No change from an average summer week day
( ) OFF
( ) DK/NS

41b. **On a hot weekend afternoon from noon to 5 pm**
( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) greater than 78 degrees
( ) No change from an average summer week day
( ) OFF

( ) DK/NS

41c. **On a hot weekend evening from 5 pm to 10pm.**
( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) greater than 78 degrees
( ) No change from an average summer week day
( ) OFF
( ) DK/NS

41d. **During a hot weekend night from 10pm to 6am.**
( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) greater than 78 degrees
( ) No change from an average summer week day
( ) OFF
( ) DK/NS

42. **Duke Energy is always looking for other ways to help their customers. If Duke were to offer a program that cycles other equipment at your home such as an electric water heater, would you be interested in participating??**
( ) Yes
( ) No *ask* **Why not?** _____
( ) DK/NS *comments optional* _____

43. **Are there any programs or services that you think Duke Energy should provide to its residential customers that are currently not provided?**
( ) Yes
( ) No
( ) DK/NS

If yes,
43b. **What services or types of programs?** _____

44. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", What is your overall satisfaction with Duke Energy?**
( ) 1
…
( ) 10
( ) DK/NS

If 7 or below,
44b. **Why were you less than satisfied with Duke Energy? _____**

45. **Did you experience any power outage issues on any of the days that Duke Energy activated your Power Manager device?**
( ) Yes
( ) No
( ) DK/NS

Finally, we have some general demographic questions…

d1. **In what type of building do you live?**
( ) Single-family home, detached construction
( ) Single-family home, factory manufactured/modular
( ) Single family, mobile home
( ) Row House
( ) Two or Three family attached residence-traditional structure
( ) Apartment (4 + families)---traditional structure
( ) Condominium---traditional structure
( ) Other _____
( ) Refused
( ) DK/NS

d2. **What year was your residence built?**
( ) 1959 or before
( ) 1960-1979
( ) 1980-1989
( ) 1990-1997
( ) 1998-2000
( ) 2001-2007
( ) 2008-present
( ) DK/NS

d3. **How many rooms are in your home (excluding bathrooms, but including finished basements)?**
( ) 1 to 3
( ) 4
( ) 5
( ) 6
( ) 7
( ) 8
( ) 9
( ) 10 or more
( ) DK/NS

d4. **Which of the following best describes your home's heating system?**
Check all that apply

[ ] None
[ ] Central forced air furnace
[ ] Electric Baseboard
[ ] Heat Pump
[ ] Geothermal Heat Pump
[ ] Other _____

d5. **How old is your heating system?**

( ) 0-4 years
( ) 5-9 years
( ) 10-14 years
( ) 15-19 years
( ) 19 years or older
( ) DK/NS
( ) Do not have

d6. **What is the primary fuel used in your heating system?**

( ) Electricity
( ) Natural Gas
( ) Oil
( ) Propane
( ) Other _____

d7. **What is the secondary fuel used in your primary heating system, if applicable?**

( ) Electricity
( ) Natural Gas
( ) Oil
( ) Propane
( ) Other _____
( ) None

d8. **Do you use one or more of the following to cool your home?**
(Mark all that apply)

[ ] None, do not cool the home
[ ] Heat pump for cooling
[ ] Central air conditioning
[ ] Through the wall or window air conditioning unit
[ ] Geothermal Heat pump
[ ] Other *(please specify)* _____

d9. **How many window-unit or "through the wall" air conditioner(s) do you use?**

( ) None
( ) 1

( ) 2
( ) 3
( ) 4
( ) 5
( ) 6
( ) 7
( ) 8 or more

d10. **What is the fuel used in your cooling system?**
[ ] Electricity
[ ] Natural Gas
[ ] Oil
[ ] Propane
[ ] Other _____
[ ] None

d11. **How old is your cooling system?**
( ) 0-4 years
( ) 5-9 years
( ) 10-14 years
( ) 15-19 years
( ) 19 years or older
( ) DK/NS
( ) Do not have

d12. **What is the fuel used by your water heater?**
(Mark all that apply)
[ ] Electricity
[ ] Natural Gas
[ ] Oil
[ ] Propane
[ ] Other _____
[ ] No water heater

d13. **How old is your water heater?**
( ) 0-4 years
( ) 5-9 years
( ) 10-14 years
( ) 15-19 years
( ) More than 19 years
( ) DK/NS

d14. **What type of fuel do you use for indoor cooking on the stovetop or range?**
(Mark all that apply)
[ ] Electricity
[ ] Natural Gas

[ ] Oil
[ ] Propane
[ ] Other _____
[ ] No stovetop or range

d15. **What type of fuel do you use for indoor cooking in the oven?**
(Mark all that apply)
[ ] Electricity
[ ] Natural Gas
[ ] Oil
[ ] Propane
[ ] Other _____
[ ] No oven

d16. **What type of fuel do you use for clothes drying?**
(Mark all that apply)
[ ] Electricity
[ ] Natural Gas
[ ] Oil
[ ] Propane
[ ] Other _____
[ ] No clothes dryer

d17. **About how many square feet of living space are in your home?**
(Do not include garages or other unheated areas)
Note: A 10-foot by 12-foot room is 120 square feet
( ) Less than 500
( ) 500 to 999
( ) 1000 to 1499
( ) 1500 to 1999
( ) 2000 to 2499
( ) 2500 to 2999
( ) 3000 to 3499
( ) 3500 to 3999
( ) 4000 or more
( ) DK/NS

d18. **Do you own or rent your home?**
( ) Own
( ) Rent

d19. **How many levels are in your home (not including your basement)?**
( ) One
( ) Two
( ) Three

d20. **Does your home have a heated or unheated basement?**
( ) Heated
( ) Unheated
( ) No basement

d21. **Does your home have an attic?**
( ) Yes
( ) No

d22. **Are your central air/heat ducts located in the attic?**
( ) Yes
( ) No
( ) N/A

d23. **Does your house have cold drafts in the winter?**
( ) Yes
( ) No

d24. **Does your house have sweaty windows in the winter?**
( ) Yes
( ) No

d25. **Do you notice uneven temperatures between the rooms in your home?**
( ) Yes
( ) No

d26. **Does your heating system keep your home comfortable in winter?**
( ) Yes
( ) No

d27. **Does your cooling system keep your home comfortable in summer?**
( ) Yes
( ) No

d28. **Do you have a programmable thermostat?**
( ) Yes
( ) No

d28b. **How many thermostats are there in your home?**
( ) 0
( ) 1
( ) 2
( ) 3
( ) 4 or more
( ) DK/NS

d29. **What temperature is your thermostat set to on a typical summer weekday afternoon?**

( ) Less than 69 degrees
( ) 69-72 degrees
( ) 73-78 degrees
( ) Higher than 78 degrees
( ) Off
( ) DK/NS

d30. **What temperature is your thermostat set to on a typical winter weekday afternoon?**

( ) Less than 67 degrees
( ) 67-70 degrees
( ) 71-73 degrees
( ) 74-77 degrees
( ) 78 degrees or higher
( ) Off
( ) DK/NS

d31. **Do You Have a Swimming Pool or Spa?**

( ) Yes
( ) No

Read all answers until they reply

d32. **Would a two-degree increase in the summer afternoon temperature in your home affect your comfort..**

( ) **Not at all**
( ) **Slightly**
( ) **Moderately, or**
( ) **Greatly**

d33. **How many people live in this home?**

( ) 1
( ) 2
( ) 3
( ) 4
( ) 5
( ) 6
( ) 7
( ) 8 or more
( ) Prefer not to answer

d34. **How many of them are teenagers?** *(age 13-19)*

If they ask why, explain that teenagers are generally associated with higher energy use.

( ) 0
( ) 1
( ) 2
( ) 3

( ) 4
( ) 5
( ) 6
( ) 7
( ) 8 or more
( ) Prefer not to answer

d35. **How many persons are usually home on a weekday afternoon?**
( ) 0
( ) 1
( ) 2
( ) 3
( ) 4
( ) 5
( ) 6
( ) 7
( ) 8 or more
( ) Prefer not to answer

d36. **Are you planning on making any large purchases to improve energy efficiency in the next 3 years?**
( ) Yes
( ) No
( ) DK/NS

The following questions are for classification purposes only and will not be used for any other purpose than to help Duke Energy continue to improve service.

d37. **What is your age group?**
( ) 18-34
( ) 35-49
( ) 50-59
( ) 60-64
( ) 65-74
( ) Over 74
( ) Prefer not to answer

d38. **Please indicate your annual household income.**
( ) Under $15,000
( ) $15,000-$29,999
( ) $30,000-$49,999
( ) $50,000-$74,999
( ) $75,000-$100,000
( ) Over $100,000
( ) Prefer Not to Answer

We've reached the end of the survey. As I mentioned earlier, we would like to send you $20 for your time and feedback today. Should we send the $20 to *{address on calling sheet}*, or would a different address be better?

Confirm Name & complete address from calling sheet. If needed, make any changes to Name or Address on calling sheet, and mark "Changed Info" column.

You should receive your $20 check in about 4-6 weeks. It will come in an envelope from our company: TecMarket Works. Thanks again for your time today!

Appendix C: Event Survey Instrument

Only calls to homes, please. Businesses are not eligible for this survey.
Use two attempts at different times of the day within 27 hours of event notification before dropping contact from the contact list. Call times are from 10:00 a.m. to 8:00 p.m. EPT Monday through Saturday. No calls on Sunday. For example, if a control event occurs on a Monday, calling hours for that particular event would be:

Monday 5pm-8pm EPT
Tuesday 10am-8pm EPT

Note: Only read words in bold type, italics are instructions.

Survey ID _____
Event ID _____
Surveyor Name _____

State

( ) Indiana
( ) Ohio
( ) Kentucky
( ) North Carolina
( ) South Carolina

Option

( ) 0.5 kW
( ) 1.0 kW
( ) 1.5 kW
( ) DK/NS

Introduction

Hello, my name is _____, and I'm calling on behalf of Duke Energy. According to our information, you presently participate in Duke Energy's Power Manager Program. This program allows Duke Energy to cycle your air conditioner when there is a critical need for electricity in the region. This is a short survey that will take about 5 minutes to complete, and the information you provide will be confidential and will help to improve the program.

for answering machine 1st attempt:

Hello, my name is _____. I am calling on behalf of Duke Energy to conduct a customer survey about the Power Manager Program. I'm sorry I missed you. I'll try again tomorrow.

for answering machine - Final Attempt:

Hello, my name is _____. I am calling on behalf of Duke Energy to conduct a customer survey about the Power Manager Program. This is my last attempt at reaching you, my apologies for any inconvenience.

on the second and final call attempt

Hello, this is _____ calling again on behalf of Duke Energy, with a survey about their Power Manager Program. This is my last attempt to reach you. Sorry for any inconvenience.

1. **Are you aware of your participation in the Power Manager program?**
   ( ) Yes
   ( ) No
   ( ) DK/NS

If no,
May I please speak to the person who would be most familiar with your household's participation in the Power Manager program?

If not available, try to schedule a callback time within the 27 hour time-frame for the particular event. If transferred, begin survey from beginning (Introduction).

2. **Has Duke Energy activated the Power Manager device since you joined the program?**
*[If they ask what this means, respond with: "***Duke Energy has the ability to send a signal to activate the device to cycle your central air conditioner on and off during an event***." Then repeat the question.]*
   ( ) Yes
   ( ) No
   ( ) DK/NS

3. **How do you know when the device has been activated?**
   [ ] A/C shuts down
   [ ] Home temperature rises
   [ ] The light on the meter is on
   [ ] Light on AC unit flashes
   [ ] Bill credits
   [ ] Lower bill
   [ ] Other _____
   [ ] DK/NS

4. **Has your device been activated within the last 7 days?**
   ( ) Yes
   ( ) No
   ( ) DK/NS

Your Power Manager device was recently activated on {*date*} starting at {*start time*} and ending at {*end time*}.

5. **At what temperature was your thermostat set to during the time of the event?**
   ( ) less than 65 degrees
   ( ) 65-68 degrees
   ( ) 69-72 degrees

( ) 73-75 degrees
( ) 76-78 degrees
( ) 79-81 degrees
( ) 82-84 degrees
( ) 85-87 degrees
( ) 88-90 degrees
( ) 91-94 degrees
( ) 95-97 degrees
( ) 98-100 degrees
( ) greater than 100 degrees
( ) It's programmed into the thermostat
( ) Thermostat was turned off
( ) Air conditioner was turned off
( ) DK/NS

6. **Were you or any members of your household home when Duke Energy activated your Power Manager device at that time?**
( ) Yes
( ) No
( ) DK/NS
If no or don't know, skip to question 13.

7. **During this recent activation, using a scale of 1 to 10 where 1 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort before the control event?**
( ) 1
…
( ) 10
( ) DK/NS

8. **Using the same scale of 1 to 10 where 1 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort during the control event?**
( ) 1
…
( ) 10
( ) DK/NS

Ask question 9 if score from question 8 is lower than score from question 7
(Select all that apply.)
9. **What do you feel caused your decrease in comfort?**
[ ] Power Manager
[ ] Rising Temperature
[ ] Rising Humidity
[ ] Power Outage
[ ] Other _____
[ ] DK/NS

10. **When Duke Energy activated your Power Manager device *{today OR yesterday}*, did you or any other members of your household adjust the settings on your thermostat?**

( ) Yes
( ) No
( ) DK/NS

If yes to question 10,
NOTE: enter a numeral for a temperature, or DK if not sure.
10a. **At what temperature was it originally set, and what temperature did you set it to during the control event?**

Original temperature setting (degrees F) _____
Adjusted temperature setting (degrees F) _____

11. **When Duke Energy activated your Power Manager device, did you or any other members of your household turn on any fans to keep cool?**

( ) Yes
( ) No
( ) DK/NS

12. **What else did you or other members of your household do to keep cool?**
Select all that apply.

[ ] Continued normal activities/ Didn't do anything different
[ ] Turned on room/window air conditioners
[ ] Closed blinds/shades
[ ] Moved to a cooler part of the house
[ ] Left the house and went somewhere cool
[ ] Wore less clothing
[ ] Drank more water/cool drinks
[ ] Turned on fans
[ ] Opened windows
[ ] Other _____
[ ] DK/NS

Now I'm going to ask you some questions about your air conditioning use.

13. **How often do you use your central air conditioner? Would you say you use it ...**
(Read first 5 answers aloud, stop when they answer.)

( ) **Not at all**
( ) Only on the hottest days
( ) Frequently during the cooling season
( ) Most days during the cooling season
( ) Everyday during the cooling season
( ) DK/NS

14. **When you think of a typical hot and humid summer day, at what outside temperature do you tend to feel uncomfortably warm?**

( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) 79-81 degrees
( ) 82-84 degrees
( ) 85-87 degrees
( ) 88-90 degrees
( ) 91-94 degrees
( ) 95-97 degrees
( ) 98-100 degrees
( ) greater than 100 degrees
( ) DK/NS

15. **At what <u>outside temperature</u> do you tend to turn on the air conditioner?**

( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) 79-81 degrees
( ) 82-84 degrees
( ) 85-87 degrees
( ) 88-90 degrees
( ) 91-94 degrees
( ) 95-97 degrees
( ) 98-100 degrees
( ) greater than 100 degrees
( ) It's programmed into the thermostat
( ) DK/NS

16. **How old is your air conditioner?**

( ) 0 to 6 years old
( ) 7 to 12 years old
( ) 13 to 20 years old
( ) over 20 years old
( ) DK/NS

17. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", what is your overall satisfaction with the Power Manager program?**

( ) 1
…
( ) 10

( ) DK/NS

If 7 or below ask,
17a. **Why are you less than satisfied with Power Manager?**
(Select all that apply)
[ ] They activated my Power Manager device more often than I would like
[ ] The bill credits/incentives were not large enough
[ ] I was uncomfortable when my Power Manager device was activated
[ ] Other _____
[ ] DK/NS

18. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", what is your overall satisfaction with Duke Energy?**
( ) 1
…
( ) 10
( ) DK/NS

If 7 or below,
18a. **Why are you less than satisfied with Duke Energy? _____**

19. **Using a scale of 1 to 10, where 1 means "Extremely Unlikely" and 10 means "Extremely Likely", how likely is it that you would recommend this program to a friend or colleague?**
( ) 1
…
( ) 10
( ) DK/NS

If 7 or below,
19a. **Why would you not recommend the program? _____**

20. **Did you experience any power outage issues on the day of the event?**
( ) Yes
( ) No
( ) DK/NS

21. **Do you get your Duke Energy bill in the mail or by email?**
( ) Mail
( ) Email
( ) DK/NS
( ) Other _____

22. **How do you pay your bill? Do you…**
(Read first 3 answers aloud, stop when they answer.)
( ) **Mail a check**
( ) log into your Duke Energy account and pay online

( ) or do you have an auto-pay set up for your account?
( ) Other _____

23. **On average, how often do you review the details of your Duke Energy bill?**
(Read first 4 answers aloud, stop when they answer.)
( ) **Every month**
( ) More than half the time
( ) Less than half the time
( ) Never
( ) Other _____
( ) DK/NS

24. **How many people live in this home?**
( ) 1
( ) 2
( ) 3
( ) 4
( ) 5
( ) 6
( ) 7
( ) 8 or more
( ) prefer not to answer

Thank you for your time and feedback today!
Politely end call.

Appendix D: Non-Event Survey Instrument

Note: Text that is in red font indicates the changed wording from the Event survey to this Non-Event survey. Use two attempts at different times of the day within 27 hours of hot weather (exceeding 90°F in Midwest, or exceeding 93 in Carolina System) and no Power Manager event being called. Call times are from 10:00 a.m. to 8:00 p.m. EPT Monday through Saturday. No calls on Sunday. For example, if a high-temperature/no-event day occurs on a Monday, calling hours for that particular non-event would be:

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

Note: Only read words in bold type. Italics are instructions.

Survey ID _____
Event ID _____
Surveyor Name _____

State

( ) Indiana
( ) Ohio
( ) Kentucky
( ) North Carolina
( ) South Carolina

Option *(if applicable)*

( ) 0.5 kW
( ) 1.0 kW
( ) 1.5 kW
( ) DK/NS

(if person answers)
Hello, my name is _____, and I'm calling on behalf of Duke Energy. According to our information, you presently participate in Duke Energy's Power Manager Program. This program allows Duke Energy to cycle your air conditioner when there is a critical need for electricity in the region. This is a short survey that will take about 5 minutes to complete, and the information you provide will be confidential and will help to improve the program.

for answering machine 1st attempt:
Hello, my name is _____. I am calling on behalf of Duke Energy to conduct a customer survey about the Power Manager Program. I'm sorry I missed you. I'll try again tomorrow.

for answering machine - Final Attempt:
Hello, my name is _____. I am calling on behalf of Duke Energy to conduct a customer survey about the Power Manager Program. This is my last attempt at reaching you, my apologies for any inconvenience.

on the second and final call attempt
Hello, this is _____ calling again on behalf of Duke Energy, with a survey about their Power Manager Program. This is my last attempt to reach you. Sorry for any inconvenience.

1. **Are you aware of your participation in the Power Manager program?**
( ) Yes
( ) No
( ) DK/NS

If no,
May I please speak to the person who would be most familiar with your household's participation in the Power Manager program?
If not available, try to schedule a callback time within the 27 hour time-frame for the particular event. If transferred, begin survey from beginning.

2. **Has Duke Energy activated the Power Manager device since you joined the program?**
*[If they ask what this means, respond with: "***Duke Energy has the ability to send a signal to activate the device to cycle your central air conditioner on and off during an event***." Then repeat the question.]*
( ) Yes
( ) No
( ) DK/NS

3. **How do you know when the device has been activated?**
[ ] A/C shuts down
[ ] Home temperature rises
[ ] The light on the meter is on
[ ] Light on AC unit flashes
[ ] Bill credits
[ ] Lower bill
[ ] Other _____
[ ] DK/NS

4. **Has your device been activated within the last 7 days?**
( ) Yes
( ) No
( ) DK/NS

5. **At what temperature was your thermostat set to at 3pm on {***day of high temperature***}?**
( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) 79-81 degrees

( ) 82-84 degrees
( ) 85-87 degrees
( ) 88-90 degrees
( ) 91-94 degrees
( ) 95-97 degrees
( ) 98-100 degrees
( ) greater than 100 degrees
( ) It's programmed into the thermostat
( ) Thermostat was turned off
( ) Air conditioner was turned off
( ) DK/NS

6. **Were you or any members of your household home at that time?**
( ) Yes
( ) No
( ) DK/NS

If no or don't know, skip to question 13.

7. **During this time using a scale of 1 to 10 where 1 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort on {***day before high temperature***}?**
( ) 1
…
( ) 10
( ) DK/NS

8. **Using the same scale of 1 to 10 where 1 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort on {***day of high temperature***}?**
( ) 1
…
( ) 10
( ) DK/NS

Ask question 9 if score from question 8 is lower than score from question 7:
9. **What do you feel caused your decrease in comfort?**
(Select all that apply.)
[ ] Power Manager
[ ] Rising Temperature
[ ] Rising Humidity
[ ] Power Outage
[ ] Other _____
[ ] DK/NS

10. **On {***day of high temperature***}, did you or any other members of your household adjust the settings on your thermostat?**
( ) Yes

( ) No
( ) DK/NS

If yes to question 10,
NOTE: enter a numeral for a temperature, or DK if not sure.
10a. **At what temperature was it originally set, and what temperature did you set it to on {***day of high temperature***}?**
Original temperature setting (degrees F) _____
Adjusted temperature setting (degrees F) _____

11. **On {***day of hot temperature***}, did you or any other members of your household turn on any fans to keep cool?**
( ) Yes
( ) No
( ) DK/NS

12. **What else did you or other members of your household do to keep cool?**
[ ] Continued normal activities/ Didn't do anything different
[ ] Turned on room/window air conditioners
[ ] Closed blinds/shades
[ ] Moved to a cooler part of the house
[ ] Left the house and went somewhere cool
[ ] Wore less clothing
[ ] Drank more water/cool drinks
[ ] Turned on fans
[ ] Opened windows
[ ] Other _____
[ ] DK/NS

Now I'm going to ask you some questions about your air conditioning use.

