BEFORE

THE PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of the Annual Energy	)	
Efficiency Portfolio Status Report of	)	Case No.17-689-EL-EEC
Duke Energy Ohio, Inc.	)	

ANNUAL ENERGY EFFICIENCY STATUS REPORT

OF DUKE ENERGY OHIO, INC.

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COMPLIANCE STATUS REPORT

This portfolio status report represents Duke Energy Ohio, Inc.'s, (Duke Energy Ohio) seventh filing of a status report on the load impacts achieved through implementation of its energy efficiency and demand response programs pursuant to Rule 4901:1-39-05 (C), O.A.C. This report is composed of the following two sections: (1) Compliance Benchmarks which provide information on load impact achievements relative to the baseline and (2) Program Performance Assessment which summarizes program activities and evaluation, measurement, and verification information. Following this report are five appendices that fulfill the remaining requirements set forth in the Commission's regulations.

Compliance Benchmarks

4901:1-39-05 (A) and (B) Initial Benchmark Report

Pursuant to Rule 4901:1-39-05 (A), O.A.C., Duke Energy Ohio must file the following information in a benchmark report:

(1) The energy and demand baselines for kilowatt-hour sales and kilowatt demand for the reporting year; including a description of the method of calculating the baseline, with supporting data.

(2) The applicable statutory benchmarks for energy savings and electric utility peak-demand reduction.

In compliance with 4901:1-39-05(B), in preparing the baseline, Duke Energy Ohio is required to adjust the sales and/or demand baseline for normal weather as well as for changes in numbers of customers, sales, and peak demand to the extent such changes are outside its control.

This benchmark update report provides information related to two topics. The first topic involves the baseline for 2016, including a discussion of adjustments made to normalize for weather and to adjust for changes in numbers of customers, sales, and peak demand, where those changes are outside the control of Duke Energy Ohio. The second topic involves an estimate of the statutory benchmarks for energy savings and electric utility peak-demand reduction.

In estimating the baseline for Duke Energy Ohio for the year 2016, the Company uses the three-year average of the actual level of total energy sold and peak demand, adjusted for differences from normal weather. Table 1 provides the historical level of total energy (kWh) and demand (kW) for the years 2006 to 2015, the amount of the weather adjustment, and the weather normalized level of total energy.

Table 1 - Duke Energy Ohio Baseline and Benchmark for 2016

Year	Total Energy (MWh)	Weather Normalization Adjustment (MWh)	Weather Normal Level of Total Energy (MWh)	Baseline: Three Year Average (MWh)	Cumulative Benchmark Percentage	Cumulative Benchmark Requirement (MWh)	Incremental Benchmark Percentage	Incremental Benchmark Requirement (MWh)
2006	22,402,660	262,896	22,665,556					
2007	23,510,777	(763,963)	22,746,814					
2008	22,321,489	(72,401)	22,249,088					
2009	20,405,122	320,494	20,725,616	22,553,819	0.3%	67,661	0.3%	67,661
2010	22,545,823	(621,454)	21,924,369	21,907,173	0.8%	177,197	0.5%	109,536
2011	20,238,172	(207,407)	20,030,765	21,633,024	1.5%	328,628	0.7%	151,431
2012	22,560,245	(15,568)	22,544,678	20,893,583	2.3%	495,777	0.8%	167,149
2013	21,339,163	92,375	21,431,537	21,499,937	3.2%	689,277	0.9%	193,499
2014	21,607,261	173,384	21,780,645	21,335,660	4.2%	902,633	1.0%	213,357
2015	21,318,866	(14,513)	21,304,352	21,918,953	5.2%	1,121,823	1.0%	219,190
2016			**21,615,295**	**21,505,511**	6.2%	1,336,878	**1.0%**	**215,055**

Year	Peak Demand (MW)	Weather Normalization Adjustment (MW)	Weather Normal Level of Peak Demand (MW)	Baseline: Three Year Average (MW)	Cumulative Benchmark Percentage	Cumulative Benchmark Requirement (MW)	Incremental Benchmark Percentage	Incremental Benchmark Requirement (MW)
2006	4,520	71	4,591					
2007	4,607	(279)	4,328					
2008	4,125	337	4,462					
2009	4,002	476	4,478	4,460	1.00%	44.6	1.00%	44.6
2010	4,114	330	4,444	4,423	1.75%	77.8	0.75%	33.2
2011	4,398	(28)	4,370	4,461	2.50%	111.2	0.75%	33.5
2012	4,295	300	4,595	4,431	3.25%	144.5	0.75%	33.2
2013	4,378	76	4,454	4,470	4.00%	178.0	0.75%	33.5
2014	4,330	177	4,508	4,473	4.75%	211.5	0.75%	33.5
2015	4,326	204	4,530	4,519	5.50%	245.4	0.75%	33.9
2016			**4,384**	**4,497**	**6.25%**	**279.2**	**0.75%**	**33.7**

The Company employs the following process to normalize kWh and kW for differences in the weather: Using econometric equations for each customer class, from the load forecast process discussed in the Long-Term Forecast Report filing, the adjustment process for kWh is performed as follows:

Let: KWH(N) = f(W(N))g(E)

KWH(A) = f(W(A))g(E)

Where: KWH(N) = electric sales - normalized

W(N) = weather variables - normal

E = economic variables

KWH(A) = electric sales - actual

W(A) = weather variables – actual

Then: KWH(N) = KWH(A) * f(W(N))g(E)/f(W(A))g(E)

= KWH(A) * f(W(N))/f(W(A))

With this process, weather-normalized sales are computed by scaling actual monthly sales for each class by a factor from the econometric equation that accounts for the impact of deviations from monthly normal weather. Similarly, using an econometric equation for peak, the adjustment process for kW is performed as follows:

Let: KW(N) = f(W(N))g(E)

KW(A) = f(W(A))g(E)

Where: KW(N) = electric peak demand - normalized

W(N) = weather variables - normal

E = economic variable

KW(A) = electric peak demand - actual

W(A) = weather variables - actual

Then: KW(N) = KW(A) * f(W(N))g(E)/f(W(A))g(E)

= KW(A) * f(W(N))/f(W(A))

With this process, weather-normalized peak demand is computed by scaling actual peak demand by a factor from the econometric equation that accounts for the impact of deviations from normal weather.

Once total energy and peak demand have been adjusted for normal weather, the computation of the baseline for 2016 is the arithmetic mean of the historical values for the three years 2013 to 2015. The baseline values for energy and demand are provided above in Table 1.

4901:1-39-05(C)(1)(a)-(c) Portfolio Status Report and Compliance Demonstration

In accordance with 4901:1-39-05(C)(1)(a), with the establishment of the baseline energy and peak demand, the level of the statutory benchmark is computed by applying the appropriate incremental percentage of achievement, as established in Substitute Senate Bill 221 (S.B. 221), to the baseline. The computation of the benchmark achievement level for 2016 is provided above on Table 1. The baseline for energy is 215,055 MWH and the baseline for peak loads is 33.7 MW. While the Company's calculation of the 2016 benchmark requirement is consistent with the requirements established by S.B. 221, the passage of S.B. 310 effectively established a freeze to the benchmarks for 2015 and 2016, and therefore the actual requirement was to simply maintain the cumulative savings that were required at the end of 2014, which was 4.20% and 4.75% for energy efficiency and peak demand respectively. Since the Company's cumulative energy savings and peak demand reduction were above the required amounts, under S.B. 310, the Company's annual benchmarks for 2016 was zero for both energy and peak demand reductions.

Duke Energy Ohio respectfully submits that this information is responsive to all of the baseline and benchmark calculations as set forth in Rule 4901:1-39-05(A), O.A.C., and requests that the Commission approve these baseline and benchmark calculations as submitted.

Pursuant to 4901:1-39-05(C)(1)(b),O.A.C., which requires a comparison of the applicable benchmark of actual energy savings and peak-demand reductions achieved, as a result of the Company's 2016 efforts to promote customer participation in its energy efficiency and demand response programs, the Company has achieved incremental energy and demand impacts in 2016 as summarized below in Table 2.

Details of impacts for each program are provided in **Appendix A.**

Table 2: Incremental Energy Efficiency and Demand Response Program Impact Summary

		Participants / Measures	MWH	MW
Demand Response Programs				
Power Manager				18.6
PowerShare®				(0.5)
Home Energy Solutions - DR				1.3
Total Demand Response Programs				**19.4**
Energy Efficiency Programs				
Residential Programs		833,100	41,906	9.9
Non-Residential Programs		21,527,876	180,191	28.7
Total EE Programs		**22,360,976**	**222,097**	**38.7**
Additional Impacts Under SB310				
T&D Infrastructure - 2013			10,008	
T&D Infrastructure - 2014			60,287	
T&D Infrastructure - 2015			112,467	
T&D Infrastructure - 2016			168,940	
Updated Prior Impacts for SB310 Counting Provisions	2		934,519	120.3
Total Additional Impacts			**1,286,221**	**120.3**
Prior Bank per SB-221	1		419,871	215.1
Total Load Impacts			**1,928,189**	**393.4**

1 - Prior bank adjusted to reflect impact adjustments for 2015 in the amount of 2.6 MW.
2 - For details, see Appendix F.

Table 3 below provides a comparison of the impacts relative to the benchmarks previously mentioned. This indicates that the Company has complied with the S.B. 221 statutory benchmarks for the year 2016.

Table 3: Comparison of Achieved Impacts to the 2016 Benchmark			
	2016 Benchmark	Achievement	Variance Over / (Under)
MWH	215,055	1,928,189	1,713,134
MW	33.7	393.4	359.7

In addition, since the Company's cumulative efforts continue to exceed the cumulative benchmark requirement, there is still a residual amount of load impacts that carry forward to support achievement of the benchmarks for 2017 and beyond.

In compliance with 4901:1-39-05(C)(1)(c), an affidavit indicating that the reported performance complies with the statutory benchmarks is provided in **Appendix B**.

4901:1-39-05(C)(2), O.A.C. Program Performance Assessment

As part of Duke Energy Ohio's Electric Security Plan (ESP) filing in 2008, the Company proposed a set of energy efficiency and demand response programs. These were subsequently approved on December 17, 2008 and reaffirmed (except for the Prepaid Meter Program) in the Commission's Order in Case No. 09-1999-EL-POR. Implementation of the Save-A-Watt programs began January 2009. On July 20, 2011, Duke Energy Ohio submitted an application for a new recovery mechanism to replace Save-A-Watt that was due to expire on December 31, 2011. In Case No. 11-4393-EL-RDR, Duke Energy Ohio proposed a recovery mechanism as well as three new programs. The recovery mechanism and programs were approved on August 15, 2012. In compliance with the Commission's Order, after reviewing the market potential study conducted by Forefront Economics Inc., Duke Energy Ohio filed its three-year portfolio plan for 2014-2016 with the Commission on April 15, 2013. The Commission approved the new portfolio proposed by the Company in its Opinion and Order in Case No. 13-0431-EL-POR on December 4, 2013. In June 2016, Duke Energy Ohio filed a new three-year portfolio plan for 2017 – 2019. This portfolio application was amended and resubmitted with updates on October 14, 2016. The Company is currently awaiting approval of the plan and is continuing to operate under the 2016 portfolio until the Company receives an Opinion and Order in the case, Case No. 16-0576-EL-POR.

Program Performance Assessment

Program descriptions and key activities for its current portfolio are provided below.

4901:1-39-05 (C)(2)(a)(i), O.A.C. Program Descriptions and Key Activities

Residential Programs

Smart $aver® Residential Program

The Smart $aver® Residential program offers a variety of programs and measures that allow customers to take action and reduce energy consumption. The program is available to residential customers served by Duke Energy Ohio.

Free LED Program

Replacing the Free CFL Program, the Free LED Program is designed to increase the energy efficiency of residential customers by offering customers LEDs to install in high-use fixtures within their homes. The LEDs are offered through an on-demand ordering platform, enabling eligible customers to request LEDs and have them shipped directly to their homes. Eligibility is based on past campaign participation (i.e. coupons, Business Reply Cards (BRCs) and other Duke Energy Ohio programs distributing free bulbs). Bulbs are available in 3, 6, 8, 12 and 15 pack kits that contain 9-watt bulbs that are the equivalent a 60-watt incandescent. The maximum number of bulbs available for each customer is 15, but customers may choose to order less.

Customers have the flexibility to order and track their shipment through three separate channels:

1) Telephone:

   Customers may call a toll-free number to access the Interactive Voice Response (IVR) system which provides prompts to facilitate the ordering process. Both English and Spanish-speaking customers may easily validate their account, determine their eligibility and place their LED order over the phone.

2) Duke Energy Web Site:

   Customers can go online to complete the ordering process. Eligibility rules and frequently asked questions are also available.

3) Online Services (OLS):

   Customers who participate in the Online Services program are encouraged to order their LEDs through the Duke Energy Ohio web site if they are eligible.

The benefits of providing these three distinct channels include:

- Improved customer experience
- Advanced inventory management
- Simplified program coordination
- Enhanced reporting
- Increased program participation
- Reduced program costs

Customers continue to utilize the simple ordering process and the convenience of bulbs being shipped directly to their home. Over 48,000 orders were placed in 2016; resulting in over 280,000 bulbs distributed.