13. **How often do you use your central air conditioner? Would you say you use it ...**
(Read first 5 answers aloud.)
( ) **Not at all**
( ) Only on the hottest days
( ) Frequently during the cooling season
( ) Most days during the cooling season
( ) Everyday during the cooling season
( ) DK/NS

14. **When you think of a typical hot and humid summer day, at what outside temperature do you tend to feel uncomfortably warm?**
( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees

( ) 76-78 degrees
( ) 79-81 degrees
( ) 82-84 degrees
( ) 85-87 degrees
( ) 88-90 degrees
( ) 91-94 degrees
( ) 95-97 degrees
( ) 98-100 degrees
( ) greater than 100 degrees
( ) DK/NS

15. **At what <u>outside temperature</u> do you tend to turn on the air conditioner?**
( ) less than 65 degrees
( ) 65-68 degrees
( ) 69-72 degrees
( ) 73-75 degrees
( ) 76-78 degrees
( ) 79-81 degrees
( ) 82-84 degrees
( ) 85-87 degrees
( ) 88-90 degrees
( ) 91-94 degrees
( ) 95-97 degrees
( ) 98-100 degrees
( ) greater than 100 degrees
( ) It's programmed into the thermostat
( ) DK/NS

16. **How old is your air conditioner?**
( ) 0 to 6 years old
( ) 7 to 12 years old
( ) 13 to 20 years old
( ) over 20 years old
( ) DK/NS

17. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", what is your overall satisfaction with the Power Manager program?**
( ) 1
…
( ) 10
( ) DK/NS

If 7 or below ask,
17a. **Why are you less than satisfied with Power Manager?**
(Select all that apply)
[ ] They activated my Power Manager device more often than I would like

[ ] The bill credits/incentives were not large enough
[ ] I was uncomfortable when my Power Manager device was activated
[ ] Other _____
[ ] DK/NS

18. **Using a scale of 1 to 10 where 1 indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", what is your overall satisfaction with Duke Energy?**
( ) 1
…
( ) 10
( ) DK/NS

If 7 or below,
18a. **Why are you less than satisfied with Duke Energy? _____**

19. **Using a scale of 1 to 10, where 1 means "Extremely Unlikely" and 10 means "Extremely Likely", how likely is it that you would recommend this program to a friend or colleague?**
( ) 1
…
( ) 10
( ) DK/NS

If 7 or below,
19a. **Why would you not recommend the program? _____**

20. **Did you experience any power outage issues on {***day of high temperature***}?**
( ) Yes
( ) No
( ) DK/NS

21. **Do you get your Duke Energy bill in the mail or by email?**
( ) Mail
( ) Email
( ) DK/NS
( ) Other _____

22. **How do you pay your bill? Do you…**
(Read first 3 answers aloud.)
( ) **Mail a check**
( ) log into your Duke Energy account and pay online
( ) or do you have an auto-pay set up for your account?
( ) Other _____

23. **On average, how often do you review the details of your Duke Energy bill?**
(Read first 4 answers aloud.)
( ) **Every month**

( ) More than half the time
( ) Less than half the time
( ) Never
( ) Other _____
( ) DK/NS

24. **How many people live in this home?**
( ) 1
( ) 2
( ) 3
( ) 4
( ) 5
( ) 6
( ) 7
( ) 8 or more
( ) prefer not to answer

Thank you for your time and feedback today!
Politely end call.

Appendix E: Participant Survey Customer Descriptive Data

TecMarket Works surveyed 80 participants about their homes and households. Additional descriptive data is provided in this appendix.

In what type of building do you live? * State

			State		Total
			South Carolina	North Carolina	
In what type of building do you live?	Single-family home, detached construction	Count	20	55	75
		% within State	90.9%	94.8%	93.8%
	Single family home, factory manufactured/modular	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
	Row House	Count	1	0	1
		% within State	4.5%	0.0%	1.3%
	Apartment (4 + families)---traditional structure	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
	Condominium---traditional structure	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
	Other: duplex	Count	1	0	1
		% within State	4.5%	0.0%	1.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

What year was your residence built? * State

			State		Total
			South Carolina	North Carolina	
What year was your residence built?	1959 or before	Count	4	12	16
		% within State	18.2%	20.7%	20.0%
	1960-1979	Count	10	22	32
		% within State	45.5%	37.9%	40.0%
	1980-1989	Count	3	11	14
		% within State	13.6%	19.0%	17.5%
	1990-1997	Count	1	6	7
		% within State	4.5%	10.3%	8.8%
	1998-2000	Count	1	1	2
		% within State	4.5%	1.7%	2.5%
	2001-2007	Count	2	1	3
		% within State	9.1%	1.7%	3.8%
	2008-present	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
	DK/NS	Count	1	4	5
		% within State	4.5%	6.9%	6.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

How many rooms are in your home (excluding bathrooms, but including finished basements)? * State

			State		Total
			South Carolina	North Carolina	
How many rooms are in your home (excluding bathrooms, but including finished basements)?	4	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
	5	Count	1	9	10
		% within State	4.5%	15.5%	12.5%
	6	Count	1	14	15
		% within State	4.5%	24.1%	18.8%
	7	Count	7	7	14
		% within State	31.8%	12.1%	17.5%
	8	Count	8	10	18
		% within State	36.4%	17.2%	22.5%
	9	Count	3	3	6
		% within State	13.6%	5.2%	7.5%
	10 or more	Count	2	13	15
		% within State	9.1%	22.4%	18.8%
	DK/NS	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Which of the following best describes your home's heating system?	South Carolina N=22		North Carolina N=58		Total N=80	
None	0	0.0%	0	0.0%	0	0.0%
Central forced air furnace	12	54.5%	34	58.6%	46	57.5%
Multiple central forced air furnaces	1	4.5%	1	1.7%	2	2.5%
Electric Baseboard	0	0.0%	0	0.0%	0	0.0%
Heat Pump	10	45.5%	23	39.7%	33	41.3%
Geothermal Heat Pump	0	0.0%	0	0.0%	0	0.0%
Boiler / radiators	0	0.0%	1	1.7%	1	1.3%
"*Radiant electric plus water stove*"	0	0.0%	1	1.7%	1	1.3%
Don't know	1	4.5%	1	1.7%	2	2.5%

May total to more than 100% because respondents could give multiple responses.

How old is your heating system? * State

			State		Total
			South Carolina	North Carolina	
How old is your heating system?	0-4 years	Count	4	16	20
		% within State	18.2%	27.6%	25.0%
	5-9 years	Count	4	9	13
		% within State	18.2%	15.5%	16.3%
	10-14 years	Count	7	9	16
		% within State	31.8%	15.5%	20.0%
	15-19 years	Count	3	5	8
		% within State	13.6%	8.6%	10.0%
	19 years or older	Count	2	10	12
		% within State	9.1%	17.2%	15.0%
	DK/NS	Count	2	9	11
		% within State	9.1%	15.5%	13.8%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

What is the primary fuel used in your heating system? * State

			State		Total
			South Carolina	North Carolina	
What is the primary fuel used in your heating system?	Electricity	Count	8	25	33
		% within State	36.4%	43.1%	41.3%
	Natural Gas	Count	13	30	43
		% within State	59.1%	51.7%	53.8%
	Oil	Count	1	1	2
		% within State	4.5%	1.7%	2.5%
	Propane	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
	DK/NS	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

What is the secondary fuel used in your primary heating system, if applicable? * State

			State		Total
			South Carolina	North Carolina	
What is the secondary fuel used in your primary heating system, if applicable?	Electricity	Count	6	17	23
		% within State	27.3%	29.3%	28.8%
	Natural Gas	Count	1	2	3
		% within State	4.5%	3.4%	3.8%
	Other	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
	None	Count	15	38	53
		% within State	68.2%	65.5%	66.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Do you use one or more of the following to cool your home?	**South Carolina N=22**		**North Carolina N=58**		**Total N=80**	
None, do not cool the home	0	0.0%	0	0.0%	0	0.0%
Heat pump for cooling	9	40.9%	21	36.2%	30	37.5%
Central air conditioning	16	72.7%	38	65.5%	54	67.5%
Through the wall or window air conditioning unit	0	0.0%	0	0.0%	0	0.0%
Geothermal Heat pump	0	0.0%	0	0.0%	0	0.0%
Fans (ceiling, window, portable)	0	0.0%	1	1.7%	1	1.3%
Don't know	0	0.0%	0	0.0%	0	0.0%

May total to more than 100% because respondents could give multiple responses.

How many window-unit or through the wall air conditioner(s) do you use? * State

			State		Total
			South Carolina	North Carolina	
How many window-unit or through the wall air conditioner(s) do you use?	1	Count	2	1	3
		% within State	9.1%	1.7%	3.8%
	None	Count	20	57	77
		% within State	90.9%	98.3%	96.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

What is the fuel used in your cooling system?	South Carolina N=22		North Carolina N=58		Total N=80	
Electricity	22	100.0%	58	100.0%	80	100.0%
Natural Gas	0	0.0%	0	0.0%	0	0.0%
Oil	0	0.0%	0	0.0%	0	0.0%
Propane	0	0.0%	0	0.0%	0	0.0%
Butane	0	0.0%	0	0.0%	0	0.0%
None (no cooling system)	0	0.0%	0	0.0%	0	0.0%
DK/NS	0	0.0%	0	0.0%	0	0.0%

May total to more than 100% because respondents could give multiple responses.

How old is your cooling system? * State

			State		Total
			South Carolina	North Carolina	
How old is your cooling system?	0-4 years	Count	6	17	23
		% within State	27.3%	29.3%	28.8%
	5-9 years	Count	5	9	14
		% within State	22.7%	15.5%	17.5%
	10-14 years	Count	4	9	13
		% within State	18.2%	15.5%	16.3%
	15-19 years	Count	3	5	8
		% within State	13.6%	8.6%	10.0%
	19 years or older	Count	2	10	12
		% within State	9.1%	17.2%	15.0%
	DK/NS	Count	2	8	10
		% within State	9.1%	13.8%	12.5%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

What is the fuel used by your water heater?	South Carolina N=22		North Carolina N=58		Total N=80	
Electricity	10	45.5%	36	62.1%	46	57.5%
Natural Gas	12	54.5%	21	36.2%	33	41.3%
Oil	0	0.0%	0	0.0%	0	0.0%
Propane	0	0.0%	0	0.0%	0	0.0%
No water heater	0	0.0%	0	0.0%	0	0.0%
"*solar system that heats the water before it goes into the water heater*"	0	0.0%	1	1.7%	1	1.3%
DK/NS	0	0.0%	1	1.7%	1	1.3%

May total to more than 100% because respondents could give multiple responses.

How old is your water heater? * State

			State		Total
			South Carolina	North Carolina	
d13 How old is your water heater?	0-4 years	Count	6	13	19
		% within State	27.3%	22.4%	23.8%
	5-9 years	Count	2	11	13
		% within State	9.1%	19.0%	16.3%
	10-14 years	Count	8	12	20
		% within State	36.4%	20.7%	25.0%
	15-19 years	Count	2	7	9
		% within State	9.1%	12.1%	11.3%
	More than 19 years	Count	1	4	5
		% within State	4.5%	6.9%	6.3%
	DK/NS	Count	3	11	14
		% within State	13.6%	19.0%	17.5%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

What type of fuel do you use for indoor cooking on the stovetop or range?	South Carolina N=22		North Carolina N=58		Total N=80	
Electricity	21	95.5%	47	81.0%	68	85.0%
Natural Gas	1	4.5%	11	19.0%	12	15.0%
Oil	0	0.0%	0	0.0%	0	0.0%
Propane	0	0.0%	1	1.7%	1	1.3%
None (no stove)	0	0.0%	0	0.0%	0	0.0%
DK/NS	0	0.0%	0	0.0%	0	0.0%

May total to more than 100% because respondents could give multiple responses.

What type of fuel do you use for indoor cooking in the oven?	South Carolina N=22		North Carolina N=58		Total N=80	
Electricity	22	100.0%	49	84.5%	71	88.8%
Natural Gas	2	9.1%	10	17.2%	12	15.0%
Oil	0	0.0%	0	0.0%	0	0.0%
Propane	0	0.0%	1	1.7%	1	1.3%
None (no oven)	0	0.0%	0	0.0%	0	0.0%
DK/NS	0	0.0%	0	0.0%	0	0.0%

May total to more than 100% because respondents could give multiple responses.

What type of fuel do you use for clothes drying?	South Carolina N=22		North Carolina N=58		Total N=80	
Electricity	20	90.9%	54	93.1%	74	92.5%
Natural Gas	1	4.5%	4	6.9%	5	6.3%
Oil	0	0.0%	0	0.0%	0	0.0%
Air dry (clothesline)	0	0.0%	0	0.0%	0	0.0%
Propane	0	0.0%	0	0.0%	0	0.0%
None (no dryer)	1	4.5%	0	0.0%	1	1.3%
DK/NS	0	0.0%	0	0.0%	0	0.0%

May total to more than 100% because respondents could give multiple responses.

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

			State		Total
			South Carolina	North Carolina	
About how many square feet of living space are in your home?	500 to 999	Count	1	2	3
		% within State	4.5%	3.4%	3.8%
	1000 to 1499	Count	0	9	9
		% within State	0.0%	15.5%	11.3%
	1500 to 1999	Count	9	21	30
		% within State	40.9%	36.2%	37.5%
	2000 to 2499	Count	6	5	11
		% within State	27.3%	8.6%	13.8%
	2500 to 2999	Count	3	3	6
		% within State	13.6%	5.2%	7.5%
	3000 to 3499	Count	2	3	5
		% within State	9.1%	5.2%	6.3%
	3500 to 3999	Count	1	4	5
		% within State	4.5%	6.9%	6.3%
	4000 or more	Count	0	4	4
		% within State	0.0%	6.9%	5.0%
	DK/NS	Count	0	7	7
		% within State	0.0%	12.1%	8.8%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Do you own or rent your home? * State

			State		Total
			South Carolina	North Carolina	
Do you own or rent your home?	Own	Count	20	53	73
		% within State	90.9%	91.4%	91.3%
	Rent	Count	2	5	7
		% within State	9.1%	8.6%	8.8%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

How many levels are in your home (not including your basement)? * State

			State		Total
			South Carolina	North Carolina	
How many levels are in your home (not including your basement)?	One	Count	10	40	50
		% within State	45.5%	69.0%	62.5%
	Two	Count	11	18	29
		% within State	50.0%	31.0%	36.3%
	Three	Count	1	0	1
		% within State	4.5%	0.0%	1.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Does your home have a heated or unheated basement? * State

			State		Total
			South Carolina	North Carolina	
Does your home have a heated or unheated basement?	Heated	Count	3	19	22
		% within State	13.6%	32.8%	27.5%
	Unheated	Count	3	4	7
		% within State	13.6%	6.9%	8.8%
	No basement	Count	16	35	51
		% within State	72.7%	60.3%	63.8%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Does your home have an attic? * State

			State		Total
			South Carolina	North Carolina	
Does your home have an attic?	Yes	Count	22	54	76
		% within State	100.0%	93.1%	95.0%
	No	Count	0	4	4
		% within State	0.0%	6.9%	5.0%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Are your central air/heat ducts located in the attic? * State

			State		Total
			South Carolina	North Carolina	
Are your central air/heat ducts located in the attic?	Yes	Count	11	16	27
		% within State	50.0%	27.6%	33.8%
	No	Count	11	37	48
		% within State	50.0%	63.8%	60.0%
	N/A	Count	0	5	5
		% within State	0.0%	8.6%	6.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Does your house have cold drafts in the winter? * State

			State		Total
			South Carolina	North Carolina	
Does your house have cold drafts in the winter?	Yes	Count	5	12	17
		% within State	22.7%	20.7%	21.3%
	No	Count	17	46	63
		% within State	77.3%	79.3%	78.8%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Does your house have sweaty windows in the winter? * State

			State		Total
			South Carolina	North Carolina	
Does your house have sweaty windows in the winter?	Yes	Count	1	11	12
		% within State	4.5%	19.0%	15.0%
	No	Count	21	47	68
		% within State	95.5%	81.0%	85.0%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Do you notice uneven temperatures between the rooms in your home? * State

			State		Total
			South Carolina	North Carolina	
Do you notice uneven temperatures between the rooms in your home?	Yes	Count	11	26	37
		% within State	50.0%	44.8%	46.3%
	No	Count	11	32	43
		% within State	50.0%	55.2%	53.8%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Does your heating system keep your home comfortable in winter? * State

			State		Total
			South Carolina	North Carolina	
Does your heating system keep your home comfortable in winter?	Yes	Count	22	55	77
		% within State	100.0%	94.8%	96.3%
	No	Count	0	3	3
		% within State	0.0%	5.2%	3.8%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Does your cooling system keep your home comfortable in summer? * State

			State		Total
			South Carolina	North Carolina	
Does your cooling system keep your home comfortable in summer?	Yes	Count	22	53	75
		% within State	100.0%	91.4%	93.8%
	No	Count	0	5	5
		% within State	0.0%	8.6%	6.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Do you have a programmable thermostat? * State

			State		Total
			South Carolina	North Carolina	
Do you have a programmable thermostat?	Yes	Count	11	28	39
		% within State	50.0%	48.3%	48.8%
	No	Count	11	30	41
		% within State	50.0%	51.7%	51.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

How many thermostats are there in your home? * State

			State		Total
			South Carolina	North Carolina	
How many thermostats are there in your home?	1	Count	15	47	62
		% within State	68.2%	81.0%	77.5%
	2	Count	7	8	15
		% within State	31.8%	13.8%	18.8%
	3	Count	0	2	2
		% within State	0.0%	3.4%	2.5%
	4 or more	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

What temperature is your thermostat set to on a typical summer weekday afternoon? * State

			State		Total
			South Carolina	North Carolina	
What temperature is your thermostat set to on a typical summer weekday afternoon?	Less than 69 degrees	Count	0	3	3
		% within State	0.0%	5.2%	3.8%
	69-72 degrees	Count	7	19	26
		% within State	31.8%	32.8%	32.5%
	73-78 degrees	Count	13	27	40
		% within State	59.1%	46.6%	50.0%
	Higher than 78 degrees	Count	1	8	9
		% within State	4.5%	13.8%	11.3%
	Off	Count	1	1	2
		% within State	4.5%	1.7%	2.5%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

What temperature is your thermostat set to on a typical winter weekday afternoon? * State

			State		Total
			South Carolina	North Carolina	
What temperature is your thermostat set to on a typical winter weekday afternoon?	Less than 67 degrees	Count	2	7	9
		% within State	9.1%	12.1%	11.3%
	67-70 degrees	Count	8	26	34
		% within State	36.4%	44.8%	42.5%
	71-73 degrees	Count	10	16	26
		% within State	45.5%	27.6%	32.5%
	74-77 degrees	Count	2	5	7
		% within State	9.1%	8.6%	8.8%
	78 degrees or higher	Count	0	2	2
		% within State	0.0%	3.4%	2.5%
	Off	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
	DK/NS	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Do You Have a Swimming Pool or Spa? * State

			State		Total
			South Carolina	North Carolina	
Do You Have a Swimming Pool or Spa?	Yes	Count	2	4	6
		% within State	9.1%	6.9%	7.5%
	No	Count	20	54	74
		% within State	90.9%	93.1%	92.5%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Would a two-degree increase in the summer afternoon temperature in your home affect your comfort * State

			State		Total
			South Carolina	North Carolina	
Would a two-degree increase in the summer afternoon temperature in your home affect your comfort	Not at all	Count	5	22	27
		% within State	22.7%	37.9%	33.8%
	Slightly	Count	10	14	24
		% within State	45.5%	24.1%	30.0%
	Moderately, or	Count	5	13	18
		% within State	22.7%	22.4%	22.5%
	Greatly	Count	2	9	11
		% within State	9.1%	15.5%	13.8%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

How many people live in this home? * State

			State		Total
			South Carolina	North Carolina	
How many people live in this home?	1	Count	1	12	13
		% within State	4.5%	20.7%	16.3%
	2	Count	15	20	35
		% within State	68.2%	34.5%	43.8%
	3	Count	3	12	15
		% within State	13.6%	20.7%	18.8%
	4	Count	3	11	14
		% within State	13.6%	19.0%	17.5%
	5	Count	0	2	2
		% within State	0.0%	3.4%	2.5%
	7	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

How many of them are teenagers? * State

			State		Total
			South Carolina	North Carolina	
How many of them are teenagers?	0	Count	18	47	65
		% within State	81.8%	81.0%	81.3%
	1	Count	3	9	12
		% within State	13.6%	15.5%	15.0%
	2	Count	1	2	3
		% within State	4.5%	3.4%	3.8%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

How many persons are usually home on a weekday afternoon? * State

			State		Total
			South Carolina	North Carolina	
How many persons are usually home on a weekday afternoon?	0	Count	3	12	15
		% within State	13.6%	20.7%	18.8%
	1	Count	7	13	20
		% within State	31.8%	22.4%	25.0%
	2	Count	9	20	29
		% within State	40.9%	34.5%	36.3%
	3	Count	3	7	10
		% within State	13.6%	12.1%	12.5%
	4	Count	0	3	3
		% within State	0.0%	5.2%	3.8%
	5	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
	6	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
	Prefer not to answer	Count	0	1	1
		% within State	0.0%	1.7%	1.3%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Are you planning on making any large purchases to improve energy efficiency in the next 3 years? * State

			State		Total
			South Carolina	North Carolina	
Are you planning on making any large purchases to improve energy efficiency in the next 3 years?	Yes	Count	4	13	17
		% within State	18.2%	22.4%	21.3%
	No	Count	16	41	57
		% within State	72.7%	70.7%	71.3%
	NS/DK	Count	2	4	6
		% within State	9.1%	6.9%	7.5%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

What is your age group? * State

			State		Total
			South Carolina	North Carolina	
What is your age group?	18-34	Count	3	5	8
		% within State	13.6%	8.6%	10.0%
	35-49	Count	3	13	16
		% within State	13.6%	22.4%	20.0%
	50-59	Count	5	8	13
		% within State	22.7%	13.8%	16.3%
	60-64	Count	2	10	12
		% within State	9.1%	17.2%	15.0%
	65-74	Count	5	12	17
		% within State	22.7%	20.7%	21.3%
	Over 74	Count	4	10	14
		% within State	18.2%	17.2%	17.5%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Please indicate your annual household income * State

			State		Total
			South Carolina	North Carolina	
Please indicate your annual household income	Under $15,000	Count	0	2	2
		% within State	0.0%	3.4%	2.5%
	$15,000-$29,999	Count	0	3	3
		% within State	0.0%	5.2%	3.8%
	$30,000-$49,999	Count	3	5	8
		% within State	13.6%	8.6%	10.0%
	$50,000-$74,999	Count	5	4	9
		% within State	22.7%	6.9%	11.3%
	$75,000-$100,000	Count	2	4	6
		% within State	9.1%	6.9%	7.5%
	Over $100,000	Count	4	8	12
		% within State	18.2%	13.8%	15.0%
	Prefer Not to Answer	Count	8	32	40
		% within State	36.4%	55.2%	50.0%
Total		Count	22	58	80
		% within State	100.0%	100.0%	100.0%

Appendix F: Event Survey Customer Descriptive Data

Event study participants were asked during the survey how many people currently live in their home. This distribution is shown below in Figure 52. Most Power Manager households surveyed have one or two people living in them; overall, only 25.6% (50 out of 195) of these households have three or more members (and there is no statistically significant difference between groups in the percentage of households with three or more members). However, surveyed Full Shed Event participants are more likely to be one-person households (53.8% or 7 out of 13) compared to either Regular Event participants (25.3% or 37 out of 146) or Non-Event participants (25.0% or 9 out of 36; differences significant at $p<.05$ using Student's t-test). There are no significant differences in household size between North and South Carolina (not shown).