The overall strategy of the program is to reach residential customers who have not adopted LED bulbs. Duke Energy Ohio will continue to educate customers on the benefits of LEDs while addressing barriers for consumers who have not participated in the program. Additionally, the ease of program participation will also be highlighted to encourage use of the on-demand ordering platform.

In regards to marketing, the Free LED program utilized a BRC (Business Reply Card) to engage with customers. The Duke Energy website contains pages explaining the program and portal through which the customer can check their eligibility and order free bulbs. Duke Energy also uses intercepts for customers calling or accessing their account online that informs them if they are eligible for the program and allows them to order. Duke Energy Ohio will continue to market the LED program through various channels including email and direct mail. Response of each channel is tracked and monitored. Cross-promotion with the online Savings Store will also be utilized to help offer lighting for specialty applications and promote LED technology to customers who are eligible for both lighting programs.

Free LED Program Potential Changes

Upon approval of the 2017 portfolio, Duke Energy Ohio's Free LED Program will offer customers who have previously participated in the CFL program and have bulbs that have matured past their 5 year measure life, the ability to participate in the program and order up to 12 LEDs.

Online Savings Store

Duke Energy Ohio expanded its lighting offer to include specialty bulbs such as recessed lights, candelabras, globe, three-way bulbs, capsules and dimmable bulbs. Purchase limits vary by category but customers may purchase additional bulbs without incentives if they choose. The web based ecommerce store provides discounted specialty lights and ships directly to the home.

Utilizing the existing on-demand CFL platform, customers may participate in the online Saving Store via:

1) Duke Energy Web Site

   Customers may go to the Savings Store landing page to learn more about the program, review frequently asked questions and CFL recycling information.

2) Online Services (OLS)

   Customers who participate in the Online Services program are encouraged to visit the Savings Store to order discounted CFL and LED bulbs through the Duke Energy Ohio web site if they are eligible.

3) Order by Phone

   Duke Energy offers phone ordering as an option for customers to order bulbs from the Duke Energy Savings Store. Customers may call the vendor directly for assistance in placing orders for discounted lighting.

4) Mail in Order

   In October of 2015, Duke Energy tested a mail in order offer to customers. Customers receive a direct mail piece allowing them to choose specialty bulbs and mail their order and payment directly to the vendor, EFI. This channel will continue to be offered periodically with special marketing campaigns.

Customers who choose to shop at the Savings Store will see a wide variety of discounted CFL and LED bulbs for different fixtures around their home. Bulbs are available in single and multi-pack sizes and various wattages. A shopping assistant is available to help customers select the right bulb types for various applications, as well as resources to understand the difference between lumens versus watts and how to compare them.

The Savings Store is managed by Energy Federations Incorporated (EFI). Customers can view special promotions and feature products as well as track order history. EFI handles inquiries regarding products, payments, shipping and warranties.

Over 11,000 orders were placed in 2016; resulting in over 152,700 bulbs purchased. Twenty three percent of orders were placed through OLS and seventy seven percent of orders were placed through the Duke Energy Ohio web site. The top five categories purchased on the Savings Store include; LED Reflectors, LED Decorative, LED Globes, LED General Purpose, and LED 3 Way bulbs.

Duke Energy Ohio will market the online Savings Store program through various channels including Email, Bill Messages, Bill Envelopes, Social Media, Direct Mail, Printed Collateral, Earned Media, and other Duke Energy Program collaboration efforts. Response of each channel is tracked and monitored. Special shipping promotions including $5 flat rate shipping and free shipping were offered in 2016 as incentives to improve participation.

Savings Store Program Potential Changes

Savings Store enhancements considered for 2017 include; additional shipping and discount options, product comparison, dynamic savings information, support for additional payment methods and improved customer experience and communication.

General Lighting Program Potential Changes

The Company continually evaluates the effectiveness of its overall lighting program to consider the addition of new delivery channels, in order to capture the potential customers who may not be prone to utilize the existing channels. In 2017, the lighting program management team is considering the addition of a retail channel to provide incentives to its customers to purchase LEDs and other specialty bulbs.

Multifamily Energy Efficiency Program

The Multifamily Energy Efficiency Program is an extension of the CFL program and allows Duke Energy Ohio to target multifamily apartment complexes. Eligible units are Duke Energy Ohio served apartments on a residential rate and are located at properties that have four or more units. Franklin Energy is the program administrator. Franklin Energy is in charge of all aspects of the program which include outreach, direct installations and customer care.

The program helps property managers upgrade lighting with energy efficient 13 watt CFLs and also save energy by offering water measures such as bath and kitchen faucet aerators, water saving showerheads and pipe wrap. The water measures are available to eligible customers with electric water heating. The Program adopts a tiered structure to determine the number of lighting measures installed in apartments. Franklin Energy may install up to 12 bulbs in a one bedroom apartment, up to 15 bulbs in a two bedroom apartment and up to 18 bulbs in a three bedroom apartment. These measures assist with reducing maintenance costs while improving tenant satisfaction by lowering energy bills.

The program offers properties the option of DI (direct install) service by Franklin Energy crews. However, Property Managers also have the ability to have their own property maintenance crews complete the installations, upon request.

The CFLs and water measures are installed during scheduled direct install visits by Franklin Energy crews or routine maintenance visits by property personnel. In the case of direct installs, crews carry tablets to keep track of what is installed in each apartment. In the case of installations that are self-installed, the property maintenance crew tracks the number of measures installed and reports them back to Franklin Energy. Franklin Energy then validates this information and uploads the results to Duke Energy.

After installations are completed, Quality Assurance (QA) inspections are conducted on 20% of properties that completed installations in a given month. The QA inspections are conducted by an independent third party.

Franklin Energy uses outbound calling as the primary tactic to solicit initial interest in the program from property managers in Duke Energy Ohio. On-site visits by appointment are also used as a way to attract properties to participate in the program.

In addition to proactively marketing the program using the above methods, a Multifamily Energy Efficiency promo and public website landing page was developed for managers to learn more about the program. Here, a program brochure and a frequently asked question sheet are available for download. Once enrolled, Franklin Energy provides property managers with a variety of marketing tools to create awareness of the program to their tenants. This includes letters to each tenant informing them of what is being installed and when the installation will take place. In addition, tenants are provided an educational leave-behind brochure when the installation is complete. This provides additional detail on the installed measures as well as tear-off customer satisfaction survey to fill out and mail back to Duke Energy to provide valuable program feedback.

Overall in 2016, the Program completed installation at 14 multifamily properties in Ohio comprising of just over 1,200 units. From a measure perspective, these units accounted for 5,936 CFLs, 755 bath aerators, 489 kitchen aerators, 621 showerheads and 765 FT of pipe wrap.

Multifamily Energy Efficiency Program- Potential Changes

The only change to this program being considered at this time is to transition from CFLs to LEDs. This change is currently being reviewed on many levels internally at Duke Energy and from a regulatory standpoint with the hope to begin offering in early to mid 2017, upon approval.

Save Energy and Water Kit Program (SEWKP)

The Save Energy and Water Kit Program was launched in April of 2014 and is designed to increase the energy efficiency of residential customers by offering customers Low Flow Water Fixtures and Insulated Pipe Tape to install in high-use fixtures within their homes. These energy saving devices are offered through a Direct Mail Campaign, enabling eligible customers to request to have these devices shipped directly to their homes, free of charge. Eligibility is based on past campaign participation (including this program and any other programs offering low flow devices that Duke Energy has offered to Ohio customers) and the customer must have an electric water heater. Customers receive a kit with varying amounts of the following devices: low flow bath and kitchen aerators, low flow shower heads and insulated pipe tape. The kit also includes directions and items to help with installation.

Over 1,700 kits were shipped to Ohio customers in 2016; resulting in over 6,485 bath aerators, 1,791 kitchen aerators, 3,297 shower heads and 8,955 feet of insulated pipe wrap being distributed.

The overall strategy of the program is to reach residential customers who have not adopted low flow water devices and hot water pipe insulation. Duke Energy Ohio will continue to educate customers on the benefits of using low flow water devices and saving the energy used to heat water, while addressing barriers for consumers who have not participated in the program.

Duke Energy Ohio will continue to market the program through Direct Mail and the response will continue to be tracked and monitored.

Save Energy and Water Kit Program Potential Changes

Innovative marketing campaigns and tactics will be utilized to improve awareness for hard to reach and late adopter[1] customers. An Online platform for the program will be pursued in 2017 to allow customers to choose a style and finish for their energy efficient showerheads.

Heat Pump Water Heater Program

The Heat Pump Water Heater Program was initially launched in August of 2014 and is designed to encourage the adoption of energy efficient water heating in new or existing residences. Duke Energy Ohio served homeowners currently residing in or building a single family residence, condominium, or duplex home, with electric water heating, are eligible for this program. Installation of a high efficiency heat pump water heater will result in a $350 incentive. Duke Energy program personnel establish relationships with home builders, plumbing contractors, and national home improvement retailers who interface directly with residential customers. All incentives are paid directly to customers upon approval of a completed application.

During 2016, program personnel focused on developing the contractor network, along with consumer awareness and education. A training workshop for plumbers was conducted to

[1] Customers who are slow to start using or buying a new product, technology, or idea.

recruit and educate contractors on the technology and energy-saving benefits. In addition, customer awareness campaigns included direct mail and targeted email leveraging Energy Star's promotional awareness month, bill inserts, product page on Duke Energy website, and in-store signage at home improvement retailers. While heat pump water heaters are a proven technology, adoption, and therefore market share, represents only approximately 2% of overall water heater sales.

Heat pump water heaters are one of the most efficient technologies for domestic water heating introduced in the last decade, providing an energy and cost savings of up to 50 percent for the typical family over the life of the unit. Duke Energy Ohio will continue to educate customers on the benefits of heat pump water heaters, while addressing barriers for consumers who have not participated in the program.

Variable-Speed Pool Pump Program

The Variable-Speed Pool Pump Program was initially launched in August of 2014 and is designed to encourage the adoption of energy efficient, variable-speed pool pumps for the main filtration of in-ground residential swimming pools. Duke Energy Ohio served homeowners currently residing in, or building, a single family residence with an in-ground swimming pool are eligible for this program. Installation of a high efficiency, variable-speed pool pump will result in a $300 incentive. Duke Energy program personnel establish relationships with home builders and pool professionals who interface directly with residential customers. All incentives are paid directly to customers upon approval of a completed application.

During 2016, program personnel focused on developing the contractor network, along with consumer awareness and education. A training workshop for pool professionals was conducted to recruit and educate contractors on the program and energy-saving benefits. The program has 20 actively registered participating contractors. In addition, customer awareness campaigns included direct mail, targeted email, bill inserts, product page on Duke Energy website, and in-store signage. The Program processed 115 customer rebates during 2016. Duke Energy Ohio will continue to educate customers on the benefits of variable-speed pool pumps through awareness campaigns and in-store signage to promote program adoption during 2017.

Residential Heating, Ventilation and Air Conditioning (HVAC) Program

Duke Energy Ohio served homeowners currently residing in, or building, a single family residence, condominium, duplex or mobile home are eligible for this program. Installation of a high efficiency heat pump or air conditioner will result in a $300 incentive. Blackhawk Engagement Solutions serves as the back office support for the program while Duke Energy program personnel establish relationships with home builders and HVAC contractors who interface directly with residential customers. These trade allies adhere to program requirements and submit the incentive application on behalf of the customer. Once the application is processed, incentives are disbursed. For replacement of an existing system, a Duke Energy Ohio customer receives $200 and the HVAC contractor receives the remaining $100. For new home construction, the home builder receives the full $300 incentive but has the option to pass the incentive on to the customer. For the additional complimentary measures offered through the HVAC program, eligible customers will receive a $50 incentive for tuning up a heat pump or air conditioner, $250 for the installation of attic insulation and completion of air sealing, $75 for the installation of duct insulation, and $100 for the completion of duct sealing. All incentives for these complimentary measures are paid directly to customers upon approval of a completed application.

Duke Energy Ohio has formed strong relationships with trade allies and continues to develop relationships with trades serving the new measures. These partnerships help application fulfillment and prompt payment of incentives as well as maintain top-of-mind awareness of the program and its benefits. The buy-in and participation of the trade ally network is vital to the success of the HVAC segment of the Program. During 2016 over 3,200 HVAC incentives, and 115 complimentary measures were processed for Duke Energy Ohio customers through a network of over 120 active trade ally companies.

Residential HVAC Program Updates

Duke Energy Ohio is continuously evaluating new ways to improve relationships with trade allies and customers while making the program both more cost effective and user friendly. In November 2015 the Program transitioned vendors moving from GoodCents to Blackhawk Engagement Solutions to provide the back office administration, application processing and call center support for the program. With this transition, a new platform was introduced and fully implemented during 2016 that offers our trade allies additional value and easier use of the rebate program while allowing Duke Energy Ohio to enhance the customer experience. Functionality of the IT platform includes program tools such as the trade ally portal which allows trade allies to register, submit applications online, a mobile application, check customer eligibility, and message boards. Functionality for program personnel includes trade ally management process and performance dashboards, company scorecards and registration management.

Due to federal increases in HVAC efficiency standards, Duke Energy Ohio updated the heat pump measure effective in April 2016 to raise the minimum equipment eligibility for the rebate incentive from a SEER 14 to a SEER 15. Other potential program changes that will be evaluated in the coming year may include refinement of program field requirements, improved trade ally tools and network management strategies, and distribution channels. Duke Energy Ohio will make changes in these areas when it is determined that the change will benefit customers and increase program value to the market and within the regulatory parameters set forth.

Residential Energy Assessments Program

The Residential Energy Assessments program currently consists of one assessment, the Home Energy House Call (HEHC). HEHC targets residential customers that own a single family home with at least four months of billing history. HEHC is a free in-home assessment designed to help customers reduce energy usage and save money. Duke Energy Ohio partners with several key vendors to administer the program in which an energy specialist completes a 60 to 90 minute walk through assessment of the home and analyzes energy usage to identify energy saving opportunities. The Building Performance Institute (BPI) certified energy specialist discusses behavioral and equipment modifications that can save energy and money with the customer. A customized report is provided to the customer that identifies actions the customer can take to increase their home efficiency. Example recommendations might include the following:

- Turning off vampire load equipment when not in use
- Turning off lights when not in the room
- Using energy efficient lighting in light fixtures
- Using a programmable thermostat to better manage heating and cooling usage
- Replacing older equipment/appliances
- Adding insulation and sealing the home

Customers receive an Energy Efficiency Starter Kit with a variety of measures that can be directly installed by the energy specialist. The kit includes measures such as energy efficient lighting, energy efficient showerhead, low flow faucet aerators, outlet/switch gaskets, weather stripping and energy saving tips booklet.

The Duke Energy Ohio Residential Energy Assessment Program conducted 2,147 assessments in 2016 and installed 5,007 additional LEDs. The program manager continues to explore enhancements to the program as well as test and consider new marketing channels to increase participation.

HEHC Program Potential Changes

- Explore upgrading kits to include chrome showerheads in 2017.
- Explore pilot to include Home Energy Score in partnership with the Greater Cincinnati Energy Alliance and Department of Energy.

Energy Efficiency Education Program for Schools

The Energy Efficiency Education Program for Schools Program is an energy conservation program available in Ohio. The Energy Efficiency Education Program is available to K-12 students enrolled in public and private schools and who reside in households served by Duke Energy Ohio.

The Program provides principals and teachers with an innovative curriculum that educates students about energy, electricity, ways energy is wasted and how to use our resources wisely. The centerpiece of the curriculum is a live interactive theatrical production delivered by two professional actors to students in kindergarten through eighth grade. Performances differ for elementary and middle school students. Teachers also received educational materials focused on concepts such as energy, renewable fuels, and energy efficiency for classroom and student take home assignments. All workbooks, assignments and activities meet state curriculum requirements.

School principals are the main point of contact and will schedule the performance at their convenience for the entire school. Once the principal has confirmed the performance date and time, two weeks prior to the performance, all materials are delivered to the principal's attention for distribution. Materials include school posters, teacher guides, classroom and family activity books.

Students are encouraged to complete a home energy survey with their family (found in their activity book), so they can receive an Energy Efficiency Starter Kit. The kit contains specific energy efficiency measures to reduce home energy consumption. It is available at no cost to all student households at participating schools, including customers and non-customers.

Since 2011, The National Theatre for Children has partnered with Duke Energy Ohio to engage students in the Ohio service territory on energy and energy efficiency through live theatrical performances. For the 2016-2017 school year, two new productions were launched. Elementary schools will save the day with Nikki Neutron in *The Conservation Caper*. In this 25-minute educational play, Nikki takes on a villain bent on wasting energy and shows students how we all can do our part to conserve. *Energy Agents* is a 40-minute program that engages Middle School students with a series of comedy sketches using improvisation and audience participation to teach students about green living.

From January through December 2016, there were 232 participating schools hosting 413 performances to reach over 64,800 students.

Duke Energy Ohio continues to enhance the program by:

- Leveraging the program webpage at duke-energy.com to showcase the program and bring awareness to employees and other stakeholders
- Partnering with Duke Energy Account and District Managers to leverage existing relationships in the community and develop positive communications
- Offering school, classroom and family contests for kit sign ups to create additional excitement in the schools and classrooms throughout the school year
- Utilizing social media to encourage awareness and participation
- Offering teacher satisfaction survey evaluations after the performances for both the elementary and middle school shows. Average survey data from 2016 indicated 93% of the teacher surveys had very high satisfaction ratings.

Now in its sixth year, the Program has effectively increased school participation. School outreach has focused on non-participating schools by making in person visits to the schools, which resulted in new schools participating. Enhanced communications before and after the performances throughout the year have encouraged participation. Additionally, after the performances, some classrooms in grades 3-5 receive follow up visits by actors in the classroom to reinforce the educational points from the curriculum and to encourage kit sign ups with the students and teachers.

The Program is reviewing how to enhance the offering by providing an alternative kit for student households that have already received the current Energy Efficiency Starter Kit. This will improve customer satisfaction and provide additional energy savings for those customers that would otherwise have been excluded from the kit offering but want to participate in energy saving measures.

Low Income Services Program

The Low Income Services Program provides assistance to low income customers by providing funding for energy efficiency measures. The upfront costs of high efficiency equipment are an especially difficult barrier for low income customers to overcome. The Weatherization and Refrigerator Replacement program is available to all customers within Duke Energy Ohio's service territory, with a household income up to 200% of the federal poverty level and who have not participated in the program within the past 10 years.

The Electric Maintenance Service program is available for low-income elderly and disabled customers up to 175% of poverty level. This program offers low-cost solutions for energy efficiency. Customers may receive energy efficiency products and services such as energy efficient lighting, water saving showerheads and aerators, water heater wraps, HVAC cleaning, HVAC filters, and energy efficiency education.

The Electric Pilot program is offered to customers residing in the Duke Energy Ohio service territory. The program is offered through a partnership with People Working Cooperatively (PWC). The program targets low income customers and focuses on energy efficiency. Customers receive whole-house weatherization services which include installation of energy efficiency measures and education. Duke Energy Ohio will purchase and recognize the energy and demand savings achieved through the whole-home weatherization in the Duke Energy Ohio service territory that are currently funded by leveraged funds, funding from sources other than Duke that are not explicitly tied to efficiency. The pilot is intended to allow the Company to recognize efficiency impacts that were previously unrecognized, achieve these impacts in a cost-effective manner, and create a new funding stream for additional whole-home weatherization to be performed in the Duke Energy Ohio Service Territory. The pilot will continued through 2016 and will become a commercialized program in 2017 upon Commission approval.

These programs are promoted through, but not limited to, Community Action Agencies, Non-Governmental Organizations (NGO's), and direct mail to customers.

Duke Energy Ohio partnered with Ohio Partners for Affordable Energy (OPAE) to provide refrigerator testing and replacement services within Duke Energy's Ohio service territory. The program launched January 1, 2014. OPAE worked with local agencies to provide additional marketing techniques to help drive participation. Due to the lack of administrative funds available to operate this program, the program did not operate in 2016; however refrigerator replacements were included in the electric pilot program with PWC.

<u>My Home Energy Report (formerly called Home Energy Comparison Report)</u>

My Home Energy Report (MyHER) is a periodic comparative usage report that compares a customer's energy use to similar residences in the same geographical area based upon the age, size and heating source of the home. Specific energy saving recommendations are included in the report to encourage energy saving behavior.

The reports are distributed up to 12 times per year (delivery may be interrupted during the off-peak energy usage months in the fall and spring). The report delivers energy savings by encouraging customers to alter their energy use. The monthly and annual energy usage of each home is compared to the average home (top 50%) in their area as well as the efficient home (top 25%). Suggested energy efficiency improvements given the usage profile for that home are also provided. In addition, measure-specific offers, rebates or audit follow-ups from other Company offered programs are offered to customers, based on the customer's energy profile.

Target customers reside in individually-metered, single-family residences with active account and 12 months of usage history. Analyzing only single-family residences eliminates the possibility of erroneous data caused by thermal transfer between adjacent units in multi-family structures.

MyHER customers also have access to the Interactive portal which was made available in March 2015. The portal allows customers to see how they use energy, set and track energy saving goals, interact with calculators and ask an expert for advice. The portal also includes weekly email challenges. The portal was promoted on the paper report as well as email campaigns.

The Company has developed a report for customers living in multifamily dwellings that was ready for implementation in December 2016. This program is part of the new portfolio filed by the Company. Eligible customers living in multifamily dwellings with the appropriate amount of usage history as well as a registered email address on file with the Company will receive four printed reports and eight electronic reports delivered throughout the year.

Low Income Neighborhood Program

The Low Income Neighborhood Program ("Program"), officially known as the Neighborhood Energy Saver (NES) Program assists low-income customers in reducing energy costs through energy education and installation of energy efficient measures to qualified customers. The primary goal of this Program is to empower low income customers to better manage their energy usage.

Duke Energy Ohio transitioned from GoodCents to Honeywell starting January of 2016 to administer the Program. The Program targets neighborhoods with a significant low income customer base using a grassroots marketing approach to interact on an individual customer basis and gain trust. Participation is driven through a neighborhood kick-off event that includes community leaders supporting the benefits of the Program. The purpose of the kick-off event is to rally the neighborhood around energy efficiency and provide thorough and pertinent information on how the program will operate in their neighborhood. Customers will have the option to sign-up for an energy assessment at the time of the event.

In addition to the kick-off event, Honeywell/Duke Energy uses the following channels to inform potential customers about the Program:

- Direct mail
- Door hangers
- Press releases
- Community presentations and partnerships
- Inclusion in community publications such as newsletters, etc.

Customers participating in the Program receive an energy assessment to identify energy efficiency opportunities in their home and one-on-one education on energy efficiency techniques. Additionally, the customer receives a comprehensive package of up to sixteen energy efficient measures, installed by professionally trained technicians. Measures received are based on each home's individual walk-through assessment. For customers receiving furnace filters as part of their comprehensive kit, they will be provided a year's supply, including the initial installation.

The Program is available only to individually-metered residential customers in neighborhoods selected by Duke Energy Ohio, at its sole discretion, which are considered low-income based on third party data, which includes income level and household size. Areas targeted for participation in this Program will have approximately 50% of the households at an income equal to or less than 200% of the federal poverty level as established by the Department of Energy.

The program launched in the second quarter of 2013. In 2016, a total of 1,315 homes were serviced through the program.

Low Income Neighborhood Program Potential Changes

The Program will be transitioning to LEDs upon approval in 2017.

Home Energy Solutions (formerly called Home Energy Management) Program

Home Energy Solutions (HES), which was formally marketed as HōM™ Energy Manager, provided customers with up to 2 free Wi-Fi enabled, programmable thermostats with professional installation. Participants also received access to an online customer engagement portal that was accessible through mobile devices, tablets and PCs with Internet access. The portal allowed customers to control their energy usage by adjusting their temperature settings, viewing energy efficiency tips and reviewing their historical energy usage compared to similar homes and neighbors.

Customers also selected from one of three demand response cycling levels: 50%, 75% and 100%. Based on the level selected, there was an annual fee assessed per thermostat install:

- 50%, $5.99
- 75%, $2.99
- 100%, $0.00

HES marketing efforts focused on eligible Duke Energy Ohio residential customers that own and reside in a single family home. Additional eligibility requirements included customers with:

- Central A/C
- Secure wireless broadband Internet connection
- Certified smart meter
- Acceptable/Good/New credit status
- Residential rate

<u>Home Energy Solutions Program Changes</u>

Based on the recent impact evaluation and the impacts to cost-effectiveness of offering the program, the HōM Energy Manager program will be discontinued. Proactive marketing of the program stopped in May, 2016. Enrollments and installations of thermostats stopped in June, 2016. Enrolled customers participated in demand response events through September, 2016. On October 1, 2016, Duke Energy Ohio communicated to participants that the program was ending and that access to the online portal would be closed on October 23, 2016. Participants may keep the thermostat and their temperature settings will be saved to the thermostat automatically when the online portal is closed. Participants were provided with information on how to access a revised thermostat manual that provides instructions on how to use the programmable thermostat features. The Company plans to evaluate other program designs in the future to meet customers' needs and capture the potential targeted savings.

<u>Power Manager® Program</u>

The Power Manager Program provides incentives to residential consumers who allow the company to turn their air conditioner's outdoor compressor and fan on or off during peak energy periods between May and September. Participating customers of the Company who have a functioning outdoor A/C unit are eligible for the program.

Participants in the Power Manager program allow Duke Energy Ohio to control their air conditioners during peak summer demand periods. Customers receive a one-time enrollment incentive of $25 or $35 depending on the Power Manager option they choose. In addition, they receive credits each month of the Power Manager event season. Customers receive a total seasonal minimal credit amount of $5 or $8 depending on the option they enrolled in. The $5 minimal event season credit is paid out as $1 per month during event season (May – September) and the $8 minimal event season credit is paid out as $1.60 per month during event season (May – September). Any additional credits are paid on the customer's October bill.