No other household or demographic questions were asked during Event and Non-Event surveys. For further household and demographic characteristics of program participants in the Carolina System, see *Appendix E: Participant Survey Customer Descriptive Data*.

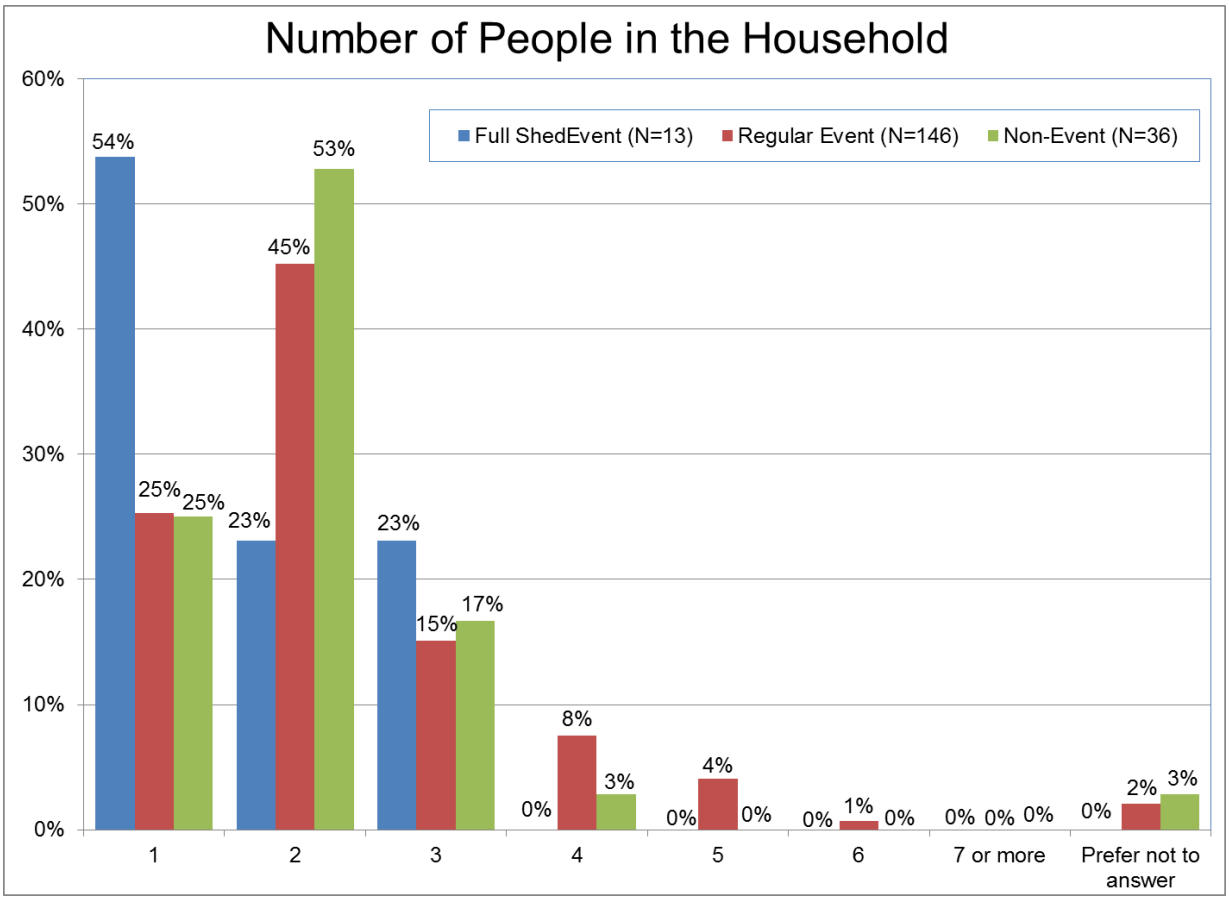


Figure 52. Population Distribution of Event and Non-Event Participants

Final Report

Impact Evaluation and Review of the 2013 Power Manager® Program in the Carolina System

Prepared for
Duke Energy

139 East Fourth Street
Cincinnati, OH 45201

May 30, 2014

Submitted by

Subcontractor:

Richard Stevie, Michael Ozog
Integral Analytics, Inc.

Nick Hall, Johna Roth
TecMarket Works
165 West Netherwood Road
Oregon WI 53575
(608) 835-8855

Table of Contents

Executive Summary

Summary of Findings

In preparing the impact evaluation for the 2013 Duke Energy Power Manager® program, the Company has employed essentially the same evaluation methodology and analytical procedures as it has used over the past few years. In our review, we find that the assessment methodology and the analytical procedures followed by Duke Energy for estimating the load impacts from the Power Manager program are reasonable, analytically reliable, and defensible. One strength of the approach is the use of an extensive history for model estimation. Instead of relying on an approach used by many utilities which compares only a few days deemed to be similar (a less rigorous and less reliable approach because it limits the comparison to a few pre-event days), Duke Energy employs a multivariate regression model to estimate the load impacts. The application of the multivariate regression model allows for more precise estimates instead of relying on assumptions about a limited set of comparable type days.

In our opinion, after reviewing the overall analysis, Duke Energy's impact evaluation is thorough and employs a state-of-the-art methodology which provides accurate and reliable estimates of event impacts and the summer load reduction capacity under peak normal weather conditions, as summarized in Table 7 on page 14.

Introduction and Purpose of Study

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

The evaluation was conducted by Duke Energy and the TecMarket Works evaluation team. Duke Energy conducted the impact analysis, and Integral Analytics (a TecMarket Works subcontractor) conducted the review of the methodology and results.

Summary Overview

This document presents a review of the impact evaluation for the Power Manager (PM) program conducted by Duke Energy as it was administered in the Carolina System.

Summary of the Evaluation

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

The impact evaluation conducted by Duke Energy developed an air conditioner (AC) duty cycle model based on information from a sample of PM participants. This duty cycle was then used to simulate the expected natural duty cycle during the PM event days and under peak normal weather conditions for different PM program options and load control technologies to produce estimates of the potential load reduction. These estimates were then de-rated by the results of operability studies to give estimates of the realized load reductions.

Evaluation Objectives

The purpose of this evaluation was two-fold. The first objective is to summarize the actual kW and expected peak normal kW impacts determined by Duke Energy for 2013. The second objective is to determine if the approach used by Duke Energy in estimating these impacts is consistent with commonly accepted evaluation principles.

Summary of Review

From our review, we find that the methodology as well as the application used by Duke Energy for estimating the load impacts from the Power Manager program are reasonable, reliable, and defensible. One strength of the approach is the use of an extensive history for model estimation. Instead of relying on only a handful of days deemed to be similar, Duke Energy employs a multivariate regression model to estimate the load impacts. The application of the multivariate regression model allows for more precise impact estimates instead of relying on assumptions about a few comparable type days.

After reviewing the overall analysis, in our opinion, Duke Energy's impact evaluation is thorough and employs a state-of-the-art methodology which provides accurate and reliable estimates of event impacts and the summer load reduction capacity under peak normal weather conditions, as summarized in Table 7 on page 14. The information supplied by Duke Energy and

reviewed by the evaluation team included written documentation as well as spreadsheets covering summer capability, M&V summary, and P&L Calculations.

Description of Program

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

When customers enroll, Duke Energy installs a switch that allows the AC unit to be cycled off and on in response to signals sent over Duke Energy's paging system.

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

Program Participation

Program	Participation Count for 2013 (number of switches)
Power Manager Carolina System	EOM Sept. 2013 = 183,402

[1] Not including pilot programs.

Methodology

Overview of the Evaluation Approach

The Duke Energy Power Manager (PM) program impact evaluations were performed by Duke Energy staff. Furthermore, the impacts presented in this report include a review by Integral Analytics (IA) of the impact evaluation methodology and results. The methodology and approach used by Duke Energy staff are nearly identical to that used in prior evaluations reviewed by the TMW team.

To begin, the impact evaluation involves an air conditioner (AC) duty cycle model developed from an analysis of a sample of PM participants. This duty cycle model was then used in two ways: (1) to simulate the expected natural duty cycle during the PM event days to produce estimates of event-related load reductions and (2) to produce estimates of the potential load reduction expected on a peak normal day using peak normal weather conditions for different PM program options and load control technologies. These load impact estimates were then de-rated to account for the results of operability studies and thus provide estimates of the realized load reductions.

Overall, the general approach employs a state-of-the-art methodology which is well established in the industry. The performance of the actual analysis was thorough and the resulting load impact estimates are accurate and reliable. The information supplied by Duke Energy and reviewed by IA included written documentation as well as spreadsheets covering participation and impacts.

Data collection methods, sample sizes, and sampling methodology

The 2013 PM M&V sample in the Southeast consists of 161 households with 205 air-conditioner (AC) units. This includes 120 households from North Carolina and 41 households from South Carolina, closely reflecting the relative numbers of PM participants in each state. There are 59 holdovers from North Carolina 2012 M&V sample and 25 holdovers from South Carolina 2012 M&V sample that were randomly selected in either 2011 or 2012. The Southeast sample is designed to target at 10% relative precision at 90% confidence level plus extra households to compensate for potential loss of sample due to data issues or removal of the switch during the summer.

At households selected for the M&V sample, any older load control switch was replaced by a Cannon load control switch. Our purpose in this study is to determine the load reduction achieved when the load control switch functions as expected, so this switch replacement does not introduce bias into our results. Completely separate operability studies are conducted to determine deviation from expected performance (the de-rating factor) for each load control technology. The M&V samples were used for both fixed and target cycling, as well as full shed impact analysis.

PM M&V sample is stratified into high and low groups according to premise monthly kWh usage from the previous summer. The Dalenius-Hodges technique for selecting strata boundary (high strata: >= boundary; low strata: < boundary) and the Neyman method for optimum sample

allocation were employed to achieve reduced sample variance of load reduction estimates. Stratification analysis was performed for the Southeast PM population. The resulting stratification of PM M&V sample is shown in Table 1.

Table 1. M&V Sample Stratification

	Strata Boundary	Sample allocation		Population weight	
	(kWh)	High	Low	High	Low
NC & SC	1785	80	81	34.8%	65.2%

Hourly run-time of AC units in the M&V sample was collected during 2013 summer months (May through September). This was accomplished with the Cannon load control switches, which record hourly run-time (in minutes) of the AC unit to which they are attached. In addition to hourly run-time, the Cannon switch scan data includes hourly shed minutes and the contents of many other switch registers. Information about the AC unit is also recorded, including rated amps for the compressor and fan.

Households in the M&V sample are equipped with load research interval meters, and 15-minute premise interval usage (kWh) was collected for 2013 summer months.

Number of completes and sample disposition for each data collection effort

See "Table 1. M&V Sample Stratification" above.

Expected and achieved precision

The 2013 M&V sample is representative of the PM population and is designed to target at 10% relative precision at 90% confidence level.

Description of baseline assumptions, methods and data sources

The baseline is developed from the duty-cycle of the sampled AC units based upon the observed AC usage during non-holiday, non-weekend, and non-control days.

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

The PM program is an AC cycling program, so the only measure in question is the AC units.

Use of TRM values and explanation if TRM values not used

The analysis provides estimate of the savings that were achieved by participating households, thus there was no need to use TRM values.

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

The approach used in the evaluation relied upon actual measurement of AC usage, and is therefore not subject to any reporting or self-selection bias.

Evaluation Findings

Validation of AC Duty Cycle Data

Hourly air conditioner (AC) run-time collected from Cannon M&V switches is compared to corresponding premise interval kWh to verify that it accurately reflects operation of the attached AC unit. The validation process is accomplished through a sequence of computer programs that: 1) convert the hourly AC run-time data into hourly duty cycle; 2) display time series plots of premise kWh and duty cycle with control over time resolution enabling visual comparison of plot detail; 3) calculate cross-correlation between hourly kWh and hourly duty cycle and display cross-plots of kWh vs. duty cycle. Each run-time data file collected for an AC in the 2013 M&V sample is reviewed in this fashion, and the AC duty cycle is added to the model database if it passes the validation process.

Duke Energy could not obtain the 2013 data for 12 ACs due to: unable to retrieve scan data (11), and customer dropped off the program (1). The run-time data was rejected for 15 ACs through the validation process. These cases appear to be due to equipment sensitivity issues, where the AC is reported to have no run-time or to be always running. Overall, hourly duty cycle data was added to the model database for 141 households with 178 ACs. Table 2 summarizes the 2013 M&V sample.

Table 2. M&V Sample

	Southeast	
	NC	SC
Households	120	41
Total AC Units	205	
Missing data	12	
Invalid Data	15	
Final AC Sample	178	
Final Households	141	

AC Duty Cycle Models

Impact estimates during PM load control periods are based upon models developed for the natural duty cycle of M&V AC units. These models are developed from 2013 duty cycle data described above, and similar duty cycle data from the two prior summers (2011, 2012) for AC units that are holdovers from previous M&V samples. Weekends and holidays are not used in the models, and hours during load control and for the remainder of the day are not used. As addressed above, Duke Energy staff was able to develop duty cycle models for AC units at 141 households in the Southeast M&V sample.

Natural duty cycle models are specified and estimated individually for M&V AC units to better capture the unique dependence of duty cycle on the temperature and humidity characteristics of each AC unit. A limited dependent variable model specification is adopted for hourly duty cycle, the dependent variable in the models. Candidate specifications for independent variables in the

models include temperature averaged over the prior 2-hour, 4-hour, and 6-hour intervals, and a weighted temperature average with declining weights over the previous six hours. Candidate specifications also include similar sets of averages based on temperature-humidity index (THI) and heat index (16-element polynomial). Models are estimated with the SAS procedure QLIM[2]. The dependent variable specification selected for an AC unit is based on fit diagnostics from hourly model fits over the typical load control hours, 2:00–6:00 PM. For the selected model, distinct parameters are estimated in each hour of interest, resulting in a set of hourly natural duty cycle fits for each M&V AC.

PM Load Control Strategies

The PM program employs two generic types of load control switches which require somewhat different treatment for load impact evaluation. The newer switch type, Cannon LCR 4700, in NC and SC, operates with an adaptive control strategy called Target Cycle (TC). For each hour of load control, the Target Cycle switch calculates a unique shed time (or percentage) based on characteristics of the attached AC unit. The older switch type, Comverge, uses traditional fixed cycling (FC) control, where all switches on the same program shed the same amount of time during the control period.

Cannon switches in NC and SC are configured with a load reduction target of 1.3 kW (TC 1.3) constrained by the maximum shed time of 22.5 minutes per 30-minute control period, and Comverge fixed cycling switches limit the AC run-time to 5 minutes of each 15-minute control period. Equivalently, PM Comverge switches in the Southeast are operated with a fixed cycling percentage of 67% (FC 67%). Another control strategy in the Southeast is full shed of the AC; in which the AC is completely turned off during the control periods. This strategy is only employed in the Southeast for emergency load shed events. Note that PLC (Power Line Carrier) switches in the Southeast are full shed only switches. Table 3 summarizes PM load control technology and strategy used in the Carolinas.

Table 3. PM Load Control Switches and Strategies

		Strategy	
Switch	Period	NC / SC	
	(min)	Cycling	Full Shed
Cannon	30	TC 1.3	FC 100%
Comverge	15	FC 67%	FC 100%
PLC	NA		FC 100%

The Target Cycle control strategy puts more functionality in the switch itself. Rated amps of the attached AC unit is entered into the switch at installation, and used to determine connected load for the unit. The switch also records hourly duty cycle of attached AC unit when instructed and builds a profile (historical profile) of the expected hourly duty cycle under weather conditions typical for load control. The historical profile can be scaled (globally) by adjusters included in the commands sent to switches for load control. The connected load and adjusted historical

[2] QLIM: qualitative and limited dependent variable model.

profile are used to calculate hourly cycling percentages for the attached AC unit expected to achieve the load reduction target of 1.3 kW.

An alternate adaptive cycling approach called True Cycle was developed before the summer of 2012 to address a firmware issue in some of the switches. For the True Cycle approach, a cycling percentage called a gear is determined using duty cycle model results and is sent to switches for load control. This gear and the scaled historical profile are then used to calculate hourly shed percentages for the attached AC unit to achieve the load reduction target of 1.3 kW.

Factors that determine Target Cycle and True Cycle shed percentages for M&V AC units during control periods are known, except for contents of hourly historical profile registers on those days. Values in these registers change frequently during the summer as they are updated with the AC hourly run-time on "saved" days, which are selected with weather conditions sufficiently close to a typical load control day. Hourly run-time profiles on 2013 control days for M&V AC units are determined from the contents at the end of the 2013 control season (when available), and the unit run-time on 2013 saved days. The impact for both of the cycling strategies are estimated and the proportions of True Cycle and Target Cycle switches are used to determine the overall shed per switch attributable to Cannon switches.

AC Connected Load

Connected load is the average power demand (kW) of a running AC unit over a full cycle. It determines the load reduction (kWh) achieved when AC run-time is reduced. Connected load is specified for M&V AC units through the basic engineering formulas:

*Apparent Power (kVA) = (Compressor Amps + Fan Amps) * 230 Volts / 1000*

*Connected Load (kW) = Power Factor * Apparent Power*

Rated amps for the compressor (FLA) and fan (RLA) are typically listed on the AC faceplate.

Power factor in this formula is actually different for different AC units, and even varies somewhat for different cycles of the same unit, increasing at high temperature and humidity. We have analyzed synchronous AC run time and premise interval kWh collected for the M&V sample to determine an appropriate overall power factor within the sample and the result is 0.83. This power factor value is used to calculate connected loads for impact evaluation.

Simulation Method for PM Impact Evaluation

Simulation with M&V natural duty cycle models is used to determine average load reduction per household within high and low M&V strata during each hour of load control and for each PM load control strategy. These strata results are combined with the population weights given in Table 1 to estimate average load reduction per household in the PM populations in NC and SC. The potential load impacts estimated in this manner represent the load reduction which would be achieved if all switches controlled as expected.

The simulation procedure is very similar for the three basic PM control strategies, Target/True cycle, fixed cycling, and full shed. In a fixed cycling or full shed (100% cycling) simulation, the same specified shed percentage is applied to all AC to evaluate load impact. In a Target/True cycle simulation for a particular load reduction target during a specified hour (and day) of load control, a customized shed percentage is calculated for each AC unit from information specific to that unit. The resulting unit-specific shed percentages remain fixed in all simulated realizations for that load reduction target and load control hour.

A single realization in the simulation is generated by a random draw of residuals for each of the M&V natural duty cycle model fits, which are evaluated at the temperature and humidity independent variable applicable to the control hour (and day). This gives a set of simulated natural duty cycles appropriate for the control hour. Load reduction for each M&V AC is calculated as follows:

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

*Load reduction = Connected load * Duty cycle reduction*

For households with multiple AC, realized load reduction is aggregated to the household level by summing load reduction from all household AC. These realized load reductions are averaged within the strata, to produce single realizations of average load reduction per household within both high and low strata. These two sample averages constitute the result from one pass through the simulation corresponding to one draw of model residuals.

Two thousand simulation trials are performed for each hour of load control to adequately capture the variation in average load reduction within strata that is consistent with our duty cycle models and M&V sample size. The results accumulate into distributions of sample averages for both high and low strata. The grand means of these distributions are the most significant output from a simulation run. They are the estimates of average load reduction per household in each stratum for the specified control hour and cycling strategy. The spread of these distributions (e.g., variance) characterizes the uncertainty in the load reduction estimates, and is inversely related to the M&V sample sizes.

Load Impact Results

Load impacts described in this section are computed with population estimates of load reduction per switch, rather than load reduction per household. Simulation results are converted to load reduction per switch using the factor of 1.191 switches per household. Population estimates of load reduction per household are divided by this factor to get corresponding population estimates of load reduction per switch. The estimate of switches per household is determined from the M&V sample.

PM hourly impact results for all 2013 load control days in NC and SC are given in Table 5. These results are adjusted for distribution and transmission line losses. Table 4 shows de-rating factors used for 2013 impact evaluation. The Comverge factor in Southeast was determined by an operability study conducted in 2010. It would normally be our approach to perform another operability study for Comverge switches in the Southeast but these switches are rapidly being

replaced and therefore another study is not expected. Cannon factor in the Southeast was determined by the operability study conducted in 2011.

Table 4. De-rating Factors for Impact Evaluation

Switch Type	NC / SC
Cannon	0.945
Comverge	0.399
PLC	0.399

Table 5. PM Impact Results for NC and SC

Event Date	Hour	PM Impact (MW)		Southeast Total
		NC	SC	
7/17/2013	15	83.3	30.1	11.4
	16	208.8	73.1	281.9
7/18/2013[3]	16	116.3		116.3
	17	115.4		115.4
7/19/2013	15	106.2		106.2
	16	118.4		118.4
7/24/2013	15	104.7	37.3	142.0
	16	117.1	41.7	158.8
8/12/2013	15	110.4	39.3	149.7
	16	121.9	43.5	165.4
8/29/2013	15	109.6	38.8	148.4
	16	122.9	43.5	166.4
9/10/2013	16	101.5	35.9	137.4
	17	108.9	38.6	147.5
9/11/2013	16	106.3	37.6	143.9
	17	111.5	39.5	151.0
	18*	54.7	19.4	74.1

*Note: The event on 9/11was ended at 5:30 pm. So the impact number for hour ending 18 is estimated as half of the impact for the whole hour calculation.

PM economic events were activated in NC on 7 days and in SC on 5 days during the summer of 2013. Both Cannon and Comverge switches were controlled on all days. Table 5 gives hourly impact results adjusted for line losses in NC and SC for each control day. The last column of Table 5 gives total PM impact in the Southeast. A test event was activated on July 17 from 2:00 to 4:00 pm in NC and SC. The first hour of the event was cycling event including both Cannon

[3] There were no events in South Carolina on July 18 and July 19 due to storm restoration activities being conducted by Duke Energy.

and Comverge switches, and the last hour of the event was full shed including Cannon, Comverge and PLC switches. The total impact was 113.4 MW for cycling hour and 281.9 MW for full shed hour after adjusting for line losses.

Table 6 gives estimated load reduction per switch not adjusted for line losses under peak normal weather conditions and load control technologies. **Table 7 shows the summer monthly load reduction adjusted for line losses under peak normal weather conditions.** Table 8 shows the peak normal weather conditions used to calculate the results in Table 6. The system peak in the Southeast is assumed to occur in the hour 4:00 – 5:00 pm EDT (identified as hour 17 in this report).

Table 6. Shed kW/switch with Peak Normal Weather

Switch Type	Control Strategy	Potential Impact	De-rated Impact
Cannon	TC 1.3	1.27	1.20
	Full Shed	2.35	2.22
Comverge	FC 67%	1.38	0.55
	Full Shed	2.35	0.94
PLC	Full Shed	2.35	0.94

Table 7. Monthly Peak Normal Weather Load Reduction De-rated Impact Adjusted for Line Losses for Cycling and Full Shed

State	Control Strategy	June	July	August	September	Summer Capability
Carolinas	Cycling	175.7	177.1	178.9	180.9	177.5
Carolinas	Full Shed	324.5	327.2	330.3	334.0	327.8

Table 8. Peak Normal Weather

Hour	NC / SC	
	Temp	Dewpt
11	89.0	69.0
12	91.0	69.0
13	92.0	68.0
14	94.0	68.0
15	93.0	69.0
16	95.0	67.0
17	95.0	66.0
18	95.0	67.0

The last column of Table 7 shows the weighted average capability of the Power Manager program across the summer months in 2013 in the Carolinas. These weighted average values are calculated using the summer monthly values and weighting them based on the probability of experiencing an annual peak load in that month in each state. However, for revenue recovery purposes, Duke Energy also calculates a value called a P&L value. The P&L value is calculated from monthly capability values in each state. The P&L value is the value proposed by Duke Energy to be used for revenue recovery since it is consistent with accounting guidelines. The P&L value for 2013 is 329.0 MW. A further explanation of the P&L value is provided below.

P&L Value (Revenue Recovery Value) – the process can be summarized as follows.

- Using the processes described above and the program participants (number of switches) for a particular month, calculate the monthly capability of those participants using summer peak normal weather. For Power Manager, these values, for the summer months, are the same values as provided above in Table 7.
- The monthly values receive accounting adjustments if applicable.
- The revised monthly values are averaged across the months during which the program is available for curtailment, June through September.

Review Results

The Duke Energy Power Manager (PM) program impact evaluations were performed by Duke Energy staff. Furthermore, the impacts presented in this report include a review by Integral Analytics of the impact evaluation methodology and results. The methodology and approach used by Duke Energy staff are nearly identical to that used in prior evaluations reviewed by the TMW team.

From our review, we find that the methodology as well as the application used by Duke Energy for estimating the load impacts from the Power Manager program are very reasonable and defensible. One strength of the approach is the use of an extensive history for model estimation. Instead of relying on only a handful of days deemed to be similar (an approach used by many utilities which is less rigorous since it just compares average usages from a pre-event period), Duke Energy employs a multivariate regression model to estimate the load impacts. The

application of the multivariate regression model allows for more precise estimates instead of relying on assumptions about comparable type days.

After reviewing the overall analysis, in our opinion, Duke Energy's impact evaluation is thorough and employs a state-of-the-art methodology which should provide accurate and reliable estimates of event impacts and the summer load reduction capacity under peak normal weather conditions, as summarized on page 14 in Table 7.

Final Report

Process Evaluation of the 2013-2014 PowerShare® Program and Impact Evaluation for the 2013 PowerShare® Program in the Carolina System

Prepared for
Duke Energy

139 East Fourth Street
Cincinnati, OH 45201

July 31, 2014

Submitted by

Subcontractors:
Michael Ozog, Richard Stevie
Integral Analytics, Inc.

Carol Yin
Yinsight, Inc.

Nick Hall and Johna Roth
TecMarket Works
165 West Netherwood Road
Oregon WI 53575
(608) 835-8855

Table of Contents

Executive Summary

Impact Evaluation Findings

TecMarket Works conducted a review of the analytical approach used by Duke Energy to estimate energy impacts from the Carolina System PowerShare program.

Duke Energy conducted the impact evaluation analysis, while Integral Analytics (a TecMarket Works' Subcontractor) reviewed the methodology and results.

From our review of Duke Energy's evaluation of the Duke Energy Carolinas' PowerShare® 2013 Program, the methodology employed, including the application used to estimate the load impacts, is very reasonable and defensible. Besides being innovative, the approach is thorough which should provide accurate estimates of Event impacts (i.e., for settlement with customers, impact results for an event, capability values, and P&L values).

In general, the model specifications in all the processes include key determinates of energy usage, which minimizes the likelihood of any bias in the results from omitted variables. One additional strength of the approach is that Duke Energy uses an extensive history to estimate the model, rather than relying on only a handful of days deemed to be similar (an approach used by many utilities which is less rigorous since it just compares average usages from a pre-event period). In addition, using a multivariate regression model in the Capabilities, P&L, and M&V processes is generally preferred over approaches that are based on average loads from a pre-event period.

The technical approach used by Duke Energy in developing settlement calculations for the customer day-ahead Pro forma load (PFL) and the M&V event impacts are detailed and very thoroughly developed. The use of multiple methods to determine the Best of Breed (BoB) in the PFL is noteworthy in that it assures that the most accurate approach will be used in developing the PFL – a step which, to the best of our knowledge, is not used by any other entity.

Finally, in the previous review of Duke Energy's analytical process for determining Capabilities and conducting M&V, Integral Analytics recommended that Duke Energy should review the need for each of the processes to see if they are truly required and look for ways to combine them. In that previous review, Integral Analytics recommended that Duke Energy investigate a mechanism that will produce all the required reports for customers, internal management and operational uses, and regulatory requirements, using a single, unified process for the PFLs and the other reports.

Since the last review, Integral Analytics has determined that while Duke Energy has not yet implemented actions in accordance with the recommendations, Duke Energy is taking steps to combine the processes.

Summary of Findings

The PowerShare program as operated in the Carolina System is a well-structured and expertly managed program serving a diverse market of customer types and with varying levels of knowledge about how the program works. The program is complex, in that there are multiple types of load reduction call events relying on different customers to achieve the load reduction objectives depending on the nature of the call event and grid-based load reserves. The program is operated on an evolutionary platform in which the program has evolved over the years to its current configuration. This evolution continues today, with new challenges brought about as a result of recent severe winter conditions that required mid-winter calls for load reductions during a period when most participants were unprepared for that call. In addition, regulatory changes which have allowed customer to opt-in or opt-out of the program have created marketing, load reduction, timing and cost control challenges for the program. These challenges are currently being addressed by the program and are described in this report.

The regulatory structure under which the program must operate needs to be examined to determine the extent to which regulatory conditions are impacting the ability of the program to acquire needed load while maintaining the highest possible levels of customer satisfaction and relationships. The program is going through a customer targeting and market interaction change phase as program managers develop new marketing strategies to attract smaller customers who may have reduced knowledge of their energy use and their ability to reduce load and who have lower levels of load reduction capabilities. The success of these changes will be determined over the next couple of years as program managers launch new marketing initiatives, establish strong methods of custom communications, and reexamine the reliably acquirable load that can be cost effectively captured under different economic, supply, and regulatory conditions. Duke Energy's managers and topic experts are among the best we have seen in this industry. The focus of these managers is to not only on meeting these challenges, but designing and operating a program that takes advantage of the challenges in ways that improve the program and the participation experience.

Recommendations From The Management Interviews

1. **Establish Both Summer and Winter Peak Program and Participant Goals**
    a. We recommend that Duke Energy investigate the potential for restructuring the program to address the ability of customers to respond to demand reduction calls at different times of the year (winter and summer events) and determine if alternative regulatory and program operational conditions are needed to meet different customer conditions associated with different seasonal peak demand call events. If those changes are needed, Duke Energy should work with state regulators if necessary to restructure those conditions to meet the need for winter and summer program designs and contract conditions.
2. **Examine Opt-in Timelines and Requirements and Determine if Changes are Needed**
    a. We recommend that Duke Energy assess this issue and the effects of program timelines in view of the regulatory structure and the potential for winter calls and work to design timelines in which the opt-in and opt-out decision timelines are supportive of the customer's decision-making requirements, provide a positive

decision experience for the customer, and which allow the program to effectively achieve both winter and summer load reductions.

b. We recommend that Duke Energy examine the timing and duration of the opt-in commitment requirements and determine if those requirements are over-restricting participation or resulting in potential load not being acquired because of the flexibility and risk avoidance needs of the target customers. If such a condition is warranted, Duke Energy should work with the Commission to structure a schedule that is more supportive of customer requirements to the extent this can be accomplished under North Carolina regulatory constraints.

Recommendations From The Participant Surveys

1. **Track CallOption Refusal Reasons**
   a. If Duke Energy wishes to better understand the reasons customers are not enrolling in CallOption, they should consider asking the account managers to document on the PowerShare contract the reasons why CallOption is not suitable for a particular company's situation and assess the responses to determine if programmatic changes are needed. This will allow Duke Energy to distinguish between lack of interest in CallOption from lack of suitability.

2. **Educate Customers on Responsibility for Call Determinations**
   b. Duke Energy should consider investigating the source of customers' expectations that Duke Energy can control the frequency of demand response events. This may reveal opportunities for Duke Energy to educate customers on the full benefits of participating in PowerShare.

Introduction and Purpose of Study

This document presents the process evaluation report for Duke Energy's PowerShare Program as it was administered in the Carolina System for calendar year 2013.

The process evaluation covers 2013 and 2014 through April. The evaluation was conducted by TecMarket Works with Carol Yin of Yinsight as a subcontractor. All surveys were conducted by TecMarket Work's staff.

Duke Energy conducted the impact evaluation analysis for the 2013 program year, while Integral Analytics (a TecMarket Works' subcontractor) reviewed the methodology and results.

Summary Overview

This document presents the process and impact evaluation and review for the PowerShare program as it was administered in the Carolina System.

Summary of the Evaluation

For the process evaluation, the evaluation team conducted in-depth interviews with three Duke Energy managers and program staff members at different levels of responsibility for the program. The evaluation team also conducted 15-minute interviews with 42 commercial and industrial customers who participated in the 2013-2014 PowerShare Carolina System program.

The 2013 impact analysis of the PowerShare program was conducted by Duke Energy. The basic approach for determining the impacts, capabilities, and profit and loss (i.e., the MW values used for revenue recovery and P&L) involves combining actual weather data with hourly load data from all enrolled customers, collected for the previous month(s), as appropriate. A regression model is developed using the combined data to provide an estimate of what the load would have been for the customer, absent an event. This is compared to the actual customer load to determine the impacts from an event.

Evaluation Objectives

The process evaluation of the 2013-2014 PowerShare program has several purposes. First, this process evaluation is intended to help identify areas where the program may be improved, drawing upon the insights of Duke Energy staff across different divisions and upon the insights of a sample of participating customers. Second, this report will document program operations for future reference, including ways in which the program has addressed and overcome past program challenges.

The purpose of the impact evaluation is two-fold. The first objective is to summarize the actual kW and expected peak normal kW impacts determined by Duke Energy for 2013. The second objective is to determine if the approach used by Duke Energy in estimating these impacts as well as the capacity values are consistent with commonly accepted evaluation principles.

Researchable Issues

This participant survey addressed several research issues that were identified collaboratively by Duke Energy and the TecMarket Works team:

- Investigate the operations of the program to document current operations and identify issues relative to effective operations and customer interaction and participation.
- Identify recommendations that can be expected to improve the operations of the program or increase effectiveness or customer satisfaction.
- Report on program and market events and changes that are impacting the ability of the program to provide cost effective load reduction.
- Identify issues related to recent winter events and discuss their implications on program operations and customer participation.

Description of Program

PowerShare is a demand response program designed to reduce non-residential customers' energy use (kW demand) during periods of high energy prices or during periods when high energy usage would cause energy supplies across the transmission and distribution system to drop to near-critical levels. In both these situations, the PowerShare program allows Duke Energy to purchase capacity from their customers by paying their commercial and industrial customers to reduce their energy demand, thus increasing the available energy supply. The program achieves a demand reduction from participants via multi-approach customer notification system notifying customers that a demand response event is needed, causing participants to reduce their electric usage to a level consistent with their program participation agreements. The reduction period is a specific period of time set to match the period of time in which the critical supply condition is expected to occur, but not beyond the timing period specified in the participation agreements.

In the past this program has focused on participants with enough demand and operational flexibility that each participant is capable of providing substantial load reduction to meet Duke Energy's PowerShare supply reduction needs. This focus has resulted in a program in which the typical participants have been and continue to be high demand industrial customers or large commercial customers. However, the opt-out provisions associated with the Carolina's program is resulting in an erosion of the larger customers as they elect to opt-out of the financial and demand reduction requirements of participation and instead move to the ability to implement demand reduction and energy efficiency initiatives on their own, without participation in Duke Energy's programs. As this trend continues it is expected that the program will move to lower levels of demand reduction per participating customer, requiring a larger participation base from which savings goals can be achieved.

PowerShare® is the brand name covering several Duke Energy Carolina's commercial and industrial (C&I) demand response program tariffs. In North Carolina, PowerShare includes NC Rider PS (NC Rider PS) and Rider PowerShare CallOption (NC Rider PSC). In South Carolina, PowerShare includes Rider PowerShare Non-Residential Load Curtailment (SC Rider PS in this document; note that this is only for this document since there exists a separate, unrelated Rider PS in South Carolina) and Rider PowerShare CallOption Non-Residential Load Curtailment (SC Rider PSC) and collectively as the PS Riders. These programs were implemented on or after June 1, 2009. The PowerShare programs are voluntary and offer customers the opportunity to reduce their electric costs by managing their electric usage during the Company's peak load periods. Customers and the Company will enter into a service agreement under the parameters established in the PS Riders.

There are four product options offered under PowerShare®; Mandatory, Generator, Voluntary, and CallOption®:

- Mandatory
  - A customer served under the Mandatory product agrees, upon notification by the Company, to reduce its demand to a pre-specified firm service level.
  - Each time the Company exercises its option under the agreement, the Company will provide the customer a credit for the energy reduced.
  - PowerShare Mandatory is an emergency only program. Emergency events are

implemented due to reliability concerns as determined by the DEC System Operations Center (SOC). Participants are required to reduce load during emergency events.
    - In addition to the energy credit, customers on Mandatory receive a monthly capacity credit.
    - Mandatory is a year around program that permits 100 hours of event time as needed. There are not a defined maximum number of events for this program.
    - Only customers able to provide a minimum of 100 kW load reduction qualify for Mandatory.
- Generator
    - A customer served under the Generator product agrees, upon notification by the Company, to reduce its demand from the Company by starting an on-site generator to supply all or a portion of the customer's electric needs.
    - Each time the Company exercises its option under the agreement, the Company will provide the customer a credit for the energy self-supplied.
    - PowerShare Generator is an emergency only program. Emergency events are implemented due to reliability concerns as determined by the DEC System Operations Center (SOC). Participants are required to transfer load to their generators during emergency events.
    - In addition to the energy credit, customers on Generator receive a monthly capacity credit based upon load transferred to the generator during events and test periods.
    - Generator is a year around program that permits 100 hours of event time as needed. There are not a defined maximum number of events for this program.
    - Only customers able to provide a minimum of 100 kW load response/self-supply qualify for Generator.
    - The Generator program requires participants to start their generators monthly for a 1-hour test period.
- Voluntary
    - Under the Voluntary product, the Company may notify the customer of a Voluntary event and provide a Price Quote to the customer for each event hour.
    - The customer will decide whether to reduce demand during the event period. If they decide to do so, the customer will notify the Company and provide a firm service level for the event hours.
    - Each time the Company exercises the option, the Company will provide the participating customer who reduces load an energy credit.
    - There is no capacity credit for the Voluntary product since customer load reductions are voluntary.
    - Only customers able to provide a minimum of 100 kW load response qualify for Voluntary.
    - Customers may participate in PowerShare Mandatory and Voluntary concurrently.
- CallOption®
    - A customer served under a CallOption® product agrees, upon notification by the Company, to reduce its demand.

  - Each time the Company exercises its option under the agreement, the Company will provide the customer a credit for the energy reduced.
  - There are two types of events.
    - Economic events are primarily implemented to capture savings for customers and not necessarily for reliability concerns. Participants are not required to curtail during economic events. However, if participants do not curtail, they must pay a marginal energy cost based price for the energy not curtailed. This is called "buy through energy."
    - Emergency events are implemented due to reliability concerns. Participants are required to curtail during emergency events.
  - If available, the customer may elect to buy through the event at a marginal energy cost-based price. The buy through option is not always available as specified in the PowerShare® Agreements. During system emergency events, customers are not provided the option to buy through.
  - In addition to the energy credit, customers on the CallOption® will receive a capacity credit.
  - For the 2013 PowerShare® CallOption program (note that NC participation years are January – December while SC participation years are June – May), there were four different enrollment choices for customers to select among in NC and SC and 1 additional choice in NC. All five choices require curtailment availability for up to five emergency events. The number of economic events varies among the choices. Customers can select exposures of zero, five, ten, or fifteen economic events or, in NC, they can choose an option that allows for 200 hours of economic events with no specific maximum number of events specified. This option is called PS 200/5 and events must be a minimum of 2 hours in duration.
  - Only customers able to provide a minimum of 100 kW load response qualify for CallOption®.
- Other
  - Note that other large commercial and industrial demand response programs are offered in DEC through Riders IS and SG. These programs are not part of PowerShare and are not included in this report.

The PowerShare programs have different enrollment periods and participation periods. This report covers the participation year of 2013. However, for some programs (e.g., CallOption in South Carolina), customers enroll for 1 year periods from June through May. Therefore, one set of customers could participate in PowerShare from January through May, 2013, while a different set of customers are enrolled for June through December, 2013. Likewise, with Mandatory, Generator, and Voluntary, customers can enroll for multiple year terms starting in any month of the year. Only PowerShare CallOption in North Carolina has a specified participation period that starts on January 1 and goes through December 31. Duke Energy Carolinas (DEC) is a summer peaking system and therefore, the most relevant participation period is the summer months of June through September and this report concentrates on those months.

The table below compares account participation levels for summer 2012 and summer 2013, as well as MWs enrolled in the program. The MW values are DEC's estimate of the curtailment

capability across the summer months. Additional information is presented below on the different calculations performed for the program including summer capability, revenue recovery values, Measurement & Verification (M&V) values, and day-ahead projected load reduction (PFLs).

Carolinas PowerShare® Participation Update by State

Enrolled Customers†

	North Carolina			South Carolina		
Program	2012	2013	Change	2012	2013	Change
CallOption®	**0**	**0**	**0**	**1**	**1**	**0**
PS Generator®	**4**	**4**	**0**	**5**	**5**	**0**
PS Mandatory®β	**96**	**110**	**14**	**71**	**69**	**-2**
Total	**100**	**114**	**14**	**77**	**75**	**-2**

†Counts coincide with summer month of maximum participation
B Includes Mandatory HP participants

Summer Curtailment Capability (MWs)*

	North Carolina			South Carolina		
	2012	2013	Change	2012	2013	Change
CallOption®	**0.0**	**0.0**	**0.0**	**0.2**	**0.0**	**-0.2**
PS Generator®	**9.4**	**7.1**	**-2.3**	**4.0**	**3.9**	**-0.1**
PS Mandatory®β	**181.3**	**185.8**	**4.5**	**185.1**	**177.4**	**-7.7**
Total	**190.7**	**192.9**	**2.2**	**189.3**	**181.3**	**-8.0**

*Numbers reported are adjusted for losses
B includes Mandatory HP capabilities

PowerShare® 2013-2014 Program Activity

During the winter of 2012/2013, there were no PowerShare® events. During the summer of 2013, there were no PowerShare® events. The relatively mild weather and low marginal energy prices resulted in no PowerShare® event activity in 2013.

Methodology

Overview of the Evaluation Approach

The process evaluation for the PowerShare program was conducted by TecMarket Works. The results presented in this report include management interviews and participant surveys.

The impact analysis for the PowerShare programs was conducted by Duke Energy staff. The results presented in this report include a review by Integral Analytics of the impact evaluation methodology and results. This can be found under the *Review of Impact Evaluation Approach* section later in this report.

Management Interviews

TecMarket Works developed the interview protocol for the PowerShare Program management that was implemented in April and May of 2014. The full interview guide can be found in *Appendix A: Management Interview Protocol*.

One-to-two-hour long management interviews were conducted with a Duke Energy product and services manager for PowerShare in the Carolina System. A shorter summary interview was conducted with a program manager who held the management responsibility prior to the period in which the new manager assumed operational control of the program. In addition, a more focused interview was conducted with the Duke Energy manager who supports the program's marketing and outreach campaigns and who provides supporting outreach support to the managers and account executives that have first line contact with the customer.