The Power Manager program manager evaluates conditions to activate a Power Manager event including temperature, heat index, humidity and market conditions as communicated by the regional transmission organization, PJM. In 2016 Duke Energy Ohio activated the Power Manager program on 7 separate occasions (4 times in July, 2 times in August and 1 time in September) in addition to the required 1 hour PJM test on September 1, 2016. In all the 7 events totaled 13 hours of reduced demand and helped Duke Energy Ohio meet peak summertime demand needs and contribute to the stability of the electric grid.

The Power Manager program was successfully promoted in 2016 through outbound calling and targeted email offers along with the company website. The annual net number of Duke Energy Power Manager participants increased by 913 in 2016. Marketing efforts yielded approximately 2,000 new participants in 2016. Approximately 1,100 participants requested to have their switch removed. All device installations and removals on customers' AC units were completed by a third party vendor.

Power Manager Program Potential Changes

Duke Energy Ohio filed to add water heater control to Power Manager in 2017 and create a separate program focused on demand response in Residential Apartment units. The Company is waiting for approval for the two proposed programs.

Non-Residential Programs

Smart $aver® Non-Residential Prescriptive Program

The Smart $aver® Non-residential Prescriptive Incentive Program provides incentives to commercial and industrial consumers to install energy efficient equipment in applications involving new construction, retrofit, and replacement of failed equipment. The program also uses incentives to encourage maintenance of existing equipment in order to reduce energy usage. Incentives are provided based on Duke Energy Ohio's cost effectiveness modeling to assure cost effectiveness over the life of the measure.

Commercial and industrial consumers can have significant energy consumption, but may lack knowledge and understanding of the benefits of high efficiency alternatives. Duke Energy Ohio's program provides financial incentives to customers to reduce the cost differential between standard and high efficiency equipment, offer a quicker return on investment, save money on customers' utility bills that can be reinvested in their business, and foster a cleaner environment. In addition, the Program encourages dealers and distributors (or market providers) to stock and provide these high efficiency alternatives to meet increasing demand for the products.

The program promotes prescriptive incentives for the following technologies – lighting, HVAC, pumps, variable frequency drives, food services, process equipment, and information technology equipment. Equipment and incentives are predefined based on current market assumptions and Duke Energy's engineering analysis. The eligible measures, incentives and requirements for both equipment and customer eligibility are listed in the applications posted on Duke Energy's website.

All non-residential customers served by Duke Energy and pay the EE rider in Ohio are eligible for the Smart $aver® program.

The program has developed multiple approaches to reaching the very broad and diverse audience of business customers. In 2016 this consisted of incentive payment applications, with paper and online options, and instant incentives offered through the midstream marketing channel and the Online Energy Savings Store. The 2016 results improved upon 2015 due to several key factors:

- LED fixture and lamp measures that were added in late 2015 saw a huge response in 2016
- New online application provided a new, easier way to apply
- Midstream marketing channel added a new tool to submit reimbursement claims, which attracted more distributors to the program
- Outreach expanded the number of Trade Allies working with the program
- Targeted marketing reached out to customers and Trade Allies
- Customer service improved with a dedicated team of representatives answering customer questions via phone and email
- Business energy advisors provided medium businesses with personalized relationships to identify and support new EE projects

Paper and Online Applications

During 2016, 1,914 applications, consisting of 4,733 measures, were paid for Duke Energy Ohio prescriptive incentives. Application activity last year was 50% higher than in 2015. During 2016, 43% of applications were submitted via the new online application portal. Similar application increases have been seen in Duke Energy's other jurisdictions. Much of this increase has been attributed to the new high efficiency LED lighting measures that were added to the program at the end of 2015. The average payment per paid application was $7,581.

Many Trade Allies participating in the application process reduce the customer's invoice by the amount of the Smart $aver® Prescriptive incentive and then receive reimbursement from Duke Energy. Customers often prefer this rather than paying the full equipment cost upfront and receiving an incentive check from Duke Energy. More information is provided on the next page, as to how the program engages with Trade Allies.

As of 1/1/2016, the program applications are no longer administered by a third party. Duke Energy has developed an internal database that allows the program to self-administer and analyze program data more efficiently for better performance.

Midstream Marketing Channel

The midstream marketing channel provides instant incentives to eligible customers at a participating distributor's point of purchase. Approved midstream distributors validate eligible customers and selected lighting, HVAC, food service and IT products through an online portal, and use that information to show customers the incentive-reduced price of high efficiency equipment. Upon purchase, the distributor reduces the customer's invoice for eligible equipment by the amount of the Smart $aver® Prescriptive incentive. Distributors then provide the sales information to Duke Energy electronically for reimbursement. The incentives offered through the midstream channel are consistent with current program incentive levels.

In 2016, Duke Energy launched major improvements to this marketing channel by partnering with the third-party Energy Solutions. Energy Solutions provides the online portal for distributors to manage the paperless validation and incentive application, which is expected to help this channel grow significantly. In 2016, approximately 16% of the Smart $aver impacts were from participation through the midstream marketing channel. Duke Energy currently has 85 distributors signed up for the midstream channel, and an additional six that are in the process of joining. Duke Energy continues to work to add more well-known distributors to this channel. Duke Energy expects this channel to continue increasing participation in the Smart $aver® Prescriptive program.

Online Energy Savings Store

Duke Energy Ohio also offers the Business Savings Store on the Duke Energy website, with orders fulfilled by the third-party EFI. The site provides customers the opportunity to take advantage of a limited number of incentive measures by purchasing qualified products from an on-line store and receiving an instant incentive that reduces the purchase price of the product. In 2016, the Savings Store had 119 unique customers; 80% of which were repeat customers. The incentives offered in the store are consistent with current program incentive levels.

Trade Ally Management

Over the years, the program has worked closely with Trade Allies (TA) to promote the program to our business customers at the critical point in time when customers are considering standard or high efficiency equipment options. Currently, there are 888 energy-efficiency equipment vendors, contractors, engineers, architects and energy services providers who are based in Ohio and registered as a TA with the Smart $aver® Non-residential programs (prescriptive and custom). The Smart $aver® outreach team builds and maintains relationships with TAs associated with the technologies in and around Duke Energy's service territory. Existing relationships continue to be cultivated while recruitment of new TAs also remains a focus. Duke Energy's efforts to engage TAs include the following activities:

- Trade Ally Search tool located on the Smart $aver® website
- Trade Ally co-marketing including information about the Smart $aver program in the TA's marketing efforts
- Online application portal training and support
- Midstream channel support
- Trade Ally year-end awards
- Trade Ally newsletter and monthly emails
- Technology- and segment-specific marketing collateral
- Trade Ally discussion group (20 trade allies that give input on program)
- Trade Ally training
- Sponsorship of trade ally events
- Online collateral toolkit for access to marketing materials

In 2016, a number of Trade Allies joined the program that specifically target traditionally hard to reach small business customers. There were challenges with a subset of the new TAs, those that had previous experience with other utilities that have different program rules and expectations of conduct. The TA outreach team continues to diligently educate these TAs on the expectations of the Smart $aver® program.

The Company continues to look for ways to engage the TAs in promotion of the Program as well as more effective targeting of TAs based on market opportunities.

Marketing

Non-residential customers are informed of programs via targeted marketing material and communications. Campaigns during 2016 included email, direct mail, bill insert, social media, paid search and other online strategies. Each month, a highlighted topic is selected along with the appropriate customer segment(s) audience. For example, in August 2016 general program information was distributed via several marketing channels and energy management & controls was targeted specifically to lodging, college and university customers.

The internal marketing channel is comprised of assigned Large Business Account Managers, small and medium Business Energy Advisors, and Local Government and Community Relations, who all identify potential opportunities as well as distribute program collateral and informational material to customers and Trade Allies. Duke Energy has two business energy advisors who perform outreach to unassigned small and medium business customers. The business energy advisors follow up on customer leads to assist with program questions and steer customers to the trade ally search tool. In addition, the business energy advisors are contacting customers with revenue between $60,000 and $250,000 to promote the Smart $aver® programs.

Smart $aver® Non-Residential Prescriptive Program Potential Changes

Standards continue to change, and new more efficient technologies continue to emerge in the market. Duke Energy periodically reviews major changes to baselines, standards, and the market for equipment that qualify for existing measures, and explores opportunities to add measures to the approved Smart $aver® Non-Residential Prescriptive Program that provide incentives for a broader suite of energy efficient products. As a result of this work in 2016, a limited number of new measures and measure updates were included in the portfolio that is pending approval. Upon approval, the changes will be announced to the market. For existing measures that are changing, such as reductions to the incentive amount, a 90-day grace period is offered for applications on the past measure and incentive amount to allow customers to apply for incentives on equipment installations that occurred prior to the incentive change.

Duke Energy Ohio is considering new and innovative ways to reach out to customer segments that have had a lower rate of prescriptive incentive applications, and considering options to partner with other Duke Energy EE programs to cover gaps in the market. In 2017, a new retail marketing channel is being tested with the third-party vendor, Leidos. Similar to the midstream marketing channel, eligible customers that shop at selected Sam’s Club stores located in Duke Energy Carolinas service area may purchase eligible LED lamps at an incentive-reduced price. Leidos provides the sales information to Duke Energy electronically for reimbursement. The test is being conducted for the first half of 2017, and based on the results will be considered for continuation and/or wider expansion within Duke Energy’s other state jurisidictions.

The program managers are evaluating the opportunity to offer low-cost measures to the commercial areas of multi-family properties, at no out-of-pocket cost to the customer. This initiative is through a partnership with the Residential Multi-family program, and the measures will be similar to the measures that are provided to the residential units. Similar initiatives are also under consideration.

The program is also exploring an optional new process for customers to pre-verify equipment eligibility, which is designed to give customers certainty that their selected equipment qualifies for an incentive prior to purchase and will overcome another barrier that can delay investment in EE projects.

<u>Smart $aver® Custom Rebate Program</u>

Duke Energy Ohio's Smart $aver® Non-residential Custom Incentive Program offers financial assistance to qualifying commercial, industrial and institutional customers (that have not opted out) to enhance their ability to adopt and install cost-effective electrical energy efficiency projects.

The Smart $aver® Custom Incentive program is designed to meet the needs of Duke Energy Ohio non-residential customers with electrical energy saving projects involving more complicated or alternative technologies, or those measures not covered by standard Prescriptive Smart $aver® Incentives.

The Custom Incentive application is appropriate for projects that are not listed on the applications for Smart $aver® Prescriptive Incentives. Unlike the Prescriptive Incentives, Custom Incentives require approval prior to the customer's decision to implement the project. Proposed energy efficiency measures may be eligible for Custom Incentives if they clearly reduce electrical consumption and/or demand. There are two approaches for applying for Custom Incentives, "Classic Custom" and "Custom to Go". Applications vary slightly. The difference between the two approaches focuses on the method by which energy savings are calculated.

Currently the following applications are located on the Duke Energy Ohio website under the Smart $aver® Incentives (Business and Large Business tabs).

- Custom Application – Administrative Information
- Energy Savings Calculations & Basis

- Classic Custom approach (> 700,000 kWh or no Applicable Custom to Go calculator)
    - Variable Frequency Drives
    - Energy Management Systems
    - Compressed Air
    - Lighting
    - General
- Custom to Go Calculators (< 700,000 kWh and Applicable Custom to Go Calculator)
    - HVAC (including Energy Management Systems)
    - Lighting
    - Compressed Air
    - Process VFDs

The program is promoted through, but not limited to the following;

- Trade ally outreach
- Duke Energy Ohio Business Relations Managers
- Duke Energy Ohio segment specific workshops
- Company website

Smart $aver® Custom Rebate Program Potential Changes

The Custom program continues to evaluate additional improvements to enhance participation and program efficiency. Three such enhancements, Performance Incentives, Fast

Track Processing, and Calculation Assistance, have been submitted with the Company's application for a new portfolio.

Non-Residential Energy Assessments Program

The purpose of the Non-Residential Energy Assessment Program is to assist non-residential customers in assessing their energy usage and providing recommendations for more efficient use of energy. The program will also help identify those customers who could benefit from other Duke Energy Ohio Energy Efficiency non-residential programs.

Duke Energy Ohio offers various types of on-site assessments wherein an assessor will spend one or more days at a customer's site identifying opportunities for increased energy efficiency. The various types of assessments include those defined by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (Level II and Level III) as well as assessments focused on specific market segments or systems (i.e. commercial real estate, data centers, hospitals, compressed air systems, and industrial refrigeration systems). After the audit is completed, the customer receives a written report of the audit findings as well as assistance applying for Smart $aver® incentives if desired. The cost of the on-site assessment varies depending on the complexity, size of the facility, and length of time required. Customers determined eligible will receive financial assistance for the cost of the service. Impacts captured as a result of Energy Assessment recommendations are recorded in Duke Energy Ohio's non-residential incentive programs.

Non-Residential Energy Assessment Program Changes

Duke Energy is improving the service with two additions: 1) the Company will provide an ancillary offer for design assistance and 2) it will also provide the customer with a choice in the firm that provides an energy assessment or design assistance.

Similar to the assessment program, design assistance offers energy savings recommendations for non-residential customers. However, the focus is on assisting customers in designing new construction, major renovations, or additions to ensure the most energy efficient structures are built. As part of the service, Duke Energy or a selected partner provide computer software energy modeling that provides the capability for innumerable efficient building designs to be considered by the customer. Impacts captured as a result of Energy Design Assistance recommendations are recorded in Duke Energy Ohio's non-residential incentive programs.

In addition to choosing to utilize a Duke Energy contracted engineering firm for an energy assessment or design assistance, customers may now select any company they wish, to perform the work. The same financial support from Duke Energy will be available. A pre-approval application is required as well as adherence to pre-defined criteria.

Mercantile Self-Direct Rebates Program

The Duke Energy Ohio Mercantile Self-Direct program was enacted in accordance with Public Utilities Commission of Ohio (Commission) Rule 4901:1-39-05(G).A.C., and the Commission's Opinion and Order in Case No. 10-834-EL-POR. Customers who use 700,000 kWh or greater annually and national accounts are eligible for the program.

A mercantile self-direct customer may elect to commit energy savings or demand reductions from projects completed in the prior three calendar years that did not receive Smart $aver® incentives, to Duke Energy Ohio's benchmark achievements. In return, Duke Energy

Ohio will assist the customer in filing an application with Commission for approval of a portion of the incentive the customer would have received had they participated in Duke Energy Ohio's standard Smart $aver® Non-Residential programs.

Any customers that paid a reduced rider amount as the result of a negotiated settlement and wish to receive a self-direct rebate will be invoiced for the differential from the date of project completion until the last effective date of the negotiated settlement.

The marketing channels for Mercantile Self-Direct project applications closely resemble those of the Smart $aver® Prescriptive and Smart $aver® Custom programs, based on applicability, as described in previous sections of this filing.

Rebates for self-direct projects eligible for a cash rebate reasonable arrangement will be a maximum of 50% of the dollar amount that would apply to the same project if evaluated in the Smart $aver® Prescriptive & Custom programs.

Self-Direct Prescriptive Program

The Self-Direct Prescriptive program provides rebates for mercantile customers who implement energy efficiency and/or demand reductions projects to install higher efficiency equipment. Major categories include lighting, motors, pumps, variable frequency drives (VFDs), food service, information technology, HVAC and process equipment. Eligible measures are reflective of the Smart $aver® Prescriptive Incentive portfolio. While many of the measures recorded under the Smart $aver® Prescriptive program will remain prescriptive in nature under the Self-Direct program, in accordance with Commission rules and orders on the mercantile program, certain measures may be evaluated under the Self-Direct Custom program to enable the use of as-found baseline.

Self-Direct Custom Program

The Self-Direct Custom program offers rebates for completed mercantile projects involving more complicated scopes, or unique technologies that resulted in improvements upon facility electrical energy efficiency. A proposed energy efficiency measure may be eligible for a Self-Direct Custom rebate if it clearly reduces electrical consumption and/or demand. Unlike the Smart $aver® Custom program, measurable and verifiable behavioral and operational measures are eligible in the Mercantile Self Direct program.

PowerShare® Program

The PowerShare® program is Duke Energy Ohio's demand side management (or demand response) program geared toward commercial and industrial customers. The primary offering under PowerShare® is named CallOption and it provides customers a variety of offers that are based on their willingness to shed load during times of peak system usage. In this program, credits are received regardless of whether an event is called or not. Energy credits are also available for participation (shedding load) during curtailment events. The notice to curtail under these offers is between 30 minutes (emergency) and day-ahead (economic) and there are penalties for non-compliance during an event.

The program is promoted through but not limited to the following;

- Duke Energy Ohio Business Relations Managers
- Email to customers
- Duke Energy Ohio website

Customer targets in 2016 continued to be large manufacturers, water/wastewater facilities and school systems. The market is very competitive with other Curtailment Service Providers acquiring customers during 2016 that had previously been PowerShare® participants.

PowerShare® Program Potential Changes

For 2016-2017 program year, there are no changes to the program structure. PJM rules will require a shift to meet their "Capacity Performance" construct starting in 2018-2019 planning year, which will require a change program parameters (such as removing the maximum number of interruption) and may impact future participation. Duke Energy Ohio program management staff is working with customers to explore ways to navigate these future changes.

PJM Interconnection, Inc. Pilot Program

As agreed to by the signatory parties in the Stipulation and Recommendation for Case No. 13-0431-EL-POR, Duke Energy Ohio created a PJM Interconnection, Inc. (PJM) Pilot program capturing all the costs and benefits of PJM Reliability Pricing Model (RPM) participation. Duke Energy Ohio agreed to bid at least 80% of eligible[2], projected cost effective[3], approved Program Portfolio resources[4] into the PJM Base Residual Auctions (BRA) occurring during the term of the 2014 – 2016 Program Portfolio. All cost effective, PJM approved MW resources were bid into the 2019/2020 BRA. This resulted in 10.2 Capacity Performance MWs of energy efficiency clearing in the 2019/2020 auction.

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[2] "Eligible" is defined for purposes of the Stipulation as existing and planned energy efficiency savings and demand response that comply with PJM Manuals 18 and 18b.

[3] "Cost effective" is defined for purposes of Duke Energy Ohio's PJM Pilot Program as the projected auction revenues are greater than the projected costs for existing and planned energy efficiency and demand response, where the phrase "projected auction revenues" is defined as the estimated kW multiplied by the previous BRA clearing price for the Duke zone and "projected costs" are defined as the costs necessary to fully qualify and bid the resources into the PJM capacity auctions.

[4] "Program Portfolio resources" is defined as the energy efficiency and demand response resources, both existing and planned, that are expected to be created under Duke's 2014 – 2016 Program Portfolio application in Case No. 13-0431-EL-POR. Program Portfolio resources specifically exclude mercantile self-direct resources, unless a self-direct mercantile customer affirmatively and explicitly chooses to grant its energy efficiency capacity resources to Duke Energy Ohio, by separate agreement.

Clearing MW revenue is allocated back to programs after all administrative and EM&V costs are covered. Revenue offset is allocated back to program based on percentage of MWs clearing each auction and customer class.

Duke Energy Ohio continues to keep the Duke Energy Community Partnership (the Collaborative) updated regarding the auction process.

<u>Small Business Energy Saver Program</u>

The purpose of Duke Energy's Small Business Energy Saver program is to reduce energy usage through the direct installation of energy efficiency measures within qualifying small non-residential Duke Energy Ohio customer facilities. All aspects of the program are administered by a single Company-authorized vendor. Program measures address major end-uses in lighting, refrigeration, and HVAC applications.

Program participants receive a free, no-obligation energy assessment of their facility followed by a recommendation of energy efficiency measures to be installed in their facility along with the projected energy savings, costs of all materials and installation, and up-front incentive amount from Duke Energy. Upon receiving the results of the energy assessment, if the customer decides to move forward with the proposed energy efficiency project, the customer makes the final determination of which measures will be installed. The energy efficiency measure installation is then scheduled at a convenient time for the customer and the measures are installed by electrical subcontractors of the Duke Energy-authorized vendor.

The Program is designed as a pay-for-performance offering, meaning that the Duke Energy-authorized vendor administering the program is only compensated for energy savings produced through the installation of energy efficiency measures.

The Small Business Energy Saver Program is available to existing Duke Energy Ohio non-residential customer accounts with an actual average annual electric demand of 100 kilowatts (kW) or less. An individual business entity's participation is limited to no more than five premises on the Company's system during a calendar year.

SmartWatt Energy Inc. (SmartWatt), a company that specializes in administering utility energy efficiency programs nationwide, similar to Small Business Energy Saver, is the Duke Energy-authorized program administration vendor in Ohio. SmartWatt is also the program administrator for the Small Business Energy Saver program in Duke Energy's Kentucky and Indiana service territories.

2016 was the second full year in which the Program was in operation in Duke Energy Ohio, after launching in late 2014. The Program continued to experience a significant amount of customer interest in 2016. There were 730 Small Business Energy Saver projects completed for eligible Duke Energy Ohio customers in 2016.

Small Business Energy Saver Program Potential Changes

Technology continues to evolve and new, more efficient products continue to emerge in the market. This continuing market progress led to additional LED options as well as programmable Wi-Fi-enabled thermostats being added to the Program as incentivized measures in 2016.

In order to broaden the Small Business Energy Saver Program offering to more small and medium business customers who would benefit from the direct install model and turn-key program process, the Company proposed to expand program availability to include all existing non-residential customer accounts with an average annual demand of 180 kW or less, which is an increase from the current eligibility limit of 100 kW annual average demand per account. This eligibility expansion proposal was included in the portfolio filing, which is currently pending approval.

In 2017, the Company will continue to evaluate the opportunity to add incentivized measures suitable for the small and medium business market to the approved program which fit the direct install program model. Specifically, the Company is placing a great deal of focus this year on identifying and implementing additional HVAC measures within the Program.

The Company would ultimately like to ensure that small business customers are given the opportunity to maximize their energy savings by being offered comprehensive energy efficiency project through the Program wherever possible.

4901:1-39-05(C)(2)(a)(i), O.A.C. Continued:

Number and Type of Participants and Comparison of Forecasted Savings to Achieved Savings

The number of participants or measures installed by customer type is summarized above in Table 2. Details on participation by measure are provided in Appendix A. Table 4 provides a comparison of achieved impacts for 2016 as well as the forecasted impacts for 2017.

Table 4: Comparison of Achievement to Forecasted Impacts and Trend Projection Through 2017									
		Achieved Load Impacts		Forecasted Load Impacts					
		MWH	MW	MWH	MWH	MWH	MW	MW	MW
	1, 2	2016	2016	2016	2017	Total	2016	2017	Total
<u>Other Programs</u>									
Low Income Weatherization		635.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0
					0.0				
<u>Residential Programs</u>					0.0				
Appliance Recycling Program		51.6	0.0	872.0	0.0	872.0	0.1	0.0	0.1
Energy Efficiency Education Program for Schools		5,215.2	1.4	4,665.0	3,209.6	7,874.6	1.3	0.9	1.1
Home Energy Comparison Report		11,904.1	3.7	5,002.0	97,847.4	102,849.5	1.5	25.0	24.8
Home Energy Solutions		599.5	0.4	2,810.4	0.0	2,810.4	1.8	0.0	1.8
Home Energy Solutions - Demand Response		0.0	1.3	0.0	0.0	0.0	5.4	0.0	0.0
Low Income Neighborhood Program		587.3	0.2	598.0	600.0	1,198.0	0.2	0.2	0.5
Low Income Services		0.0	0.0	107.3	0.0	107.3	0.0	0.0	0.0
Low Income Weatherization - Pay for Performance		0.0	0.0	0.0	5,679.3	6,277.3	0.0	1.2	1.5
Residential Energy Assessments		1,997.7	0.2	2,935.0	2,050.7	4,985.7	0.4	0.2	0.5
Smart $aver Residential		19,872.5	3.8	24,342.5	37,620.0	61,962.5	3.9	4.2	7.6
Weatherization Pilot		1,042.6	0.1	2,620.5	0.0	2,620.5	0.4	0.0	0.0
Power Manager®		0.0	18.6	0.0	0.0	0.0	0.0	48.6	56.1
Power Manager® for Apartments		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
<u>Non Residential Programs</u>									
Power Manager® for Business - EE		0.0	0.0	0.0	62.6	62.6	0.0	0.0	0.0
Small Business Energy Saver		21,952.4	4.5	20,490.5	26,257.8	46,748.3	4.6	5.9	10.0
Smart $aver Non Residential Custom		24,254.3	3.1	27,605.6	23,557.2	51,162.8	3.2	2.7	5.5
Smart $aver Non Residential Performance Incentive Program		0.0	0.0	0.0	631.3	631.3	0.0	0.1	0.1
Smart $aver Non Residential Prescriptive		91,986.0	16.2	74,977.6	44,235.7	119,213.3	15.0	6.2	18.5
Power Manager® for Business - DR		0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
PowerShare®		0.0	-0.5	0.0	0.0	0.0	-9.9	46.2	16.1
Mercantile Self-Direct		41,998.3	5.0	9,044.8	8,315.6	17,360.4	1.7	0.9	1.6
Total for All Programs		**222,097.4**	**58.1**	**176,071.2**	**250,067.2**	**426,736.4**	**29.5**	**142.7**	**146.0**

1. 2016 forecasted impacts from the 2015 SB221 filing.
2. 2017 forecasted impacts from the 2017-2019 portfolio filing.

This table indicates that the achieved MWH impacts through 2016 are above the 2016 forecasted load impacts.

4901:1-39-05(C)(2)(a)(ii) O.A.C., Energy Savings Counted Toward Benchmark as a Result of Mercantile Customers

The energy savings counted towards the benchmark for 2016 as a result of energy efficiency improvements and implemented by mercantile customers and committed to the Company are 41,998 MWH.