Two additional interviews were conducted with Carolina System account executives to discuss the program's interactions with participating customers.

Participant Interviews

TecMarket Works and Yinsight developed a customer survey for the PowerShare Program participants. The survey can be found in *Appendix B: Participant Survey Protocol*.

Data collection methods, sample sizes, and sampling methodology

- Data collection method: Questionnaires were administered via short telephone interviews with the contact person identified to receive PowerShare alerts on behalf of the company.
- Sample sizes: The evaluation team attempted a census.
- Sampling methodology: The evaluation team attempted interviews with a census of the 71 current PowerShare Carolina participants for the 2013-2014 program year (42 in North Carolina and 29 in South Carolina). Forty-two interviews were completed by phone between 3/10/14 – 3/18/14[1].

[1] Note that an Emergency event was called in Carolina on March 4, from 6:30 to 8:30 am, which likely affected participant responses.

Forty-two companies (26 from North Carolina, 16 from South Carolina) were randomly selected from current Carolina System participants in PowerShare, and asked to take part in this survey.[2] These 42 companies comprise 10 textile manufacturers, 6 water plants, 5 furniture manufacturers, 12 manufacturers of other products with the rest being sole representatives of assorted other non-manufacturing sectors. Thirteen of the respondents also manage more than one site that currently participates in PowerShare. Of these companies, 41 are enrolled in the Mandatory program, with six on the Generator option. Thirty-two of the companies are enrolled in the Voluntary Curtailment Option, and one enrolled in CallOption. On average, these companies have been participating in PowerShare for 3 to 4 years.

Number of completes and sample disposition for each data collection effort

For this process evaluation, the evaluation team conducted in-depth interviews with three Duke Energy product managers and program staff members at different levels of responsibility for the program. The evaluation team also conducted 15-minute interviews with 42 commercial and industrial customers who participated in the 2013-2014 PowerShare Carolina program.

Expected and achieved precision

The sample is representative of the PowerShare population and is designed to target at 10% relative precision at 90% confidence level.

Description of baseline assumptions, methods and data sources

Not applicable.

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

Not applicable.

Use of TRM values and explanation if TRM values not used

Not applicable.

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

No causal relationships were being investigated, so threats to validity are not a concern. Participants may have exhibited the social desirability bias when answering a question relating to the customer's main motive for participating in the PowerShare program, and when answering questions about satisfaction with the PowerShare program. To counter this bias, these questions used neutral language wherever possible. When probing customer's motivations for participating, customers were probed for additional motivations so that socially desirable biases would hopefully only affect one response, if at all.

[2] Not all companies provided responses to all questions.

Impact Evaluation

Overview of the Evaluation Approach

There are many different numbers calculated by the DSM Analytics group for PowerShare. A large portion of the effort surrounding analytics for PowerShare falls into four different calculation areas. These calculations can be grouped into 2 categories. These categories and calculation areas are listed below and then described in more detail.

a. Hourly Event Day Impact Estimates
    i. *Pro-forma Load Estimations (PFLs)* – estimates of participant's hourly electric consumption for the next day. These baseline projections are used to determine potential load reduction for a potential event the next day.
    ii. *Measurement and Verification Load Reduction Estimates (M&V)* – estimates of actual load reduction provided by participants on an event day.
b. Peak Available Load Reduction Estimates
    i. *Load Reduction Capability (LRC)* – estimates of load reduction under peak normal weather conditions, if applicable, over a specified period of time such as a month or the entire summer for participants during the period of time in question.
    ii. *Revenue Recovery Load Reduction Estimates (P&L)* – monthly estimates of summer load reduction enrolled in the program under peak normal weather conditions, if applicable, for all participants enrolled in the program during the calendar year. A single value is obtained by averaging the monthly values over the period when the program can be implemented (i.e., all year).

As the categories above imply, the impact evaluation of the PowerShare program must meet a diverse set of goals. Specifically, after each event, the level of load reduction must be calculated for each participant. If the participant is on a firm service level reduction agreement, the determination is made if they reduced load from wherever their load would have been absent the event, a baseline, to their actual load during the event period. Another key feature of a firm service level agreement is to determine if the customer's actual load is at or below the firm service level during the event hours, regardless of the amount of load reduction provided.

If the customer is on a fixed reduction agreement (CallOption only), the evaluation calculates the difference between the baseline and the actual load during the control period to see if the agreed amount of reduction was achieved.

[Note that PS Generator has a completely different approach from all the other programs. Generators are required to be metered and impacts are derived from the generator output metered during events. Likewise, for other calculations, the 12 test hours of metered data is utilized and therefore embeds a forced outage rate into the capability of the generators.]

Credits or penalties for participants for events, using PFL baselines, are calculated within the Energy Profiler Online (EPO) system for PowerShare and recorded on the customer's utility bill.

In addition, the results of the various calculations mentioned above are used to develop reports for the system operator, load reduction projections, summer curtailment projections for state level planning, and event load reduction analysis.

An additional requirement related to PFLs is that an event can be called on any day and therefore, the PFL calculation must be available every day. The control season runs all year for emergency events; however, economic events, although possible outside the summer season, tend to be during the summer season. Regardless of the date, the evaluation needs to be able to assess the load data of all participants so that Duke Energy can calculate a projected amount of load reduction that could be achieved during any hour.

The above requirements have resulted in an extensive impact evaluation procedure as described above. This impact evaluation procedure consists of the following:

Table 1. PowerShare Impact Evaluation Procedures

Process	Purpose	Frequency
PFLs	Settlement with customers and emergency event load reduction projections	Every weekday
LRCs	Internal & external reporting and input into P&L process	Monthly
P&L	Internal reporting and revenue recovery requests	Monthly as needed for internal reporting and a year-end true-up for revenue recovery
M&V	Reporting actual impacts of events to regulatory bodies.	Monthly if an event occurred in the prior month

A high-level overview of each process in Table 1 is given below. [Again, note that these processes are not applicable to PowerShare Generator which uses the metered generator output from events and test events to calculate the values needed.]

Day-Ahead PFLs

This process, as the name implies, creates the day-ahead pro forma (i.e., estimated assuming no control events) load shapes (PFL) specific to each customer. This process applies to PowerShare Mandatory and CallOption.

The estimation of the PFL involves using 12 weeks (84 days) of historical load and weather data (eliminating or accounting for NERC holidays, event days, and any days identified as quiet periods from the analysis) to produce hourly predicted load shapes for the next thirty days based upon forecasted weather, if applicable, for the region. A PFL is estimated for each account individually.

The estimation of the PFL involves using five different estimation approaches:

- Hourly regression,
- PJM average method,
- MISO average method,
- Last two days average, and a

- Hybrid method.

A summary of each approach is presented below.

Hourly Regression

In this method, hourly energy is regressed on a set of Fourier variables, weather variables and monthly dummies (if appropriate). An autoregressive (AR) process is fit to the error terms. The same model is re-fit except that weather variables are excluded. Then an F-test is performed to see if weather is a significant explanatory factor and the appropriate model results are used for further calculations.

PJM Method

This method is based on the default method PJM uses to calculate CBLs for settlement. It calculates an average load shape based on the high 4 of 5 days selected by the method. Those 5 days are selected from a 45 day window of days. Only non-NERC holiday weekdays are considered that are not event days. The initial set of days is the most recent 5 days in the window. If the average usage over the exposure hours on any day in the 5 days is less than 25% of the overall average level over the exposure hours for the 5 days, that day is dropped and a replacement selected. This loop is repeated until there are 5 days, none of whose average usage over the exposure hours is less than 25% of the overall average usage level over the exposure hours. The 4 days with the highest usage are selected from this group and the average load shape is calculated using those 4 days.

MISO Method

The MISO method is similar to the PJM method. The differences are the MISO method uses 10 days, there are no exclusions for low usage and all 10 days are used to calculate the load shape.

Last Two Days Method

For this method, the load shape is calculated based upon the most recent past two non-NERC holiday and non-event day weekdays.

Hybrid Method

This method first performs a regression of the daily energy usage for a customer. The explanatory variables are binary variables for day of the week, a daily weather variable, monthly dummies (if appropriate) and interactions between the weather variables and binary variables. The model is fit using an AR(7) process. As with the hourly regression, the model is re-fit without the weather variables and an F-test performed to determine the appropriate model. Once the predicted daily energy has been determined it is spread over the hours of the day using the load shape from the PJM method after that load shape has been normalized by the total energy under the shape.

Best-of-Breed (BoB)

For each customer, the “best” method is chosen to produce the final day-ahead baseline estimates. This is done by comparing the predicted load from each method to the actual load for the five days that went into the PJM method at an hourly, daily, and total level. Specifically:

- For the hourly value, the absolute value of each hourly difference between the predicted and actual load is summed across all five days.
- For the daily value, the difference for each hour is summed for each day, then the absolute value is summed across the five days.
- For the total the difference in each hour for all five days is calculated for all five days, then summed and the absolute value is taken.

The best method is chosen based on each methods relative performance of these differences. If a method is the best for at least two values, then the PFL from that method is used. Otherwise, the PFL from the method which produced the lowest hourly variance is used

Measurement and Verification (M&V)

The steps involved in the calculation of the monthly LRC, P&L, and M&V are all similar but not exactly the same. In addition, for PowerShare Voluntary, the LRC and P&L processes are not performed since they are not relevant to the program. For the M&V process for PowerShare Mandatory, CallOption, and Voluntary, hourly load data from all enrolled customers is collected for a particular month. Data is treated similarly among the processes but with a few exceptions such as the modeling of quiet periods. In the M&V process, event days are excluded as they are in all the processes. However, Quiet Periods, such as days where participants have reduced load due to a maintenance period, and included but accounted for in the model. If an event occurs during a period when the customer is on a maintenance shutdown, the information used in the analysis concentrates only on the information during their shutdown period and requires special handling. This is a rare event though and the typical procedure is described below.

The data is combined with the actual weather for that month. Regression models (one with and one without weather terms) are developed using the combined data similar to the hourly regression model discussed in the day-ahead PFL calculations discussed above. Specifically, the regression equation relates the customer's hourly electricity load to:

- A Fourier transform of hour of the day
- A Fourier transform of hour of the week
- A Fourier transform of hour of the month
- Temperature Humidity Index
- Binary variables for holidays and quiet periods, if appropriate
- Interactions between the Fourier transforms and the other variables

An F-test is calculated for each customer to determine if weather is a significant explanatory variable (unless weather is explicitly excluded for customers known not to be weather sensitive). If so, then the estimated parameters are used to create predicted loads using actual weather conditions on the event days. Thus, the baselines from the M&V process are representative of the actual load the customer would have consumed absent an event. These baselines from event days are then used with actual load data from the event hours and a load reduction is calculated.

However, note that all results are reviewed by DSM Analytics. If regression results are clearly not representative of a specific participants load absent the event, an adjustment to the baseline

may be applied. In addition, small variances around the baseline expected from typical model variance, above and below, are set to zero and therefore not considered load reduction.

M&V results are shown above in the Introduction section. Please note that the PFL event load reduction estimates are used for settlement with customers due to their quicker availability and the fact that the baselines are available for customer review for load reduction decisions. However, M&V load reduction estimates are Duke Energy's best estimate of the load reduction impacts and these impacts are used for regulatory reporting purposes.

Load Reduction Capability (LRC)

Similar to the M&V regression process described above, Load Reduction Capability (LRC) is calculated on a monthly basis for PowerShare Mandatory and CallOption. [Note that for PowerShare Generator, capability is defined by the metered performance during test hours and events.] For the LRC process, hourly load data from all enrolled customers is collected for a particular month. Event day information is eliminated from the analysis. Quiet periods, for example due to a maintenance shutdown, are included and modeled in the analysis. The regression methodology is the same as the M&V regression described above. The differences between the M&V process and the LRC process are:

A. Event day information is eliminated from the analysis similar to the M&V process. However, Quiet Periods, which are eliminated in the M&V process, are included and modeled in the LRC analysis.
B. Once the regression equation is specified as described above in the M&V section, the estimated parameters are used to create predicted loads using peak normal weather conditions for all days of the month, if weather is applicable. Thus, the baselines from the LRC process are representative of the peak normalized load the customer would have consumed throughout the month.
C. The weekday, non-holiday baselines are then used with the customer's specified fixed reduction amount or firm load level to calculate the load reduction available each hour. By hour, these values are averaged across the month.

However, monthly LRC by participant is typically not of interest for most reporting purposes. Of primary interest is the summer LRC given that DEC is a summer peaking utility. Therefore, by hour and by participant, a weighted average of the summer monthly LRC values is calculated. Then, the hour ending (HE) Eastern Daylight Time (EDT) 17 is captured to determine the summer LRC of each participant. Summing across all participants provides the Summer LRC of the program.

Revenue Recovery Load Reduction Estimates (P&L)

Similar to the LRC regression process described above, P&L is calculated based on capability calculations for all 4 summer months for PowerShare Mandatory and CallOption. For the P&L process, hourly load data from June through September is collected for all enrolled customers during the year regardless of whether they actually participated in the program during the summer months. Event day information is eliminated from the analysis. Quiet periods, for

example due to a maintenance shutdown, are included in the analysis but are not explicitly modeled.

The data is combined with actual weather data. Monthly, a regression model is developed using the combined data similar to the hourly regression models discussed above. Specifically, the regression equation relates the customer's hourly electricity load to:

- A Fourier transform of hour of the day
- A Fourier transform of hour of the week
- A Fourier transform of hour of the month
- Temperature Humidity Index
- Binary variables for holidays
- Interactions between the Fourier transforms and the other variables

An F-test is calculated for each customer to determine if weather is a significant explanatory variable (unless weather is explicitly excluded for customers known not to be weather sensitive). If so, then the estimated parameters are used to create predicted loads using peak normal weather conditions for all days of the month. Thus, the baselines from the P&L process are representative of the peak normalized load the customer would have consumed throughout the month for all customers; even if the customer wasn't actually participating in one or more of the summer months.

> *[This is where the LRC and P&L processes differ. In LRC, the monthly value for June for a participant who joined the program in July would be 0. However, in P&L, the calculated value for the customer would be used for June. The fact that the customer did not participate in June is captured below, not here.]*

Continuing, the weekday, non-holiday baselines are then used with the customer's specified fixed reduction amount or firm load level to calculate the load reduction available each hour. By hour, these values are averaged across the month.

Then, by hour and by participant, a weighted average of the four monthly values is calculated. Then, by participant, the hourly value for hour-ending (HE) Eastern Daylight Time (EDT) 17 is captured to determine the summer P&L of each participant. This is where the LRC process would terminate after summing across all participants. However, the P&L process now calculates monthly values by taking the sum of the summer values described above for each month for only the participants in a particular month. These monthly values are then delivered to Product Analytics for final calculations of the P&L results. Accounting adjustments are made as needed including the application of a line loss factor.

Summary

As discussed above, each calculation PFL, M&V, LRC, and P&L has a specific purpose. Primarily, PFLs are used for customer settlements where applicable for event incentives and operational projections of load reduction available the following day. M&V is used for regulatory and internal reporting of load reduction during events. LRC is used for internal and external reporting of load reduction available during each monthly period and for the summer.

P&L is used for revenue recovery requests to demonstrate the enrolled summer load reduction capacity each month. For DEC PowerShare Mandatory, Generator, and CallOption, the LRC and P&L values including adjustments for line losses for 2013 are provided in Table 2below.

Table 2. LRC & P&L Program Summary

Program	Summer LRC (MWs)			P&L (MWs)
	NC	SC	Total	System Total
PS CallOption 0/5	0.0	0.0	0.0	0.0
PS CallOption 5/5	0.0	0.0	0.0	0.0
PS CallOption 10/5	0.0	0.0	0.0	0.0
PS CallOption 15/5	0.0	0.0	0.0	0.1
PS CallOption 200/5	0.0	0.0	0.0	0.0
Total PS CallOption	0.0	0.0	0.0	0.1
PS Generator	7.1	3.9	11.0	11.1
PS Mandatory	185.8	177.4	363.2	366.8
Total PowerShare	192.9	181.3	374.2	378.0

Review of Impact Evaluation Approach

Integral Analytics reviewed the analysis as well as information contained in the files covering participation and impacts.

From our review of Duke Energy's evaluation of the Duke Energy Carolina's PowerShare® 2013 Program, the methodology employed, including the application used to estimate the load impacts, is reasonable and defensible. Besides being innovative, the approach is thorough and provides accurate estimates of Event impacts (i.e., for settlement with customers, impact results for an event, capability values, and P&L values).

In general, the model specifications in all the processes include key determinates of energy usage, which minimizes the likelihood of any bias in the results from omitted variables. One additional strength of the approach is that Duke Energy uses an extensive history to estimate the model, rather than relying on only a handful of days deemed to be similar (an approach used by many utilities which is less rigorous since it just compares average usages from a pre-event period). In addition, using a multivariate regression model in the Capabilities, P&L, and M&V processes is generally preferred over approaches that are based on average loads from a pre-event period.

The technical approach used by Duke Energy in developing settlement calculations for the customer day-ahead Pro forma load (PFL) and the M&V event impacts are detailed and very thoroughly developed. The use of multiple methods to determine the Best of Breed (BoB) in the PFL is noteworthy in that it assures that the most accurate approach will be used in developing the PFL – a step which, to the best of our knowledge, is not used by any other entity.

Finally, in the previous review of Duke Energy's analytical process for determining Capabilities and conducting M&V, Integral Analytics recommended that Duke Energy should review the need for each of the processes to see if they are truly required and look for ways to combine them. In that previous review, Integral Analytics recommended that Duke Energy investigate a mechanism that will produce all the required reports for customers, internal management and

operational uses, and regulatory requirements, using a single, unified process for the PFLs and the other reports.

Since the last review, Integral Analytics has determined that while Duke Energy has not yet implemented actions in accordance with the recommendations, Duke Energy is taking steps to combine the processes.

Overall, based on our review, Duke Energy's impact evaluation is a complete and innovative approach, and provides accurate estimates of event impacts.

Process Evaluation

Management Interviews

This section of the report presents the results from the management interviews with program managers, marketing support managers, and account executives. These interviews focused on the operations of the programs and the interactions with the customers who must be able to reduce load for the program to achieve its goals.

Program Goals

According to the Carolina System Program Manager, the PowerShare Program has the following program goals.

1. Maximize program resource in terms of mega-watt to support grid reliability and deal with power supply grid restraints when we have grid or demand supply issues.
2. Deliver a cost effective program.
3. Design and operate a program that is easy for customer to understand and participant.
4. Have very clear customer commitments; make sure the customers fully understand the commitments associated with their participation.

The interviewed manager noted that this last goal is not as easy as it sounds and noted that because the demand reduction events are few, and in some cases a year or more can pass without an event, the customers may forget their commitments and need to be reminded of those commitments and in some cases brush-up on how they intend to meet those kW reduction commitments. The manager noted that they need to continually deal with the issue of participant information and education and are adding new information resources to the program (see section "*Marketing Challenges*") to help participants understand the program and their commitments and how they can respond. Duke Energy has examined and continues to examine message consistency across the various messaging approaches to make sure the program-related information provided by Duke Energy is accurate, reliable, and consistent with respects to the customer and the program obligation and requirements.

Program Structure and Operations

While there are few program staff specifically assigned to the PowerShare program in the Carolina System, the program is supported by a wide and diverse set of professionals across Duke Energy that form the PowerShare operational team. The Carolina System PowerShare program is supported by Duke Energy professionals, including, but not limited to, professional engineers who understand customer kW load levels who project participant kW resources; professional grid experts who understand the conditions that drive market resources and prices; program tool development professionals that help design program management and operational tools; marketing and messaging experts who help with customer interface opportunities; customer notification support team that helps with notifying customers of event warnings, watches and calls; energy demand tracking experts that help determine if and when calls are going to be needed; response analysts that help interpret customer and program demand reduction achievements, and others.

Duke Energy has developed system and grid monitoring capabilities that help support the Carolina System supply planning and monitoring function, but who also help program managers understand current and anticipated demand conditions. As peak demand conditions appear to be critical the Duke Energy Carolina System managers work with the system operators to gauge the probability of an event call during that period, and determine when warnings, watches, and calls are needed. This formation and use of topic experts to serve as the PowerShare operational team helps assure that the right skills are available to the program and minimizes the potential for under-performance of the program. It also means that Duke Energy has established a team of experts to support the program design or redesign function as well as support the program's implementation and operational processes not just in the Carolina System, but across the Duke Energy territories.

Need for the Program

An interviewed manager noted that Duke Energy needs to plan for a wide range of supply and weather-associated needs and noted that the PowerShare program serves as one of the key tools in both planning for expected and unexpected supply constrained conditions. The program is considered as a valuable part of the Duke Energy supply resource mix.

The manager also noted that call events are not conducted for the sole purpose of economically benefiting Duke Energy, but are called when capacity relief is needed to meet demand or when a call can benefit all customers by acting to lower supply costs. It is a demand-related event that is typically required for supply requirements.

Change in Marketing Approach

The program's marketing efforts have undergone a substantial change over the last year. In the past, the marketing efforts of the programs have been initiated and maintained by the account executives with limited support from Duke Energy's marketing professionals. The marketing support in the past has focused on brochure development and web-page design support. These efforts have been designed to support the one-on-one program presentations to large customers by the account executives and program managers. However, over the past year, the program's marketing efforts have moved and continue to move to a more segment-based marketing approach. In the new marketing efforts, Duke Energy develops a marketing plan in conjunction with input from the PowerShare managers and the other energy efficiency program managers. Those PowerShare aspects of the marketing plan are then implemented as they have been in the past by the account executives that have direct contact with the larger customers. However, in addition to these efforts Duke Energy is in the process of developing segment-based strategies that can be directed at groups of customers, rather than single customers. In the past years, the account executives shouldered the majority of the marketing and outreach responsibilities, including outreach to specific customers, presentation of the program to these individually targeted customers, going over the program benefits and responsibilities with the customers, and negotiating the participation contracts with these customers. The targeting of customer was largely a function of the account managers who know their customers well and understand their assigned customer's operations to the extent that they can target customers who may have demand shedding potential that can be utilized by Duke Energy and at the same time benefit the customer. The Duke Energy marketing support managers described the marketing approach as "one-on-one" marketing.