4901:1-39-05(C)(2)(a)(iii) O.A.C., Peak Demand Reduction Counted Toward Benchmark as a Result of Mercantile Customers

The peak-demand reductions counted towards the benchmark for 2016 as a result of energy efficiency improvements and implemented by mercantile customers and committed to the Company are 4.95 MW.

4901:1-39-05(C)(2)(a)(iv) O.A.C., Peak-Demand Reductions Claimed Due to Transmission and Distribution Infrastructure Improvements

Consistent with S.B. 310, the Company's verified savings now reflect Duke Energy Ohio impacts from transmission and distribution infrastructure improvements at this time dating back to 2013. These impacts have not been recognized in prior years' compliance filings and the associated net benefits will not be counted in the calculation of shared savings during the course of its 2017-2019 portfolio plan.

4901:1-39-05(C)(2)(b) O.A.C., Evaluation, Measurement, and Verification (EM&V)

In its Entry in Case Number 09-512-GE-UNC, July 31, 2013, the Commission stated an intention to treat the 2010 Draft Technical Reference Manual (TRM) and those comments agreed to by Vermont Energy Investment Corporation (VEIC) as a "safe harbor" rather than a mandate. As a result, Duke Energy Ohio has directed third-party evaluators to consider guidelines presented by the TRM in evaluations going forward into the 2016 program evaluation year. For the current compliance filing, the independent EM&V was generally conducted consistent with the most current draft of the TRM. It should be noted however, that the TRM provides no specific methodologies for behavior programs or direct load control.

Energy savings and peak-demand reduction values are documented in the individual program EM&V studies in the appendices. The following studies have been completed.

Power Manager Impact and Process Evaluation Report (March 23, 2016)	**Appendix D**
PowerShare Impact and Process Evaluation Report (March 8, 2016)	**Appendix E**

Appendix C provides an up-to-date summary of EM&V methodologies and protocols. Any new programs or measures that will be offered in the future have not been included in Appendix C.

The cost effectiveness of the current programs is provided below in Table 5.

TABLE 5:

SB310 - 2014-2016
Cost Effectiveness Test Results

Program Name		UCT	TRC	RIM	PCT
Residential Programs - Energy Efficiency					
Appliance Recycling Program		1.69	2.20	1.18	
Energy Efficiency Education Program for Schools		3.42	4.56	2.01	
Home Energy Comparison Report		2.42	2.42	1.59	
Low Income Neighborhood Program		1.33	2.12	1.04	
Low Income Services		N/A	N/A	N/A	N/A
Residential Energy Assessments		2.14	2.27	1.49	
Smart $aver Residential		3.62	3.62	1.86	5.35
Home Energy Solutions	**1**	0.35	0.32	0.34	1.73
Weatherization Pilot		1.60	2.03	1.11	
Total		**2.36**	**2.39**	**1.51**	**7.32**
Residential Programs - Demand Response					
Power Manager®		8.75	6.86	8.75	
Total		**8.75**	**6.86**	**8.75**	
Non-Residential Programs - Energy Efficiency					
Smart $aver Non Residential Custom		6.37	0.98	3.34	1.06
Smart $aver Non Residential Prescriptive		3.20	1.57	2.29	1.62
Non Residential Energy Management Information System	**2**	0.00	0.00	0.00	
Small Business Energy Saver		3.94	2.50	2.72	2.63
Total		**3.94**	**1.40**	**2.62**	**1.48**
Non-Residential Programs - Demand Response					
PowerShare®		3.79	64.36	3.79	
Total		**3.79**	**64.36**	**3.79**	
Overall Portfolio Total		**3.34**	**1.91**	**2.26**	**2.08**

1 - Home Energy Solutions includes both EE and DR components. Based on the recent impact evaluation and the impacts to cost effectiveness, the program was discontinued effective October 23, 2016.

2 - Based on the limited number of interested potential customers the program was discontinued in 2014.

4901:1-39-05(C)(2)(c) O.A.C., Continuation of Programs

Based on the success of the programs and positive response from customers and trade allies, Duke Energy Ohio proposes to continue with the existing portfolio of programs with modifications and additional measures as filed in Case No. 16-0576-EL-POR. The portfolio is subject to annual adjustments for changes in efficiency levels or market conditions.

The Company is continually researching other energy efficiency opportunities for both the residential and non-residential customer classes. Also, based on such factors as changing market conditions, customers' efficiency needs, etc., the Company modifies and otherwise manages existing programs as needed given contemporaneous experience. This allows it to meet its annual energy efficiency benchmarks as required.

The Company's portfolio plan, including its shared savings incentive mechanism, was approved incorporating the same banking principles that were established by the Commission's rules with respect to its energy efficiency benchmark compliance. As approved by the Commission, the Company does not double count the net benefit of energy savings achieved in a particular year for the purposes of calculating the incentive. Once energy savings are recognized in determining the Company's allowed shared savings percentage, the impacts are exhausted for the purpose of determining its annual incentive achievement level in the future. Duke Energy Ohio has entered into a stipulation related to its pending application for approval of a new portfolio that contains provisions that define and clarify the parameters regarding both the achievement requirement to earn a shared savings incentive, as well as what net benefits should not be included in the calculation of shared savings in 2017 and beyond.[5]

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[5] *In the Matter of the Application of Duke Energy Ohio, Inc., for Approival of its Energy Efficiency and Peak Demand Recution Program Portfolio Plan*, Case No.16-576-EL-POR, Amended Stipulation and Recommendation, (January 27, 2017), at paragraphs 5 and 7.

4901:1-39-05(D) O.A.C., Independent Program Evaluator Report

Appendix C, provides an up-to-date summary of EM&V methodologies and protocols. Individual reports have been provided as appendices D through E.

4901:1-39-05 (E)(1) and (2)(a-b) O.A.C., Peak Demand Reductions

Duke Energy Ohio has satisfied its peak-demand reduction benchmarks through energy efficiency and peak-demand response programs implemented by the Company and programs implemented on mercantile customer sites where the mercantile program is committed to the electric utility.

4901:1-39-05(F) and (G)(1-5) O.A.C., Mercantile Customers

Duke Energy Ohio's Mercantile Self Direct program is the avenue through which mercantile customers commit energy and demand impacts from their energy efficiency projects to Duke Energy Ohio in exchange for cash rebates or commitment payments. The program uses the constructs for calculating and deeming energy and demand savings that are present in the Custom Incentive and Prescriptive Incentive programs, respectively.

Upon approval of the customer's application, Duke Energy Ohio tenders an offer letter agreement to the customer which outlines the cash rebate or commitment payment offered. After the customer signs the offer letter agreement, Duke Energy Ohio submits a mercantile application to the Commission on behalf of the customer. Upon Commission approval of the application or the passing of 60 days, Duke Energy Ohio remits payment to the customer for the agreed dollar amount.

The offer letter provided to applicants pursuant to each project submitted to Duke Energy Ohio requires the customer to affirm its intention to commit and integrate the energy efficiency projects listed in the offer into Duke Energy Ohio's peak demand reduction, demand response and/or energy efficiency programs. The offer letter agreement also requires the customer to agree to serve as joint applicant in any future filings necessary to secure approval of this arrangement as required by the Commission and to comply with any information and reporting requirements imposed by rule or as part of that approval. Noncompliance by the customer with the terms of the commitment is not applicable at this time.

The attached offer letter agreement template, used for each mercantile application provides for formal declaration. Additionally, the application documents located on Duke Energy Ohio's website request that the applicant allow Duke Energy Ohio to share information only with vendors associated with program administration. The release is limited to use of the information contained within the application and other relevant data solely for the purposes of reviewing the application, providing a rebate offer, submitting documentation to the Commission for approval and payment of the rebate. All program administration vendor contracts strictly prohibit the sharing of customer information for other purposes.

Upon customer request, Duke Energy Ohio will agree, as it is able to do so, to provide information to the Commission in the proper format such that confidential customer information is redacted from the public record.

With regard to the customers in Duke Energy's Ohio territory who have undertaken self-directed energy efficiency projects, these initiatives will not be evaluated by the Company's independent evaluation contactor. These efforts have been implemented in the past and were self-directed by our mercantile customers without involvement in Duke Energy Ohio's energy efficiency or demand reduction programs under Duke Energy Ohio's Shared Savings Cost Recovery mechanism. As a result they will not be included in the evaluations of Duke Energy Ohio programs.

As of December 31, 2016, one customer remained exempted from the rider in exchange for commitment of energy and demand savings to Duke Energy Ohio.

4901:1-39-05(H), O.A.C. Prohibition Against Counting Measures Required by Law Toward Meeting the Statutory Benchmark

Duke Energy Ohio did not count, in meeting its statutory benchmark, the adoption of measures that were required to comply with energy performance standards set by law or regulation, including but not limited to, those embodied in the Energy Independence and Security Act of 2007, or an applicable building code.

4901:1-39-05 (I) and (J), O.A.C. Benchmarks Not Reasonably Achievable

The above referenced sections are not applicable to Duke Energy Ohio since it has met its statutory benchmarks.

Conclusion

With this status report, Duke Energy Ohio has demonstrated that it is in compliance with the statutory load impact requirements as measured and reported in its Benchmark Report. Duke Energy Ohio respectfully requests that the Commission find that the Company has met its compliance requirements for the 2016 compliance year.

Respectfully submitted,

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APPENDIX A

SB 310 Appendix A

2016 Total Reported Achievement

Program	Customer	Product Code	Measure	Annual KW Gross FR, @ Plant Total	Annual KWH Gross FR, @ Plant Total	Participants
Grand Total				**58,064**	**222,097,377**	**22,360,976**

Other EE Programs and Impacts

Program	Customer	Product Code	Measure	Annual KW Gross FR, @ Plant Total	Annual KWH Gross FR, @ Plant Total	Participants
Low Income Weatherization	Res		Low Income Weatherization	171	635,882	603
Grand Total				**171**	**635,882**	**603**

Shared Savings and Mercantile Portfolios

Program	Customer	Product Code	New Short Name	Annual KW Gross FR, @ Plant Total	Annual KWH Gross FR, @ Plant Total	Participants
Appliance Recycling Program	Residential	FRCYCL	Freezer Recycle	1	10,014	13
		FRCYCL Total		1	10,014	13
Appliance Recycling Program	Residential	RRCYCL	Fridge Recycle	4	41,626	80
		RRCYCL Total		4	41,626	80
Appliance Recycling Program Total				6	51,640	93
Energy Efficiency Education Program for Schools	Residential	K12PRF	K-12 Education Program- Curriculum	1,403	5,215,191	9,782
		K12PRF Total		1,403	5,215,191	9,782
Energy Efficiency Education Program for Schools Total				1,403	5,215,191	9,782
Home Energy Comparison Report	Residential	HECR	Home Energy Comparison Report - Commercialized	3,342	10,893,009	312,372
Home Energy Comparison Report	Residential	HECR	My Home Energy Report - Online	310	1,011,071	4,114
		HECR Total		3,652	11,904,080	316,486
Home Energy Comparison Report Total				3,652	11,904,080	316,486
Home Energy Solutions	Residential	HES	Home Energy Manager EE Pre EMV	378	599,546	1,024
		HES Total		378	599,546	1,024
Home Energy Solutions Total				378	599,546	1,024
Home Energy Solutions - Demand Response	Residential	HOM	HOM	1,291		
		HOM Total		1,291	-	-
Home Energy Solutions - Demand Response Total				1,291	-	-
Low Income Neighborhood Program	Residential	HWLI	Low Income Neighborhood	180	587,278	1,315
		HWLI Total		180	587,278	1,315
Low Income Neighborhood Program Total				180	587,278	1,315
Power Manager	Residential	PWRMGR	PowerManager -Midwest	18,585		
		PWRMGR Total		18,585	-	-
Power Manager Total				18,585	-	-
PowerShare®	Non Residential	PWRSHR	PowerShare - Annual	930		
PowerShare®	Non Residential	PWRSHR	PowerShare - Extended Summer	10,316		
PowerShare®	Non Residential	PWRSHR	PowerShare - Summer Only	51,568		
PowerShare®	Non Residential	PWRSHR	PS Air Products	(7,614)		
PowerShare®	Non Residential	PWRSHR	PS CallOption 1/10	(55,685)		
		PWRSHR Total		(485)	-	-
PowerShare® Total				(485)	-	-
Residential Energy Assessments	Residential	HEHC	Home Energy House Call - Additional LED	18	160,841	5,007
Residential Energy Assessments	Residential	HEHC	Home Energy House Call - Energy Efficiency Starter KIT	0	1,042	1
Residential Energy Assessments	Residential	HEHC	Home Energy House Call - Kit w LEDs	231	1,835,833	2,146
		HEHC Total		250	1,997,716	7,154