This approach is changing with the addition of a segment-based approach to capture customers who cannot opt-out. The customers who were (and remain) the primary targets for this program are also the customers who can now opt-out of being eligible for participation in Duke Energy's energy efficiency and demand response programs. The opt-out provision allows customers to avoid paying for the energy efficiency and demand response programs via the additional charge on their electric bills. However, if they exercise the opt-out option, they are no longer eligible to receive participation incentives (payments) for their load reduction or energy savings actions. As a result, some of the larger customers who make excellent PowerShare participants can now opt-out of these programs. The opt-out option is currently eroding the eligible high-priority (larger customers) participation population for the PowerShare Carolina System program, requiring the program to move to smaller segment-based customers. Duke Energy is now in the process of developing a new approach for marketing to these smaller customers. The success of this effort will be tested over the next couple of years as the program attempts to gain a larger number of smaller customers who will need to set up kW reduction agreements which result in less load reduction per customer which will need to be off-set by increasing the number of participants if the program kW levels are to be maintained.

According to the interviewed managers, the opt-out provision and the resulting change in the per-customer kW reduction potential is resulting in increased cost for the program per unit of kW reduction achieved. The opt-out provision is impacting costs per kW reduction in the following ways:

1. A new marketing approach is being developed to target and attract the smaller customers who do not qualify for the direct support of an account executive and will need to acquire program information and participation decision support information from program information sources that are more market based and that do not directly require the engagement of the account executives.
2. The average kW reduction per customer is expected to go down as smaller customers enroll in the program, at the same time that the cost to obtain a participant are moving up.

The goal of the program, with regards to the marketing efforts, are to maintain as much of the kW load reduction as possible, while controlling marketing and program operations costs that are resulting from the need to acquire larger numbers of smaller, segment-based customers that are offering less kW reduction. It is a significant challenge. According to one interviewee, "*The costs are not going down at a rate to match the opt-out rate, resulting in increasing cost per kW acquired. As a result we need better more effective marketing approaches to supplement our one-on-one approaches. "*

The change in the opt-out condition was a challenge for Duke Energy in that it occurred over a short period of time, compressing the need to develop new marketing strategies. As a result, early changes focused on updating the web site and in the development of new program brochures more appropriate for the smaller customer. In addition, Duke Energy updated the large customer website and provided a link to the program page that helped customers get to the PowerShare site resulting in an increase in web traffic to the site. Additional improvements to the marketing efforts included the use of a new web-trackable e-mail approach that allows program

managers to see which customer are opening the mail and are visiting the website. The first use of this approach was sent to 1,800 customers of whom 25% opened the e-mail and viewed it.

Improvements to the marketing efforts are continuing as the outreach efforts for 2014-2015 are being developed at the time of the process evaluation interviews. While these new approaches are still in development, the early results from the e-mail tracking look promising. Duke Energy is also working on the development of case studies that are tailored to show the smaller segment-based customers examples of how the program has benefited specific customers that are like those being targeted. These efforts will be launched in the 2014 fall campaign and will be assessed in future evaluations. There are about 4,000 of these newly targeted segment-based customers in the Carolina System that will be targeted in the fall campaign.

Marketing Challenges

When asked about the primary challenge to the marketing effort caused by the need to go after smaller participants, customer education was noted as an increasingly problematic challenge. Managers noted that the smaller customers do not understand kW use or their ability to control their energy use as well as the larger customers. While the account executives can work directly with the largest customer, the smaller customers cannot be assigned to an account executive. This means that the marketing and educational materials will need to be effective not only at informing the customer about the program, but in helping them understand how they might benefit from the program. The marketing approaches will need to educate the customer about what kinds of things (event actions) they can take to achieve a kW reduction over the event period that is consistent with their kW reduction participation agreements. According to the interviewed managers, the program is going to need to help these customers understand the kW reductions they can acquire and the time periods or operational conditions during which those resources can be acquired. They noted that flexibility of operations and equipment use will be important to the success of their participation experience.

Marketing, Supply, and the Polar Vortex

The extreme winter of 2013-2014 caused Duke Energy to experience higher demand levels not typically experienced in the Carolina System and drove electric prices higher while limiting access to additional energy supplies. During the period of time in which a polar vortex was channeling a southerly push of frigid air over the United States, utilities such as Duke Energy were experiencing a substantially higher winter peak as customers used more electricity to heat their homes and businesses. This event drove consumption to peak levels within the Duke Energy distribution system and substantially increased the cost of market acquired power as demand substantially increased within a limited supply condition. The weather extremes were noted by the PowerShare team and caused program managers and their marketing support teams to consider adjusting the marketing materials and program designs to reflect the potential for future winter peak events or structuring new components of the program to consider winter emergency peak program events. Managers also noted that the polar vortex caused participants to become more aware of their commitments to the program because of the unexpected kW load on the Duke Energy system and the potential for winter peak call events. Duke Energy will continue to assess the degree to which the program or its marketing materials may need to be adjusted, especially if the winter peaking events repeat in future winters.

The managers noted that they are going to need to develop case studies and other materials and approaches that convey the kind of information that will be read by the customer, and more importantly, allow them to understand that material well enough to make a decision to consider participation. Managers also noted that Duke Energy is developing a Medium-Sized Business Advisor Group that will help Duke Energy develop materials that are effective at educating these customers, and also assist with helping educate businesses about the program and the program requirements, but also help educate them about what they can expect to gain as a result of their participation. Duke Energy has begun the development of these materials and will put them into use this year.

Understanding the Impact of the Program on Customer

Duke Energy managers noted that the program can have a very substantial impact on customers and needs to be used with care. It was noted that participants can be substantially harmed by a load reduction call if that reduction is not well planned and implemented by the participating company. The manager noted that there are risks as well as rewards of participation for the customers. For most of the participants the rewards are greater than the risks, especially when the customers have a well-structured kW reduction plan that they are comfortable implementing. However, as the managers noted, because the call for a kW reduction may not occur for a year or more, it is important for participants to review their participation agreement periodically and be comfortable with their kW reduction response. The managers noted that while it is common for the account executives to help participants understand their commitments and responsibilities, and for these managers to help them identify ways to respond to a call event, most participants understand the program and their obligations well. The manager noted that participants are better educated about the program now than in the past, and that the program's improved communications with the customers supported by internal communications training, as well as the use of contact check-lists have helped improve customer understanding and ability to respond. The manager noted that the program has adopted a check-list communications approach that helps to assure that each customer is exposed to key information designed specifically to help improve an understanding of the program and their commitments. The check list is an online internal management tool that tracks all contacts with the participants and documents the information discussed with the customer.

Follow-up with the Customer

Following each event, the monitoring assessments of the program, the event and the response of the participating customers are conducted and examined. The monitoring is examined for performance and to assess the performance-against-costs and to determine if penalties are required for specific customers. This information is provided to the account executives so that the account executives can work with and report performance to the participating customer. In addition, customer reports are generated so that individual customers can see how well they did on that call event. However, this report is not provided in real time (nor do we think it needs to be unless it can be automated), but is provided after a few days when the Duke Energy internal analysis is complete. Once performance is assessed the payments are calculated for each customer and the credit amount is incorporated into an export file to be sent to the billing department. However, prior to the sending of the credit file for billing, the program manager confirms that the amounts to each customer are accurate. Once the confirmation is made, the file is provided to the billing department for incorporating into the next utility bill.

Once the credit is incorporated into the utility bill, it is checked and confirmed to be the correct amount before the bill is sent to the customer. Errors in billing or credit amounts are corrected at one or more of the multiple pre-release quality control checks. As customers elect to continue or drop-out of the program, or as new customers are enrolled in the program, the program records are updated so that they can be confirmed to be a part of the performance assessment monitoring stream for future events.

Event Monitoring

The Duke Energy program manager monitors the performance of the Carolina System program through the use of analytical tools in which the manager examines the historical load contract commitment and compares that to the daily performance metrics reports that show the kW load profiles of the participants within a called event. In addition, the manager uses Energy Profiler OnLine, a tool that allows the manager to examine daily performance of the participating event customers. These tools provide the information to monitor both program performance and customer performance to assess and confirm kW reductions but do not provide real-time monitoring.

Incentive Levels

Managers were asked about the incentive levels and if there was a need to adjust those levels in view of the smaller customers being approached for participation or to consider winter peaking conditions. Managers noted that the incentives are set to reflect the market price of acquired power in order for the program to be cost effective. They noted that increased incentives can drive the program to be non-cost effective. They also noted that incentive levels are not considered substantial barriers to participation for the larger legacy participants or for the newly targeted smaller customers. Managers noted that the program is experiencing higher cost per acquired kW pressures as gaps created by the participants who opt-out are requiring the program to go after participants that can offer lower kW levels. Managers noted that adjustments may be required to the incentive levels in the future once the full impact of the opt-out provisions and the addition of smaller customers are more fully understood, but they do not think that incentives should be changed (increased or lowered) at this time.

Winter and Summer Peak Need Different Pricing and Load Reduction Plans

Interviewed account executives noted that customer responses and response conditions to demand reduction calls need to be different in winter than they are in the summer. The interviewed account executives noted that these are very different types of load events and noted that load reduction pricing and demand reduction plans appropriate for summer may not work in winter. It was noted that many customers have load reduction plans to drop summer air conditioning loads that do not apply in winter. Likewise, reductions to manufacturing and processing plans, which apply to summer contracts and work schedules, do not always match what they do in the winter. Other managers noted that they had established reduction contracts with their customers based on summer conditions and a specific participant may have no reducible load for a winter call. The manager noted that these large customers were financially penalized for their lack of ability to reduce in the winter.

The manager indicated that a winter event can cause a customer to give notice to opt-out, only to be told by Duke Energy that they are required to stay in for at least 12 months in accordance with their participation agreements and the program's regulated operational rules.

It was noted that many participants need seasonal flexibility in their reduction plans and have to implement different strategies that provide different load reductions and require a winter-structured incentive that is different than a summer incentive. As a result, according to the account managers, the planning and pricing agreements reached for anticipated summer demand reductions may need to be different than winter demand reduction calls. However, according to the account executives, the program does not need to be segregated into different seasonal focused programs (PowerShare Winter vs PowerShare Summer). These account executives noted the difficulty of their participants trying to meet a summer load reduction commitment during the winter when their operations and operational cost structures are different. Duke Energy's customers need to have PowerShare contracts and event calls that are specifically designed to the operational and pricing requirements of the load conditions at the time of the call events. This means that customers need to have program-approved reduction plans and incentive structures that may be different from season to season.

> Recommendation: Duke Energy may wish to investigate the potential for restructuring the program to address the ability of customers to respond to demand reduction calls at different times of the year and determine if alternative regulatory and program operational conditions are needed to meet different customer conditions associated with different seasonal peak demand call events.

Timing of the Customer Agreements and the Opt-out Provisions

According to the results of the management interviews, there is a need to reexamine the timelines associated with establishing customer agreements and the participation enrollment processes so that they are in agreement with the opt-in and opt-out timelines and decision events. Interviewed managers suggest that the opt-in opt-out rules and timelines are having an impact on customer participation decisions that are impacting Duke Energy's ability to maintain participation and reach program load reduction goals. Managers noted that the opt-in opt-out rules are not set up for winter event decisions and have long decision-change timelines that can cause customers to be forced to participate after they have made a decision to opt-out. For example, a customer who is penalized after they were unable to meet a winter reduction call because their reduction plan and incentive structure was established to achieve a summer load reduction must give a 12 month notice in order to opt-out. Managers also noted the opposite decision is problematic as well in which a customer can decide to be a participant, only to be told that they cannot join the program until the opt-in window is open. The managers noted that it can take months for the window to open, over which time the customer can change their mind because of the inability to implement their decision within the timeline that their operations need. Managers noted that regulatory and program decision timelines can act to alienate customers who must operate in real time and make decisions effectively.

> Recommendation: We recommend that Duke Energy assess these issues and the effects of program timelines in view of the regulatory structure and the potential for winter calls and work to design timelines in which the opt-in and opt-out timelines are supportive of

the customer's decision making requirements, provide a positive decision experience for the customer and which allow the program to contract to effectively achieve both winter and summer load reductions.

Participation Decision Mechanisms and Regulated Opt-Out Provisions

Interviewed managers noted that there is a significant timing difference between the timing of a customer's participation decision and the regulated timing of the Opt-Out / Opt-In decision. Managers noted that a participant will consider participation within a decision frame that is appropriate for their operations and budgeting schedules, but noted that this timeline may be substantially different from what the opt-in regulatory timeline requires. It was noted that the opt-in decision was a 3-year decision over which substantial changes to a company's operations can occur which directly impact their ability to reduce load. The account managers noted that the 3-year opt-in requirement means that there is load that can be achieved but will not be contracted because of the operational and financial risk associated with a three-year decision within a business climate that is based on annual or in some cases seasonal needs and budgets. One manager noted, *"The three year commitment is hard for customers to do, it is a barrier to participation."*

We recommend that Duke Energy examine the timing and duration of the opt-in commitment requirements and determine if those requirements are over-restricting participation or resulting in potential load not being acquired because of the flexibility and risk avoidance needs of the targeted customers. If such a condition is warranted, Duke Energy should work with the Commission to structure a schedule that is more supportive of customer requirements to the extent this can be accomplished under Carolina System regulatory constraints.

EPA Regulations Impacting Program Design and Operations

The legacy PowerShare program has enrolled customers who have stand-by or older generators that can be used as alternative power supply options within these participant facilities. When there is a PowerShare control event called by Duke Energy, these generators could (in the past) be used by the customers to replace or offset the program-contracted PowerShare energy required from Duke Energy, thereby decreasing the short-fall of kW needed by Duke Energy to serve their customers. In the past, the participants and utility companies have had considerable flexibility in the use of these generators to support supply needs, however recent changes to the EPA regulations have resulted in prohibitions against relying on all of these generators to offset supplies under some emergency conditions unless they have passed the updated EPA emission regulations. This regulation change means that Duke Energy cannot call on all of these customers to provide load relief for events not defined by the EPA as an emergency unless the generators are certified to pass the new regulatory requirements. Beginning January 1, 2015, customer generators that do not meet the new EPA emissions standards will need to participate in the PowerShare Generator option.

Recommendations from the Management Interviews

The evaluation identified a set of recommendations that we think Duke Energy should consider. These recommendations stem from an observation of how the current program operates relative to the winter peak events of 2013-2014 and the process associated with cost assessment. The recommendations are as follows:

1. **Establish Both Summer and Winter Peak Programs and Participant Goals**
    a. We recommend that Duke Energy investigate the potential for restructuring the program to address the ability of customers to respond to demand reduction calls at different times of the year (winter and summer events) and determine if alternative regulatory and program operational conditions are needed to meet different customer conditions associated with different seasonal peak demand call events. If those changes are needed Duke Energy should work with the North Carolina Commission to restructure those conditions to meet the need for winter and summer program designs and contract conditions.

2. **Examine Opt-in Timelines and Requirements and Determine if Changes are Needed**
    a. We recommend that Duke Energy assess these issues and the effects of program timelines in view of the regulatory structure and the potential for winter calls and work to design timelines in which the opt-in and opt-out decision timelines are supportive of the customer's decision-making requirements, provide a positive decision experience for the customer and which allows the program to contract to effectively achieve both winter and summer load reductions.

    b. We recommend that Duke Energy examine the timing and duration of the opt-in commitment requirements and determine if those requirements are over-restricting participation or resulting in potential load not being acquired because of the flexibility and risk avoidance needs of the target customers. If such a condition is warranted, Duke Energy should work with the Commission to structure a schedule that is more supportive of customer requirements to the extent this can be accomplished under Carolina System regulatory constraints.

Participant Survey Results

Forty-two companies (26 from North Carolina, 16 from South Carolina) were randomly selected from current participants in PowerShare, and asked to take part in this survey[3]. These 42 companies comprise 10 textile manufacturers, six water plants, five furniture manufacturers, 12 manufacturers of other products with the rest being sole representatives of assorted other non-manufacturing sectors. Thirteen of the respondents also manage more than one site that currently participates in PowerShare. Of these companies, 41 are enrolled in the Mandatory program, with six on the Generator option. Of the respondents, thirty-two of the companies are enrolled in the Voluntary Curtailment Option and one enrolled in CallOption. On average, these companies have been participating in PowerShare for three to four years.

Marketing

The PowerShare program is marketed mainly by Duke Energy Account Managers, to their assigned large customers: 30 respondents (71%) reported they first became aware of PowerShare through a Duke Energy representative, with the rest learning about the program through previous experience with demand response programs or from colleagues. The respondents felt their sources provided almost everything they needed to decide whether or not to participate (a mean rating of 9.19, on a scale of 1 to 10, with 1 meaning "almost nothing I needed" and 10 meaning "everything I needed", S.E.=.28). In addition, when asked where they sought out additional information, 8 of 12 reported they went back to a Duke Energy representative or account manager. The remaining three respondents reported they sought out additional information from the Duke Energy website, engineers within their company, or a consulting engineer. The additional information ranged from more details on the benefits and opt-out procedure, to curtailment logistics for their company (3 of 10 responses mentioned this). All but two reported they got the information they needed.

Enrollment

By an overwhelming count, respondents said that their main reason for participating is financial (37 out of 42). Of the others, three respondents said their primary reason was to help prevent outages, and two said they had a need to test their generators. When prompted for any secondary reasons for participating, 22 of 39 respondents said that there was no secondary reason[4]. Of the others, eight said they wanted to help avoid outages, five said their secondary reason was financial, three said their company's processes made them a good fit for the program, and one respondent said their secondary reason was that they thought there would be no events called.

CallOption Awareness

At the time they were first learning about PowerShare, 22 of 30 respondents reported that they were also presented with information about the PowerShare CallOption program. However, Duke Energy's program participation data shows that only one company enrolled in CallOption. When companies were asked why they didn't enroll, four of eleven respondents said it wasn't their decision, three said they were not aware of CallOption, two said the incentives were too

[3] Not all companies provided responses to all questions.
[4] A social desirability bias would lead respondents to cite environmental or corporate citizenship as a primary or secondary reason for participating. The fact that very few cited these reasons assures that very little social desirability bias is affecting our findings

low, one explained they used an emergency generator, and one said it was difficult for their company to curtail energy. When asked what Duke Energy could do to make CallOption more attractive to their company, six said they would need more information about CallOption, four said their production needs took priority, and only one mentioned that Duke Energy could increase the incentive. Taken all together, while the sample size for this set of questions is small, these data suggest that there may be a need for consistent marketing of CallOption. An alternative explanation for these findings may be that CallOption was indeed presented to all companies, but found to be an unsuitable option for these companies due to their production priorities or other constraints. Once ruled out as unsuitable, it is possible that respondents simply forgot about CallOption, because it became irrelevant. From these responses, it also seems that PowerShare incentives were priced well, with very few respondents citing low incentives as a reason for not participating.

Event Notification

Participants were asked if there were any other methods by which they would like to be notified about events, and they all said no. One customer did volunteer that they preferred the Automated Demand Response pilot that was offered in the Carolina System for a short period. Customers were also asked how useful it was for them to receive "day ahead" notices, which the program managers sometimes are able to provide. On a scale of 1 ("useless") to 10 ("useful"), 40 respondents gave a mean rating of 9.53 (S.D.=1.38). Respondents were asked to provide feedback on the event communications efforts. The top two most frequent responses from the 42 companies were that Duke Energy was already doing a good job (14 responses) and that there had no feedback (13 responses). Examples of responses include: "*Their event communication efforts are superb*." And "*The event communication efforts are great. Sometimes our Duke rep even sends us a thank you letter afterwards*." Of the other feedback, five respondents mentioned a desire to alter the event contact list, including the ability to do it online themselves. "*I would prefer being able to edit our event notification call list simply by logging onto my account. As is, I need to involve my Duke rep every time a number or name gets changed.*" And "*I would prefer during the annual [enrollment] period, to have the ability to reassess our event notification contact list. As is, Duke simply sends me a list I'm supposed to blanket-sign-off on and return. I need the ability to edit this list.*" Six other respondents mentioned that the more advance notice they can get, the better, with one specifically mentioning the need for more advance notice when there were winter events. Three customers mentioned that there were too many notifications, but we note that they were outweighed by those who appreciated the redundancy, "*Duke attempts to notify several of us in the case of events. This is actually pretty helpful, especially for early morning events. It ensures that we're all in the same communication loop.*"

Based on these data, we conclude that Duke Energy's communications efforts are effective and useful, and report that there is no need to change existing communications procedures. However, because interviews with Duke Energy managers suggest that some customers have to contact the account executive to learn of an event termination, there may be room for improvements to subsets of customers who are not now learning about the timing of the end of an event call. There does not now seem to be significant room for additional improvement beyond a small subset of participants who provided a few comments on event termination. We share two interesting comments about the content of the notifications for Duke Energy's consideration. One respondent remarked, "*Only thing that we've run into is that they're very vague as to when*

we can start back up. They'll say like 11:00, but then say it may go past that. We don't know when to bring our people back in. It's hard to plan." Another mentioned, "*If Duke leaves me a phone message, that message should be informative. The message should not request that I call another number to find out what it's about.*" At this time, these singleton comments do not warranty any recommendations from the evaluation team.

Event Response

With the exception of three companies (of 30 respondents), all reported that their company declined at least one event since 2012. With the caveat that 32 of the 42 total companies in our sample are enrolled in Voluntary, this is not surprising, but provided an opportunity to explore their reasons for declining events. Of the 26 companies, almost three-quarters (19) cited production priorities. Four cited lack of cost effectiveness, with a few mentioning the cost of fuel to generate the electricity during the event, one mentioning that they had an emergency generator, and one more explaining that they didn't participate because of the burden of calculating cost-effectiveness: "*It's more trouble with our finance department than it's worth. It takes time to figure out the bidding.*" This is likely not new information for Duke Energy. However, for those events in which these companies do participate, 36 of 42 (86%) report that they successfully reduced their load.

Energy Profiler Online

Respondents also report some usage of Energy Profiler Online to review their load shape. Of those that use EPO, there is limited review of EPO after a bill arrives, with most of the review occurring during an event (see Figure 1).

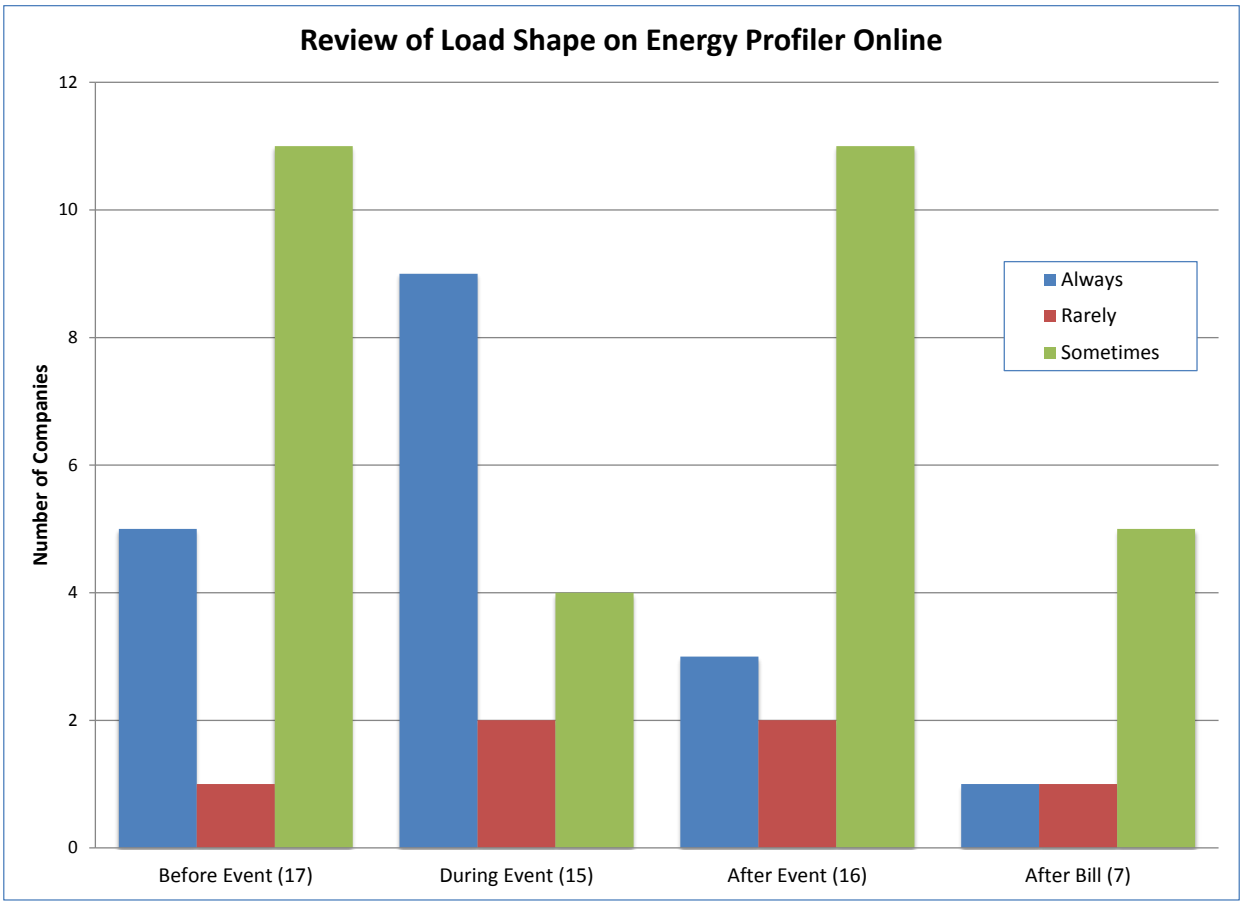


Figure 1. Review of Load Shape on Energy Profiler Online

EPO is seen by the respondents as being moderately easy to use, with 33 respondents rating it 6.91 (S.D.=2.5), with 1 meaning "very difficult" and 10 meaning "very easy". Those rating EPO with less than 8 reported a range of difficulties.

Two respondents asked for better usability features:

- *Duke could reduce the number of clicks required to log into EPO. It is currently quite cumbersome on the front end.*
- *Duke could make EPO easier to navigate.*

Three suggested that they would like more training

- *I'd like some training or examples.*
- *Duke could make the mechanics of EPO more intuitive by providing additional training resources and online tools.*
- *Have directions posted online, just something to clarify the whole process.*

Two others mentioned usability, as well as suggestions for more features:

- *Duke could make EPO a little more user friendly by having less back & forth. Add the ability to redraw. Make it a more dynamic system.*
- *Duke could make EPO more user-friendly by allowing me to filter and then easily export data.*

Load Capacity Commitment

Most of the respondents report that their targeted level of load reduction is "about right for their company" (see Figure 2).

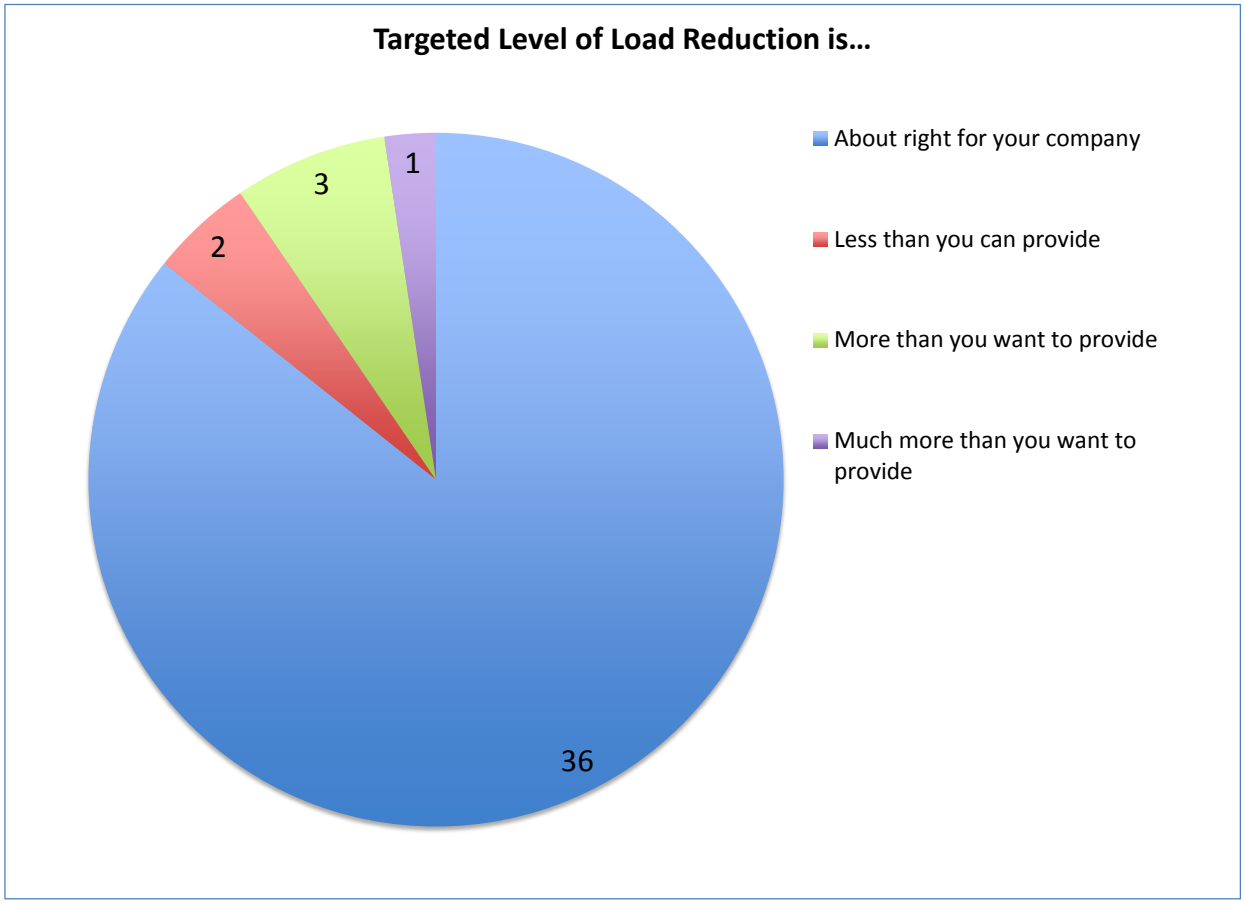


Figure 2. Targeted Level of Load Reduction

Generator

Fourteen of the respondents report that they do use generation as part of their load reduction strategy. Of these, seven report that they will continue to participate in Generator. However, four others are unsure, and two others are concerned about meeting the new EPA regulations, and one company reported "the cost to retrofit outweigh the cost benefit of the credits".

PowerShare Concerns

We asked the respondents to share their biggest concern about PowerShare during their decision-making process[5]. Their primary concern was about interrupting production at their company (See Figure 3).

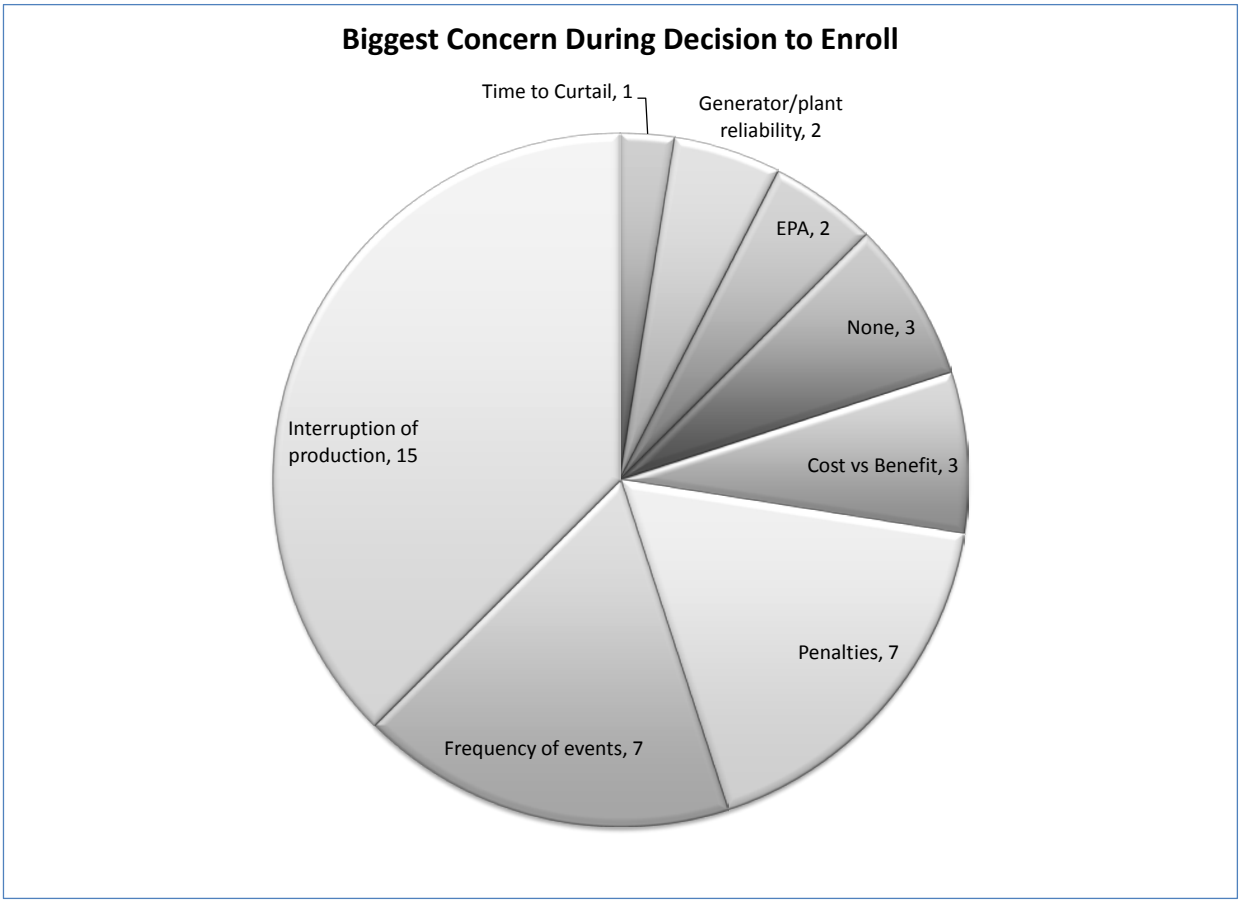


Figure 3. Biggest Concerns During Decision to Enroll

In seven cases, respondents reported that their experience with PowerShare this past event season decreased their concerns. When asked to elaborate, they gave these explanations:

- *History has shown us that the events occur infrequently.*
- *I don't think we've ever incurred a penalty.*
- *Since our enrollment began I think the longest shutdown we've experienced was 12 hours. Most events last only a couple hours, so we can make up for lost production later that same week if need be.*
- *We appreciate our continuing dialog between Duke Energy and various air quality organizations regarding the RICE NESHAP regulations.*

[5] Three respondents volunteered two additional "biggest" concerns, but the graph includes only the first "biggest" concern mentioned. The additional concerns that were mentioned were: Interrupting production (one mention), and penalties (two mentions).

- *We didn't have any problems meeting any requirements.*
- *We finally experienced an event and everything went smoothly.*
- *We have received the incentives exactly as they were initially described.*

For 32 respondents, their experience this past season did not decrease their concerns. When asked for ways in which Duke Energy could decrease their concerns, 9 of 21 respondents wanted Duke Energy to control the events in some way. These ranged from suggestions to stop having events during peak hours, to several simplistic suggestions that "*Duke could eliminate the need for events altogether*" and "*eliminate them during the winter*", to one suggestion that Duke Energy could "*put more generators online so we don't have to worry about brownouts.*" While these attitudes may not affect the companies' ability or willingness to reduce load, and it may not be representative of the overall PowerShare participants in the Carolina System, it suggests that a segment of the participants may not understand the larger purpose of the PowerShare program, or that they perceive grid and power unreliability as due to Duke Energy's actions. Of the others, there were three suggestions to provide as much advance notice as possible. There were also three respondents who suggested more feedback would help, including one customer who wanted Duke to "offer us equipment that we can use to monitor ourselves to measure our load" and another who would like real time monitors. Two participants suggested that Duke split the program into a summer program and a winter program in some way, not including the respondent who wanted Duke to eliminate events during the winter. Of the remainder, there was one call each for increased incentives, decreased penalties, a request to increase one participant's targeted load, and two suggestions unrelated to PowerShare (to decrease rates, and stop power spikes.)

> Recommendation: Duke Energy should consider investigating the source of customers' expectations that Duke Energy can control the frequency of demand response events. This may reveal opportunities for Duke Energy to educate customers on the full benefits of participating in PowerShare.

Overall Satisfaction

Respondents were asked to rate their satisfaction, on a scale of 1 ("very dissatisfied") to 10 ("very satisfied") with various aspects of the PowerShare program. Overall, the PowerShare program garnered high ratings from the participants. These ratings can be seen in Figure 4.

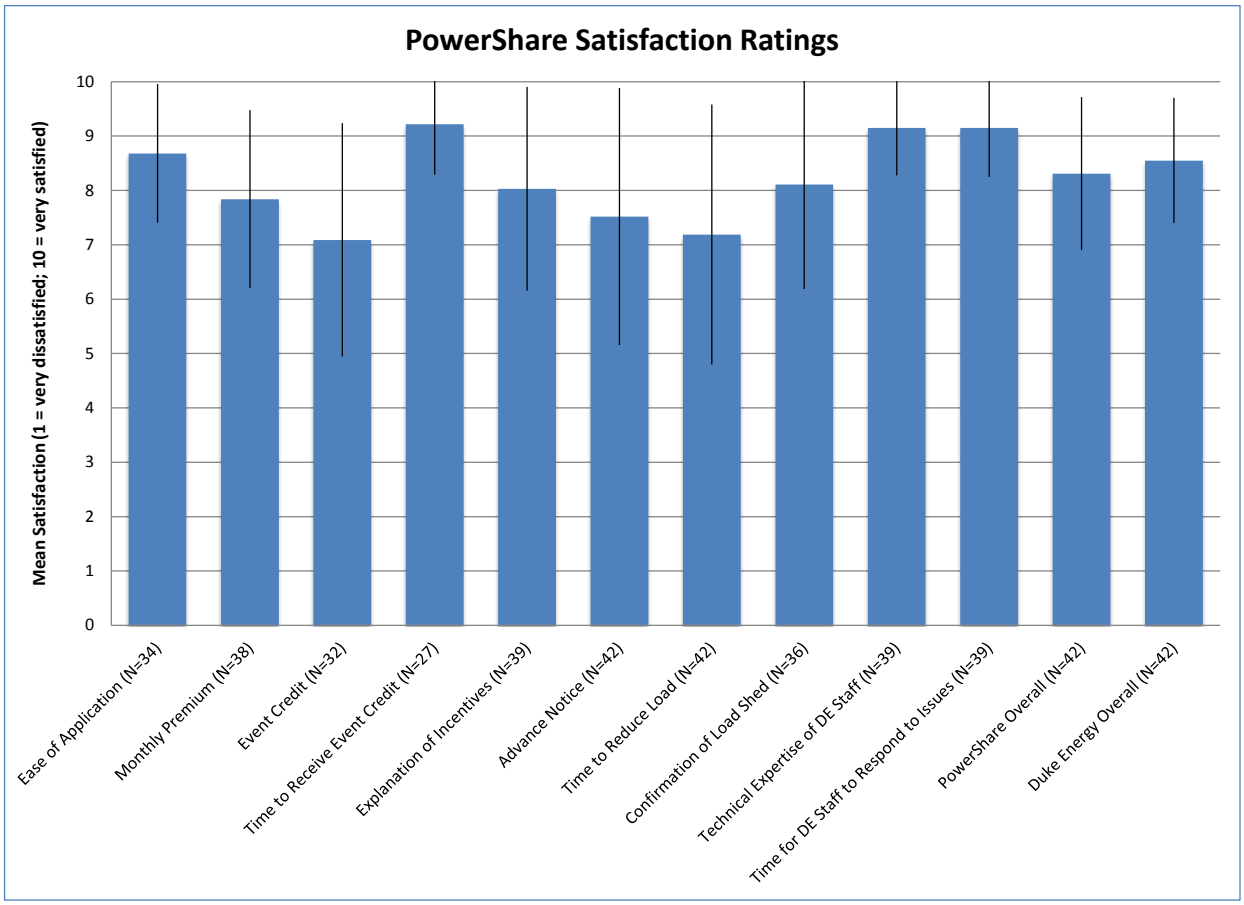


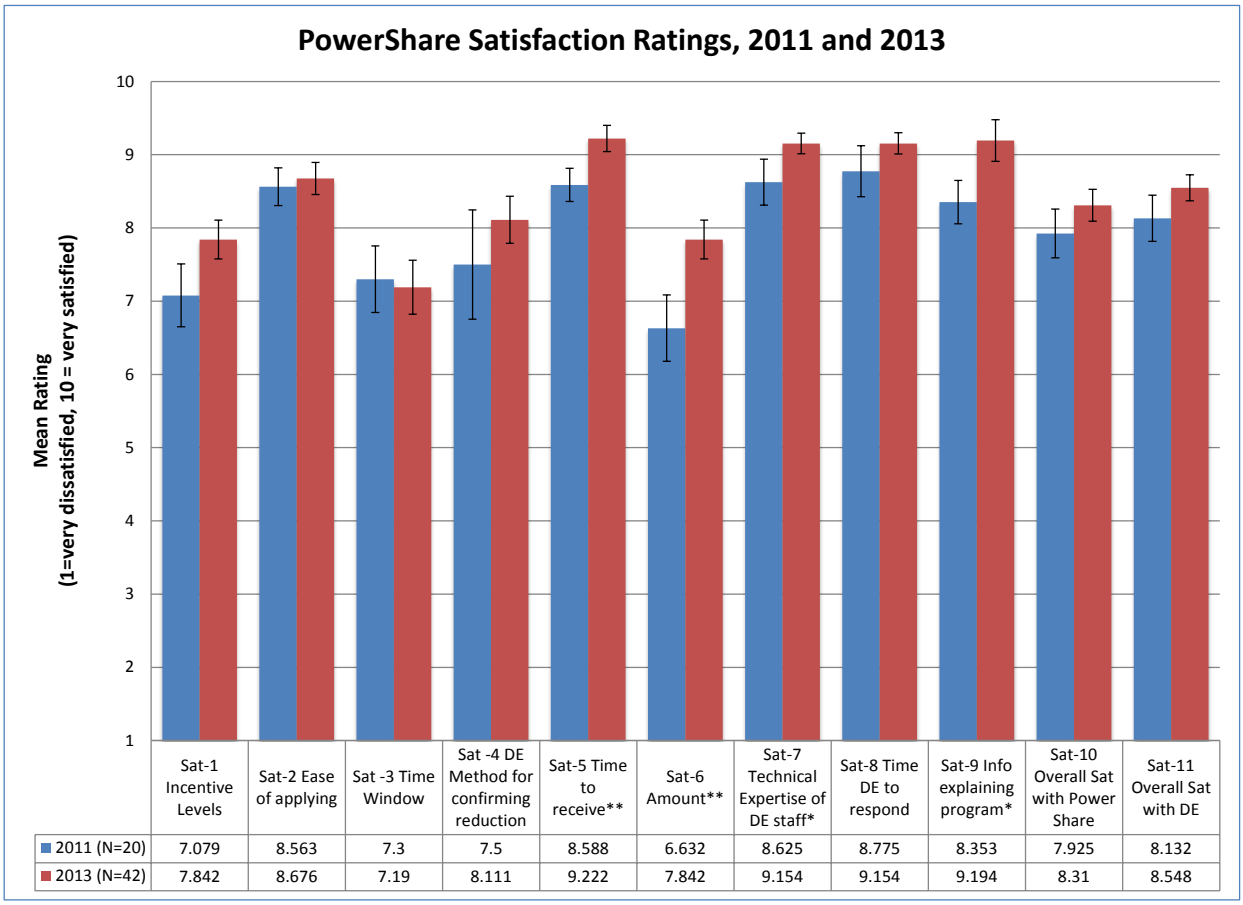
Figure 4. Participant Satisfaction Ratings

The highest satisfaction ratings were given to Duke Energy staff's technical expertise and the time it took for Duke Energy staff to respond to issues. Respondents were also highly satisfied with the time it took to receive event credits. Likewise, overall satisfaction with PowerShare and with Duke Energy itself were very high. Not unexpectedly, the financial incentives were some of the lowest ratings, but even these should be considered moderately high ratings: participants had higher satisfaction with the premium credits (average rating of 7.84) than with event credits (mean of 7.09). In the past, this evaluation team has heard participants say that they had difficulty understanding the calculation of the incentives. In 2013, participants rated their satisfaction with the incentive explanation at 8.03. Note that this evaluation team considers an "8"rating to be so high as to not warrant follow up questions.