Residential Energy Assessments Total				250	1,997,716	7,154
Small Business Energy Saver	Non Residential	SSBDIR	SBES HVAC HP	1	3,201	2,996
Small Business Energy Saver	Non Residential	SSBDIR	SBES Lighting 8760	402	3,520,043	3,294,409
Small Business Energy Saver	Non Residential	SSBDIR	SBES Lighting Daylighting	3,962	14,699,135	13,922,732
Small Business Energy Saver	Non Residential	SSBDIR	SBES Lighting DusktoDawn		2,595,680	2,427,643
Small Business Energy Saver	Non Residential	SSBDIR	SBES OccSensors	12	43,727	41,417
Small Business Energy Saver	Non Residential	SSBDIR	SBES Refrigeration	124	1,090,569	1,020,664
		SSBDIR Total		4,501	21,952,355	20,709,861
Small Business Energy Saver Total				4,501	21,952,355	20,709,861
Smart $aver Non Residential Custom	Non Residential	NRPRSC	Custom	3,072	24,254,302	12,221
		NRPRSC Total		3,072	24,254,302	12,221
Smart $aver Non Residential Custom Total				3,072	24,254,302	12,221
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Anti-sweat Heater Controls	0	98,368	55
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Beverage Reach-in Controller	0	2,140	3
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Combination Oven_10 pan	15	83,346	12
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Convection Oven Full-Sized	1	4,451	2
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Door Gaskets - Cooler and Freezer	0	314	3
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	ECM Case Motors	10	89,091	250
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	ECM Cooler and Freezer Motors - ECM replacing PSC	2	20,649	11
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	ECM Cooler and Freezer Motors - ECM replacing SP	4	42,211	68
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	ENERGY STAR Commercial Glass Door Freezers 30 to 50ft3 - var	0	4,131	1
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	ENERGY STAR Commercial Glass Door Freezers more than 50ft3 - var	8	83,597	11
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	ENERGY STAR Commercial Glass Door Refrigerators 15 to 30 ft3 - var	0	1,426	2
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	ENERGY STAR Commercial Glass Door Refrigerators 30 to 50ft3 - var	1	6,218	8
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	ENERGY STAR Commercial Glass Door Refrigerators more than 50ft3 - var	1	8,629	9
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	ENERGY STAR Commercial Solid Door Freezers 15 to 30 ft3 - var	0	1,856	2
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	ENERGY STAR Commercial Solid Door Refrigerators < 15ft3 - var	0	2,018	7
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	ENERGY STAR Commercial Solid Door Refrigerators 15 to 30 ft3 - var	0	2,007	4
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Fryer (Standard Vat)	1	3,387	3
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Holding Cabinet Half Size Insulated	2	11,508	6
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	HT ES Sngl Tank - CNV DW New -rplc on Burnout	1	10,679	1
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	HT ES Sngl Tank - CNV DW w-Boost Htr (Elec) New -repl on BO	1	10,679	1
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	HT ES Sngl Tank - Door DW w-Boost Htr (Elec) New -repl on BO	2	14,057	1
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Icemaker (> 1000 lbs_day)	3	30,270	8
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Icemaker (100 to 500 lbs_day)	0	603	1
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Icemaker (500 to 1000 lbs_day)	0	3,620	3
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Pre Rinse Sprayers	1	8,918	6
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Steamer_3 pan	2	11,953	1
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Steamer_6 pan	3	16,207	1
Smart $aver Non Residential Prescriptive	Non Residential	NRFS	Walk-In Cooler Automatic Door-Closer Retrofit		2,855	4
		NRFS Total		60	575,188	484
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	0.5 gpm Faucet Aerator (DI) - COMM, pvt use	4	29,480	123
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	0.5 gpm Faucet Aerator (DI) - School, public use	0	15,318	12
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	1.5 gpm Low Flow Showerhead (DI) - COMM, public use	2	42,230	50
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	1.5 gpm Low Flow Showerhead (DI) - COMM, pvt use	0	845	2
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	AC 135,000 - 240,000 per ton	5	4,365	61
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	AC 65,000 - 135,000 per ton	1	1,112	19
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	Air Cooled Chiller_Any greater than 150 tons	65	49,057	653
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	Air Cooled Chiller_Any less than 150 tons	74	57,317	748
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	ARC 10 to 15 Ton Gas Heat	11	41,662	60
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	ARC greater than 15 Ton Gas Heat	4	17,172	20
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	ARC HP 10 to 15 Ton	4	19,867	24
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	ARC less than 10 Ton Gas Heat	5	19,276	32

Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	CEE Tier 1 Room AC greater than 14,000 Btu per hr	1	1,359	6
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	CEE Tier 2 Room AC greater than 14,000 Btu per hr	3	3,091	11
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	CoolRoof New Replace on Burnout Other-sq ft	8	57,052	166,794
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	CoolRoof New Replace on Burnout Retail-sq ft		132,258	217,646
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	DCV Retrofit Retail - per sq ft	3	749	4,000
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	DX RTU Tune-up_ AC_ TXV_ +30% chg adj	17	16,094	138
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	DX RTU Tune-up_ AC_ TXV_ +5% chg adj	37	33,935	1,283
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	DX RTU Tune-up_ AC_ TXV_ -20% chg adj	1	713	20
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	HVAC DX AC 135-240kBtuh 11.7 EER (Tier 0_1)	47	59,292	690
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	HVAC DX AC 135-240kBtuh 12.2 EER (Tier 2)	7	8,589	67
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	HVAC DX AC 240-760kBtuh 10.5 EER (Tier 0_1)	15	18,630	227
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	HVAC DX AC 240-760kBtuh 10.8 EER (Tier 2)	36	45,368	398
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	HVAC DX AC 65-135kBtuh 11.7 EER (Tier 0_1)	15	19,686	300
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	HVAC DX AC 65-135kBtuh 12.2 EER (Tier 2)	13	16,074	149
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	HVAC DX AC greater than 760kBtuh 10.4 EER (Tier 2)	6	7,583	69
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	HVAC DX AC less than 65kBtuh 14 SEER (Tier 0_1)	1	1,061	16
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	HVAC DX AC less than 65kBtuh 15 SEER (Tier 2)	15	16,829	136
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	HVAC DX HP 135-240kBtuh 10.9 EER 3.3 COP (Tier 1)	3	4,607	30
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	HVAC DX HP 65-135kBtuh 11.3 EER 3.4 COP (Tier 1) (eff 11.30.15)	1	1,054	8
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	HVAC DX HP greater than 240 kBtuh 10.3 EER 3.3 COP (Tier 1)	5	7,525	54
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	HVAC DX PTAC 7600 Btuh 12.2 EER	1	1,109	30
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	Setback Programmable Thermostat	(0)	112,642	91
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	Water Cooled Chiller_Centrifugal at least 600 tons	73	50,127	1,570
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	Water Cooled Screw or Scroll at least 150 tons and less than 300 tons	17	12,888	299
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	Water-cooled screw chiller < 150 ton 0.79 kW_ton with 0.59 kW_ton IPLV per ton	2	11,689	101
Smart $aver Non Residential Prescriptive	Non Residential	NRHVAC	Window Film	46	104,649	23,934
		NRHVAC Total		548	1,042,352	419,871
Smart $aver Non Residential Prescriptive	Non Residential	NRIT	Controlled Plug Strip		1,276	12
		NRIT Total		-	1,276	12
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS 2 High Bay 6L T-5 High Output replacing 1000W HID	10	50,935	30
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Bay 4L T-5 High Output	22	117,401	123
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Bay 6L T-5 High Output	8	43,457	108
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Bay Fluorescent 3 Lamp (F32 Watt T8)	2	11,145	28
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Bay Fluorescent 4 Lamp (F32 Watt T8)	38	207,955	313
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Bay Fluorescent 6 Lamp (F32 Watt T8)	257	1,389,776	1,338
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Performance Low Watt T8 4ft 1 lamp, replacing standard T8	1	7,196	110
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Performance Low Watt T8 4ft 2 lamp, replacing standard T8	35	205,331	2,197
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Performance Low Watt T8 4ft 3 lamp, replacing standard T8	39	228,313	1,437
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Performance Low Watt T8 4ft 4 lamp, replacing standard T8	35	206,415	1,227
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Performance T8 4ft 1 lamp, replacing standard T8	0	917	19
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Performance T-8 4ft 2 lamp replacing T-12 High Output 8ft 1 lamp	21	120,768	389
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Performance T8 4ft 2 lamp, replacing standard T8	11	67,385	856
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Performance T8 4ft 3 lamp, replacing standard T8	2	11,999	135
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Performance T-8 4ft 4 lamp replacing T-12 High Output 8ft 2 lamp	42	246,574	433
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS High Performance T8 4ft 4 lamp, replacing standard T8	15	91,254	691
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS Low Watt T8 lamps replacing standard 32 Watt T-8's	284	1,706,314	44,797
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS Occupancy Sensors over 500 Watts	158	359,643	489
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	BONUS Occupancy Sensors under 500 Watts	1,490	3,335,195	11,337
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	CFL Reflector Flood	47	232,849	960
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	CFL Screw high wattage	78	381,489	776
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	CFL Screw in, Specialty	2	12,004	79
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	Compact Fluorescent Fixture	22	109,977	267
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	Compact Fluorescent Screw in	159	781,578	4,857

Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	Exterior HID replacement above 175W to 250W HID retrofit		873,064	1,033
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	Exterior HID replacement above 250W to 400W HID retrofit		4,669,793	3,067
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	Exterior HID replacement above 400W HID retrofit		5,218,286	2,227
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	Exterior HID replacement to 175W HID retrofit		1,100,101	1,751
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	Exterior LED Lighting Motion-Sensor Control		9,497	65
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	Garage HID replacement above 175W to 250W HID retrofit	166	1,391,976	824
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	Garage HID replacement above 250W to 400W HID retrofit	9	67,704	23
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	Garage HID replacement above 400W HID retrofit	10	90,741	14
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	Garage HID replacement to 175W HID retrofit	345	2,889,261	2,952
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED 2ft Tube 1-LED, replacing or in lieu of T8 fluorescent	15	71,219	2,071
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED 2ft Tube 2-LED, replacing or in lieu of T8 fluorescent (eff 11.30.15)	29	136,574	2,444
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED 2ft Tube 3-LED, replacing or in lieu of T8 fluorescent	4	18,707	256
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED 2ft Tube 4-LED, replacing or in lieu of T8 fluorescent	10	48,840	598
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED 4ft Case Lights, T8 to LED	3	17,771	193
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED 4ft Case Lights, T8 to LED - With Controls	0	2,706	22
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED 4ft Tube 1-LED, replacing or in lieu of T8 fluorescent	376	1,751,496	33,955
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED 4ft Tube 2-LED, replacing or in lieu of T8 fluorescent	401	1,869,449	21,745
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED 4ft Tube 3-LED, replacing or in lieu of T8 fluorescent	466	2,174,303	18,065
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED 4ft Tube 4-LED, replacing or in lieu of T8 fluorescent (eff 11.30.15)	1,019	4,750,936	30,701
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED 5ft Case Lights, T8 to LED	13	75,951	653
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED 5ft Case Lights, T8 to LED - With Controls	2	13,296	88
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Canopy replacing 176-250W HID		73,458	104
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Canopy replacing 251-400W HID		1,466,170	1,422
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Canopy replacing up to 175W HID		101,662	228
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Case lighting	1	9,327	19
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Case lighting sensor control	1	11,541	35
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Downlight	292	1,288,978	4,561
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Exit Signs Electronic Fixtures (Retrofit Only)	54	402,163	1,645
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED FLD rplcng or ILO GRT 100W HAL, INCD, or HID		858,918	1,547
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED FLD rplcng or ILO up to 100W HAL, INCD, or HID		35,129	215
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Highbay replacing 251-400W HID	1,822	9,013,105	8,104
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Highbay replacing greater than 400W HID	585	2,893,332	1,416
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Lamps	2,874	16,263,799	52,736
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Lowbay replacing 176W-250W HID	50	247,488	312
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Lowbay replacing up to 175W HID	42	207,631	415
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Panel 1x4 replacing or in lieu of T8 FL	226	1,052,337	12,297
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Panel 2x2 replacing or in lieu of T8 FL	152	710,250	13,193
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Panel 2x4 replacing or in lieu of T8 FL	3,586	16,720,445	83,969
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Portable Task Lights (rplcng or ILO INCD, HAL, or CFL task Ltng)	1	5,457	56
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LED Track Ltng (rplcng or ILO INCD, HAL, CFL, or HID track Ltng)	16	72,809	345
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LW HPT8 4ft 2 lamp, Replace T12	136	804,723	5,219
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	LW HPT8 4ft 4 lamp, Replace T12	12	71,196	224
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	Remote-Mounted Daylight Sensor	8	33,371	82
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	Switch or Fixture-Mounted Daylight Sensor	4	16,978	187
Smart $aver Non Residential Prescriptive	Non Residential	NRLTG	T8 HB 4ft 2L rplcng 150-249W HID (retrofit only)	1	6,012	11
		NRLTG Total		15,514	89,533,820	384,085
Smart $aver Non Residential Prescriptive	Non Residential	NRP&M	1.5 Horse Power High Efficiency Pumps	-	1,658	7
Smart $aver Non Residential Prescriptive	Non Residential	NRP&M	10 Horse Power High Efficiency Pumps	1	4,299	2
Smart $aver Non Residential Prescriptive	Non Residential	NRP&M	15 Horse Power High Efficiency Pumps	1	3,520	1
Smart $aver Non Residential Prescriptive	Non Residential	NRP&M	3 Horse Power High Efficiency Pumps	0	1,290	2
Smart $aver Non Residential Prescriptive	Non Residential	NRP&M	VFD HVAC Fan	33	474,524	439
Smart $aver Non Residential Prescriptive	Non Residential	NRP&M	VFD HVAC Pump	4	33,292	20
Smart $aver Non Residential Prescriptive	Non Residential	NRP&M	VFD Process Pump 1-50 HP	15	121,248	420