While there is still room for improved satisfaction for the time that participants have to reduce load (7.19) and for the amount of advance notice (7.52), these two areas are historically where participants experience the most stress in response to an event call. Given the unavoidable stress associated with responding, the evaluation team considers these to be high ratings that may not have much room to be increased.

The most interesting finding, however, can be seen when comparing satisfaction with PowerShare in 2011 (the date of the last process evaluation survey) with current PowerShare satisfaction. As can be seen in Figure 5, there is a laudable overall increase in satisfaction.

Further analyses show that this increase is statistically significant (with p≤.05) for the time it took to receive the incentive, and with the amount of the incentive (marked with ** in the legend). Also notable is the increased satisfaction with the technical expertise of Duke Energy staff, and with the information explaining the program (marginally significant with p≤.10, marked with * in the legend).



	Sat-1 Incentive Levels	Sat-2 Ease of applying	Sat -3 Time Window	Sat -4 DE Method for confirming reduction	Sat-5 Time to receive**	Sat-6 Amount**	Sat-7 Technical Expertise of DE staff*	Sat-8 Time DE to respond	Sat-9 Info explaining program*	Sat-10 Overall Sat with Power Share	Sat-11 Overall Sat with DE
2011 (N=20)	7.079	8.563	7.3	7.5	8.588	6.632	8.625	8.775	8.353	7.925	8.132
2013 (N=42)	7.842	8.676	7.19	8.111	9.222	7.842	9.154	9.154	9.194	8.31	8.548

Figure 5. PowerShare Satisfaction Ratings in 2011 and 2013

Appendix A: Management Interview Protocol

Interviewer: _____ Date of Interview: _____ Interview method: _____

Name: _____

Title: _____

Position description and general responsibilities:

_____

_____

_____

We are conducting this interview to obtain your opinions about and experiences with the PowerShare Program for the Carolina System. We'll talk about the Program and its objectives, your thoughts on improving the program and its participation rates. As you may know, due to regulatory requirements Duke Energy needs to conduct periodic evaluations whether they are needed or not. Today's interview will take about an hour to complete. May we begin?

Program Overview

1. In your own words, please briefly describe the PowerShare Program's objectives. Are there any objectives at the participant level? What are they?
   Are there any objectives at the state portfolio level?
   Are there any objectives at the company level, across all the PowerShare states?

2. In your own words please describe how the PowerShare Program works and go over its design, marketing and operational approaches. Walk us through the participatory steps starting with a customer who knows nothing about the program.

3. Please explain the different PowerShare options that are available to Duke Energy customers along with their incentives.

4. Please describe your role and scope of responsibility in detail. What is it that you are responsible for as it relates to this program? When did you take on this role?

5. Please describe for me the roles and responsibilities of vendors that are supporting Duke Energy's PowerShare program?

6. Are there any changes you would like to see in the vendors' roles or responsibilities that would improve the PowerShare program's operations?

Objectives

7. Have the PowerShare's objectives changed in the last year or so, and if so how? Why?

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

9. Since the program objectives were devised, have there been any changes in external influences (such as market conditions) or internal influences that have affected the PowerShare program's operations?

10. Should the current objectives be revised in any way because of these changes that developed since the program objectives were devised? What changes would you put into place, and how would it affect the objectives?

11. Are there any pre-existing conditions that are associated with the program or the market that are not being addressed or that you think should have more attention? If yes, which conditions are they? How should these conditions be addressed? What should be changed? How do you think these changes will increase program participation or impacts?

Incentives

12. Do you think the incentives offered through the PowerShare Program are adequate enough to entice the C&I community to enroll in the program? Why or why not?

13. Do you think the customers understand the incentive levels and how they are calculated? Have there been any issues relating to the customers understanding the incentive approach or confusion over what they are paid? What can be done to minimize this confusion?

14. If Duke were able to change the incentive level for each event, how do you think this would impact PowerShare's ability to acquire power reductions? In other words, do you think customers have additional ability to shed load that could be tapped if the incentives were increased?

Marketing

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

16. Do you think the materials and information presented to the C&I community about the PowerShare Program provides a complete enough picture for them to understand the potential importance of the program to them and their operations and the incentive or participatory benefits of the program?

17. In the state of [insert state], are there specific customer types (business types) or market segments that you think Duke Energy should focus more effort on enrolling? What are they? How should PowerShare approach them with this program?

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

19. What are the key market or operational barriers that impede a more efficient program operation or limit obtainable impacts?

20. What market information, research or market assessments are you using to identify market or segment-level barriers, and develop more effective or targeted operational mechanisms?

Overall PowerShare Management

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

22. Do you think there should be changes made to the structure of the participation options?

Event calls

23. How do you track, manage, and monitor or evaluate customer response to the event calls?

24. For customers who do not shed as much load as anticipated, do you know why customers did not shed enough load?

25. Can you describe for me a picture of how customers react to a call? How fast do they learn of a call, what determines what they can do, how fast can they react?

26. Given that PowerShare customers have different capabilities to react to an event depending upon their work volumes, production schedules, etc., how does PowerShare capture needed savings within the different customer conditions and capabilities in the market?

27. How do you know if they reached their load shifting objectives?

28. What is the quality control, tracking and accounting process for determining how well control and control strategies work at the customer level and at the program level?

29. Are there any market segments or customer types that the program is now serving that are not able to provide the load shed within the timelines and notification systems used today? What would you suggest should be done about this customer segment?

30. Overall, what about the PowerShare Program works well and why?

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

32. In what ways can the PowerShare Program's operations be improved?

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

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

35. How did PowerShare respond to the following recommendations, that were made in the previous evaluation study?

    a) RECOMMENDATION: Duke Energy should consider conducting a conjoint analysis to obtain data on what value customers place upon the different PowerShare program offerings. Such a study would provide Duke Energy management with more information on which to base any reviews of the PowerShare incentive structure in the Carolina System. TecMarket Works further recommends that any conjoint analysis use a choice-based approach, such as discrete choice analysis. This would allow Duke Energy to mimic a real-life decision-making scenario and increase the predictive validity of the study. If Duke Energy does decide to conduct conjoint studies, TecMarket Works recommends that two conjoint studies with different participant samples be considered: One presenting the features of PowerShare Mandatory/Generator versus PowerShare CallOption (i.e., higher premium versus more lead time for events), and another that presents CallOption versus non-participation scenarios in which customers consider the costs of blackouts and of paying higher energy prices due to not curtailing energy use. The second study with non-participation scenarios would allow Duke Energy to compare the relative attractiveness of receiving lower CallOption premium credits versus not participating at all, removed from the context of PowerShare Mandatory/Generator's higher premium credits.
        a. Duke Energy's response and any actions taken:
            i. _____
               _____
               _____

    b) RECOMMENDATION: Because economic curtailment programs are new to customers in the Carolina System, Duke Energy may wish to provide a one-page reference to remind customers of the requirements for participating in Voluntary and CallOption economic events. This would allow new Voluntary participants to make more accurate decisions about whether or not they could participate in a Voluntary event, and when they could end their curtailment. This may also help remove any customer barriers to curtailment based upon a misunderstanding of program logistics and thus allow Duke Energy to focus on promoting the Voluntary program based upon its benefits.
        a. Duke Energy's response and any actions taken:
            i. _____
               _____
               _____

    c) RECOMMENDATION: It is not unexpected that PowerShare participants might forget details about the program in between the summer peak event seasons. To

help remind customers, Duke Energy should consider providing customers with a summary sheet that highlights the program's key components, and their company's specific commitment in their agreement. If not already done, Duke Energy should also consider developing a process flow chart that illustrates the sequence of events during an event day, starting with the identification of event conditions, notification of customers, and the different paths to settlement should the customer choose to reduce load, generate, or buy through. This summary sheet could end with a reminder of where customers may find confirmation of their load reduction.

a. Duke Energy's response and any actions taken:
    i. _____
    _____
    _____

d) RECOMMENDATION: If the account managers are not already doing so, Duke Energy should consider following-up with first year PowerShare participants to review their load reduction commitments, whether or not those participants were compliant with the previous season's events. Duke Energy should also consider providing first year participants with the ability to adjust their commitments for the next event season, while their experience of the most recent event season is still fresh in their minds. This will allow these customers to provide feedback to Duke Energy on whether their load reduction commitments were easily achieved, just right, or too onerous. If a new participant has overcommitted and simply cannot deliver on that commitment, Duke Energy should identify them sooner rather than later, and stop paying on premiums on capacity that does not exist.

a. Duke Energy's response and any actions taken:
    i. _____
    _____
    _____

e) RECOMMENDATION: Duke Energy is already aware that the calculation of capacity and incentives may be difficult for customers to understand, and results from these participant surveys confirm that there still is some confusion. If Duke Energy has not already done so, they should consider easily-accessible tools for helping customers understand these calculations. For example, Duke Energy may develop short tutorials on how customers could calculate their capacity, specifying how baselines are calculated and used, and how proformas are calculated and used. While Duke Energy currently does have marketing collateral explaining these processes, they may be difficult for customers to locate if they are embedded in a large document. Short tutorials that are available on the PowerShare website may be more convenient for customers who are trying to access specific information. Alternatively, if Duke Energy account managers are not already doing so, they could consider "showing their work" and leaving customers with documentation showing their company's specific incentive and baseline calculations. There are many other methods Duke Energy may be considering to improve the understanding of these technical issues.

a. Duke Energy's response and any actions taken:

i. _____
_____
_____

f) RECOMMENDATION: Duke Energy should consider ways to reduce customer uncertainty about whether they can actually provide the amount of curtailment they have contracted (for both Mandatory and Voluntary events). Customers may have less uncertainty if they had a plan for curtailment and entered each event with an expectation that they will fulfill their curtailment commitment if they followed the entire plan. Such a plan may include a schedule specifying which pieces of equipment to turn off and which generators to turn on, and how much load would be curtailed with each of these actions if taken in the order specified. This schedule of curtailment would allow Voluntary participants to gauge how long they need to curtail and when they could return to normal operations. While developing such a plan would be the responsibility of the customer, Duke Energy might offer them some technical assistance. Duke Energy should obtain more data from customers on whether technical assistance with developing a curtailment plan and schedule would encourage more customers to participate in PowerShare. This may be accomplished informally by the Duke Energy account managers, or more formally with a telephone survey of customers whose main strategy is curtailment.

a. Duke Energy's response and any actions taken:

i. _____
_____
_____

Appendix B: Participant Survey Protocol

Survey ID _____
Surveyor Name _____

State
( ) North Carolina
( ) South Carolina

Participant Info
Name: _____
Company: _____
Title: _____

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

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

Message for voicemail
Hello, my name is _____ from TecMarket Works. I am calling on behalf of Duke Energy to conduct a customer satisfaction interview about the PowerShare Program. Duke Energy has given us your name as someone who might be able to share some of your experiences with the PowerShare Program. We are an independent evaluation firm and we are not selling anything. We would like to conduct a short interview that will take about 15 minutes. All your answers will be kept confidential. This information will enable Duke to make improvements to the program and the application process.
If you can help, please call me at _____. If there is someone at your company who would be more appropriate for us to speak to, we would appreciate if you could let us know that as well.

OPTIONAL - only If the customer wishes confirmation from Duke.
If you would like to verify this request, please contact your account manager. Or, you can contact ** ****, Manager of Measurement and Verification Ops, at Duke Energy. She can be reached at (***) ***-**** or *****@duke-energy.com.**

IN-1. Would you be able to help us?
( ) Yes
( ) No

(If no)
IN-2. Can you please give me the name of someone else who might be the more appropriate person to tell us about your company's participation in PowerShare?

_____

ESTABLISHING QUESTIONS

ES-1. Would you please tell me what your company does and what your role is in your company? _____

ES-2a. Do you manage more than one site that participates in PowerShare for your company?

( ) Yes
( ) No

If yes,
ES-2b. How many sites?

_____

Most of the questions you will be answering today are about PowerShare in general, but if you manage sites that participate in PowerShare differently from one another, please answer for your company's facility that is listed as ...
[Please fill in facility name from info sheet].

_____

ES-4. In which option(s) did your company enroll?
Please select all that apply.

[ ] Mandatory Curtailment Option
[ ] Voluntary Curtailment Option
[ ] Generator Option
[ ] CallOption

ES-5. How long has your company been participating in the PowerShare ?

_____

INFORMATION-GATHERING PHASE

INFO-1. How did you first become aware of the PowerShare Program?

( ) Duke Energy sent me a brochure
( ) A Duke Energy representative told me about it
( ) Duke Energy website
( ) I saw an ad in: _____

( ) Other: _____
( ) DK/NS

INFO-2. Please tell me how useful that source was in providing the information you needed to decide whether or not to participate. Please rate the usefulness of that source on a scale of 1 to 10, with 1 meaning "Almost nothing I needed", and 10 meaning "Everything I needed".

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

(If INFO-2 was less than 10, ask questions INFO-3a, 3b and 3c)

INFO-3a. Where else did you go to get information?

_____

INFO-3b. What additional information were you seeking?

_____

INFO-3c. Were you able to get the information you needed about the program's participation requirements and benefits?

( ) Yes
( ) No
( ) DK/NS

CALL OPTION

CO-1. I have some questions specifically about the PowerShare CallOption Program. When you were learning about the PowerShare Program, were you also presented with information about the PowerShare CallOption Program?
(CallOption is a combination of emergency and economic events)

( ) Yes
( ) No
( ) DK/NS

CO-2a. Did your company enroll in the CallOption ?

( ) Yes
( ) No
( ) DK/NS

If CO-2a was "No", ask CO-2b and 2c
CO-2b. Can you please tell me why you decided that the CallOption was not right for your company? _____

CO-2c. What can Duke Energy do to make CallOption more attractive to your company?

_____

DECISION MAKING

DM-1. What was the primary reason that you decided to participate in the PowerShare Program?

_____

DM-2. Was there a secondary reason that your company decided to enroll?

_____

PARTICIPATION IN AN EMERGENCY OR ECONOMIC EVENT

EV-1a. How many PowerShare <u>emergency</u> events has your business been asked to respond to in 2012?

( ) 0
( ) 1 or more *(enter number)*: _____
( ) DK/NS
( ) NA

EV-1b. How many PowerShare <u>emergency</u> events has your business been asked to respond to in 2013?

( ) 0
( ) 1 or more *(enter number)*: _____
( ) DK/NS

EV-1c. How many PowerShare <u>emergency</u> events has your business been asked to respond to in 2014 (to date) ?

( ) 0
( ) 1 or more *(enter number)*: _____
( ) DK/NS

EV-2a. How many PowerShare <u>economic</u> events has your business been asked to respond to in 2012?

( ) 0
( ) 1 or more *(enter number)*: _____
( ) DK/NS
( ) NA

EV-2b. How many PowerShare <u>economic</u> events has your business been asked to respond to in 2013?

( ) 0

( ) 1 or more *(enter number)*: _____
( ) DK/NS

EV-2c. How many PowerShare economic events has your business been asked to respond to in 2014 (to date)?
( ) 0
( ) 1 or more *(enter number)*: _____
( ) DK/NS

EV-3. In addition to phone calls, texts, and emails, is there another way in which you would like to be notified of events? _____

EV-3b. For some events, Duke Energy is able to send out a notice a day ahead of the event, to warn of the possibility that an event may occur. Can you please rate how useful it is for you to receive the "day ahead" notices, on a scale of 1 to 10, where 1 means "Useless" and 10 means "Useful".
( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA

EV-3c. Do you have any other feedback for Duke Energy on their event communication efforts?
_____

(If EV-2 was 1 or more)
EV-4a. For the Economic events, did you decide to reduce energy use for every event, or did you decide to decline one or more events?
( ) Yes, I reduced energy for every event.
( ) No, I declined one or more events
( ) DK/NS

[If customer did reduce, EV4a=Yes]
EV-4b. Do you think you would have been able to reduce more? Why or why not?
_____

[If customer declined to reduce, EV4a=No]
EV-4c. Why did you decline to reduce energy usage?
_____

EV-5. What did you need to do at your facility to reduce load?
_____

EV-6a. Was your company successful in reducing load?
( ) Yes
( ) No
( ) DK/NS
( ) NA

If No,
EV-6b. Were there any negative consequences of not reducing enough load?

_____

Note to Interviewer:
When reading answers to EV-7 aloud, if customers answers Yes, immediately ask follow-up "Rarely, Sometimes, Always". Then proceed with EV-7 answers, if appropriate.

EV-7. As you know, Duke Energy provides a forecasted load pattern to you on EPO (Energy Profiler Online) the day before an economic event to help in your decision making process for a Voluntary Event. Do you review that load shape….
(Read choices aloud.)

[ ] **Never, I do not need to review the load shape before making the decision to participate or not.**
[ ] Before participating in a Curtailment Event?
[ ] During or immediately after a Curtailment Event?
[ ] Sometime after a Curtailment Event but before the bill comes?
[ ] After the monthly bill comes?

EV-7b. How often "Before participating in a Curtailment Event"?
( ) Rarely
( ) Sometimes
( ) Always

EV-7c. How often "During or immediately after a Curtailment Event"?
( ) Rarely
( ) Sometimes
( ) Always

EV-7d. How often "Sometime after a Curtailment Event but before the bill comes"?
( ) Rarely
( ) Sometimes
( ) Always

EV-7e. How often "After the monthly bill comes" ?
( ) Rarely
( ) Sometimes
( ) Always

EV-8. Please rate how easy is it for you to use EPO, on a scale of 1 to 10, where 1 means very difficult and 10 means very easy.
( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

(If rating was less than 8)
EV-9. What can be done to make using EPO easier for you?

_____

EV-10. Would you say the targeted level of load reduction you currently have with Duke Energy is ....

( ) **Much less than you can provide**
( ) Less than you can provide
( ) About right for your company
( ) More than you want to provide
( ) Much more than you want to provide
( ) DK/NS

EPA REGULATIONS

GEN-1. Do you turn on any generators as part of your load reduction strategy?

( ) Yes
( ) No
( ) DK/NS

If "Yes"

GEN-2. How has EPA's National Emissions Standards for Hazardous Air Pollutants that came into effect in January of 2013 affected your participation in the PowerShare ? Would you say that...

(Please read choices aloud).

( ) **My company has, or will, retrofit engines and continue participating in Mandatory and/or Voluntary.**
( ) My company will stop participation in Mandatory and/or Voluntary, but continue to participate in the PowerShare Generator option.
( ) My company will stop participation in PowerShare entirely.
( ) Other: _____

IMPROVEMENTS

IMPR-1. While your company was deciding whether or not to enroll, what was the biggest concern about participating in PowerShare?

_____

IMPR-2a. During the past season, did anything happen to decrease your concern?

( ) Yes
( ) No

If YES

IMPR-2b. What happened?

_____

If NO
IMPR-2c. What can Duke Energy do that would decrease your concern?

_____

IMPR-3. How interested would you be in aggregating your accounts together, for PowerShare purposes only, in order to optimize load curtailment strategies across several Duke Energy accounts? This would allow you to reduce a certain kilowatt across several sites, so that you could decide to curtail for one site and not for another, and still provide the agreed-upon load reduction. Would you be:

( ) **Not at all interested**
( ) Slightly interested
( ) Somewhat interested
( ) Very interested
( ) NA

IMPR-4. Is there anything about PowerShare you would say was working exceptionally well? It's fine if there isn't.

_____

IMPR-5. What doesn't work well and why?

_____

SATISFACTION

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

SAT-1. How would you rate your satisfaction with: The ease of applying for the program?

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If rating was less than 8
SAT-1a. How can this be improved?

_____

SAT-2. How would you rate your satisfaction with: The amount of the monthly premium credit provided by the program?

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If rating was less than 8
SAT-2a. How can this be improved?

_____

SAT-3. How would you rate your satisfaction with: The amount of the load reduction credit for the events in which you participated?

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If rating was less than 8
SAT-3a. How can this be improved?

_____

SAT-4. How would you rate your satisfaction with: The time it took for you to receive your load reduction credit?

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If rating was less than 8
SAT-4a. How can this be improved?

_____

SAT-5. How would you rate your satisfaction with: How clear the explanation of the PowerShare incentive structure was?

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If rating was less than 8
SAT-5a. How can this be improved?

_____

SAT-6. How would you rate your satisfaction with: The amount of advance notice you had about the events?

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If rating was less than 8
SAT-6a. How can this be improved?

_____

SAT-7. How would you rate your satisfaction with: The time window in which you were required to reduce your load once you had received notification about the start of the event?

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If rating was less than 8
SAT-7a. How can this be improved?

_____

SAT-8. How would you rate your satisfaction with: Duke Energy's method for confirming how much load you reduced?

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If rating was less than 8
SAT-8a. How can this be improved?

_____

SAT-9. How would you rate your satisfaction with: The technical expertise of Duke Energy staff?

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If rating was less than 8
SAT-9a. How can this be improved?

_____

SAT-10. How would you rate your satisfaction with: The time it took for Duke Energy staff to respond to any questions or address any issues?

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If rating was less than 8
SAT-10a. How can this be improved?

_____

SAT-11. Considering all aspects of the program, how would you rate your overall satisfaction with the PowerShare Program?

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If rating was less than 8
SAT-11a. How can this be improved?

_____

SAT-12. How would you rate your overall satisfaction with Duke Energy?

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If rating was less than 8

SAT-12a. How can this be improved?

_____

SAT-13. Are there any other thoughts or comments you would like to share with Duke management about the PowerShare Program that we have not discussed already?

_____

Thank you for taking this time to share your thoughts! We appreciate it very much.