		NRP&M Total		54	639,830	891
Smart $aver Non Residential Prescriptive	Non Residential	NRPROC	VSD Air COMP replacing load no load COMP	21	85,652	160
Smart $aver Non Residential Prescriptive	Non Residential	NRPROC	VSD Air Compressors	19	107,842	180
		NRPROC Total		40	193,494	340
Smart $aver Non Residential Prescriptive Total				16,215	91,985,961	805,683
Smart $aver Residential	Residential	HPWH	Heat Pump Water Heater	3	35,789	19
		HPWH Total		3	35,789	19
Smart $aver Residential	Residential	MFEEAR	Faucet Aerators MF Direct 1.0 GPM - bath	6	47,387	755
Smart $aver Residential	Residential	MFEEAR	Faucet Aerators MF Direct 1.0 GPM - kitchen	8	61,027	489
		MFEEAR Total		14	108,415	1,244
Smart $aver Residential	Residential	MFEEPW	Pipe Wrap MF Direct	5	42,077	765
		MFEEPW Total		5	42,077	765
Smart $aver Residential	Residential	MFEESH	LF Showerhead MF Direct 1.5 GPM	18	224,955	621
		MFEESH Total		18	224,955	621
Smart $aver Residential	Residential	PEEPVS	Pool Pump	72	192,712	114
		PEEPVS Total		72	192,712	114
Smart $aver Residential	Residential	RCFL	RCFL Opt-In Free CFLs	(6)	(48,284)	(1,884)
		RCFL Total		(6)	(48,284)	(1,884)
Smart $aver Residential	Residential	RCFLPM	Property Manager 13WCFL	32	285,227	5,936
		RCFLPM Total		32	285,227	5,936
Smart $aver Residential	Residential	RCFLSP	RCFLSP - Specialty Bulbs 3 Way LED	11	112,827	2,394
Smart $aver Residential	Residential	RCFLSP	RCFLSP - Specialty Bulbs Candelabra LED	181	907,244	46,720
Smart $aver Residential	Residential	RCFLSP	RCFLSP - Specialty Bulbs Globe LED	30	305,067	16,156
Smart $aver Residential	Residential	RCFLSP	RCFLSP - Specialty Bulbs Recessed Outdoor LED	2	120,167	938
Smart $aver Residential	Residential	RCFLSP	Specialty Bulbs 3 Way	11	110,062	3,002
Smart $aver Residential	Residential	RCFLSP	Specialty Bulbs A Line	2	16,323	689
Smart $aver Residential	Residential	RCFLSP	Specialty Bulbs A Line LED	26	256,944	9,783
Smart $aver Residential	Residential	RCFLSP	Specialty Bulbs Candelabra	3	31,339	2,416
Smart $aver Residential	Residential	RCFLSP	Specialty Bulbs Globe	2	19,080	1,236
Smart $aver Residential	Residential	RCFLSP	Specialty Bulbs Recessed	5	49,098	1,832
Smart $aver Residential	Residential	RCFLSP	Specialty Bulbs Recessed Dimmable	7	73,934	1,646
Smart $aver Residential	Residential	RCFLSP	Specialty Bulbs Recessed LED	265	2,661,807	57,212
Smart $aver Residential	Residential	RCFLSP	Specialty Bulbs Recessed Outdoor	7	70,914	1,024
		RCFLSP Total		553	4,734,806	145,048
Smart $aver Residential	Residential	RLED	RLED - Free LED Phase 1	1,171	8,989,530	293,310
		RLED Total		1,171	8,989,530	293,310
Smart $aver Residential	Residential	SFEEAR	Faucet Aerators SF DIY 1.0 GPM - bath	52	665,156	6,485
Smart $aver Residential	Residential	SFEEAR	Faucet Aerators SF DIY 1.0 GPM - kitchen	12	151,170	1,791
		SFEEAR Total		64	816,325	8,276
Smart $aver Residential	Residential	SFEEPW	Pipe Wrap SF DIY	35	440,114	8,955
		SFEEPW Total		35	440,114	8,955
Smart $aver Residential	Residential	SFEESH	LF Showerhead SF DIY 1.5 GPM	48	602,361	3,297
		SFEESH Total		48	602,361	3,297
Smart $aver Residential	Residential	SSAC	Smart Saver - Central Air Conditioner	1,283	2,092,654	2,499
		SSAC Total		1,283	2,092,654	2,499
Smart $aver Residential	Residential	SSAIAS	Smart Saver - Attic Insul & Air Seal	51	166,362	134
		SSAIAS Total		51	166,362	134
Smart $aver Residential	Residential	SSDSEA	Smart Saver - Duct Sealing	1	1,314	3
		SSDSEA Total		1	1,314	3
Smart $aver Residential	Residential	SSHP	Smart Saver - Heat Pump	419	1,188,180	999
		SSHP Total		419	1,188,180	999
Smart $aver Residential Total				3,764	19,872,536	469,336
Weatherization Pilot	Residential	WTZKWH	WTZKWH - ACR Insulation SC Only_EH	0	285	1,124

Weatherization Pilot	Residential	WTZKWH	WTZKWH - ACR Insulation SH Only_EH	1	2,255	1,764
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Air Sealing SC Only_EH	0	686	5,278
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Air Sealing SH Only_EH	3	14,053	8,030
Weatherization Pilot	Residential	WTZKWH	WTZKWH - CFL_EH	14	76,689	2,033
Weatherization Pilot	Residential	WTZKWH	WTZKWH - CFL_NonEH	52	418,121	7,618
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Energy Efficient Shower Head_EH	0	1,382	8
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Energy Efficient Shower Head_NonEH	0	1,728	10
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Faucet Aerator_EH	0	581	29
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Faucet Aerator_NonEH	0	501	25
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Floor Insulation SH Only_EH	0	758	948
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Refrigerator Replacement_EH	8	71,685	80
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Refrigerator Replacement_NonEH	51	447,421	328
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Water Heater Pipe Insulation_EH	0	2,014	8
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Water Heater Pipe Insulation_NonEH	1	2,014	8
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Water Heater Replacement Electric_EH	0	266	2
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Water Heater Replacement Electric_NonEH	0	1,330	10
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Water Heater Tank Wrap_EH	0	621	3
Weatherization Pilot	Residential	WTZKWH	WTZKWH - Water Heater Tank Wrap_NonEH	0	207	1
		WTZKWH Total		132	1,042,598	27,307
Weatherization Pilot Total				132	1,042,598	27,307
Mercantile Self-Direct	Non Residential	NRCSSD	SD Custom	4,950	41,998,293	111
		NRCSSD Total		4,950	41,998,293	111
Mercantile Self-Direct Total				4,950	41,998,293	111
Grand Total				57,893	221,461,495	22,360,373
Grand Total				57,893	221,461,495	22,360,373

APPENDIX B

AFFIDAVIT
OF
TRISHA A. HAEMMERLE

COMES NOW Trisha A. Haemmerle being duly sworn, deposes and says:

1. My name is Trisha A. Haemmerle. I am employed by Duke Energy Business Services, Inc. as Senior Strategy and Collaboration Manager.

2. This Affidavit will be filed with the Ohio Public Utilities Commission in support of Duke Energy Ohio's Annual Energy Efficiency Portfolio Status Report (the Report) which is required by Ohio Administrative Code §4901:1-39-05(C).

3. As Senior Strategy and Collaboration Manager, I have responsibility for overseeing the demand side management regulatory requirements for Ohio. As part of my professional responsibilities I assisted with the underlying analysis and preparation of Duke Energy Ohio's Report.

4. The information contained within the Report is true and accurate to the best of my knowledge.

5. The performance detailed in the Report demonstrates that Duke Energy Ohio has complied with the statutory benchmarks contained in Ohio Revised Code 4928.66.

FURTHER AFFIANT SAITH NOT.

Trisha A. Haemmerle

Trisha A. Haemmerle

State of Ohio)
) SS:
County of Hamilton)

Subscribed to and sworn to before me this 10th day of March 2017.

ADELE M. FRISCH
Notary Public, State of Ohio
My Commission Expires 01-05-2019

Adele M. Frisch

Notary Public

APPENDIX C

Duke Energy Ohio Schedule and Description of Planned Evaluation Activities
March 2017

Schedule of Planned[1] Evaluation Activities and Reports

Residential Customer Programs	Program/ Measure	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018	Q2 2018	Q3 2018	Q4 2018
Energy Education Program for Schools	K12 Curriculum				M&V	M&V	M&V	Report	
Low Income Neighborhood			M&V	Report					
Low Income Weatherization	Pay for Performance								
My Home Energy Report	MyHER								
Residential Energy Assessments	HEHC			M&V	Report				
Residential Smart Saver®	HVAC	M&V	Report						
	Lighting			M&V	M&V	Report			
	Multi-Family								
	Save Energy & Water			M&V	Report				
Power Manager 2016		M&V	2016 Report						
Power Manager 2017		M&V	M&V	M&V	M&V	M&V	2017 Report		

Non-Residential Customer Programs	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018	Q2 2018	Q3 2018	Q4 2018
Small Business Energy Saver	Report			M&V	Report			
Smart $aver® Custom					M&V	Report		
Smart $aver® Prescriptive							M&V	Report
PowerShare®	Report		M&V	M&V	Report			

LEGEND	
M&V	Plan Development and Data collection (surveys, interviews, onsite visits, billing data) and analysis
Report	Evaluation Report

[1] Note: evaluation report dates are subject to change. Those programs without reports scheduled in 2017 and 2018 have EM&V activities planned during those time periods.

Description of Planned Evaluation Activities by Program

Duke Energy Ohio has contracted with several independent, third-party evaluation consultants for each program in the portfolio to provide the appropriate Evaluation, Measurement & Verification support for planned evaluations. The work performed by the evaluation consultant varies by program and includes the development of a complete evaluation plan and the implementation of that plan to collect data and conduct impact evaluation analysis to estimate energy and demand savings resulting from the program. If included in the plan, the evaluation consultant conducts data collection and analysis for process evaluation to provide unbiased information on past program performance, current implementation strategies and opportunities for future improvements. The following section provides general descriptions of the current plans, which are subject to change in the complete evaluation plans.

Residential Programs

Energy Education Program for Schools
Evaluation, measurement and verification actions will provide an independent, third-party report of energy savings attributable to the program including an impact analysis and process evaluation.

The process evaluation is planned to include program manager, implementer and teacher surveys/interviews to assess program operations, and student family surveys to assess program awareness, satisfaction, and compliance with installations and recommendations. For the theater component, the process evaluation is planned to consist of interviews with school administrators and a review of the theatrical presentation and program operations. A statistically representative sample of participants will be selected for the analysis.

The impact analysis is planned to consist of a billing analysis to determine program impacts. An engineering analysis is also planned to be conducted using data collected through the participant survey. This analysis will provide measure level savings to offer insight into individual measure contributions to overall program impacts. While the billing analysis approach provides net savings, net-to-gross estimates are planned to be calculated for program management and information purposes using customer responses from the participant surveys at the measure level. Free-ridership and spillover are expected to be part of the net-to-gross analysis.

Low Income Neighborhood
Evaluation, measurement and verification actions will provide an independent, third-party report of energy savings attributable to the program including an impact analysis and process evaluation.

The impact analysis is planned to consist of a billing analysis to determine program impacts using a comparison of treated homes versus a comparison group of not-yet-treated homes. An engineering analysis is also planned to be conducted using data collected through the participant survey. This analysis will provide measure level savings to offer insight into individual measure contributions to overall program impacts. The billing analysis approach will incorporate the effects of both free ridership and spillover, thus providing program net savings. Since the billing analysis incorporates the effects of free ridership and spillover, a separate net-to-gross analysis is not included in the evaluation.

The process evaluation is planned to include a participant survey to collect information on energy efficiency actions taken as a result of the program, prior intentions, and changes in other major end uses, changes in household occupancy, persistence and program satisfaction. A statistically representative sample of participants will be selected for analysis. In addition, the process evaluation is planned to include program manager and implementer interviews to assess program operations, and program and measure satisfaction.

Low Income Weatherization (Pay for Performance)
The pilot evaluation, measurement and verification report provided an independent, third-party report of energy savings attributable to the program including an impact evaluation.

The impact analysis consisted of a review of program tracking data, measure installation verification reports from the independent inspector, and work-papers supporting the deemed energy savings values assigned to each measure. The program will be filed in 2017. No evaluation is planned for 2016.

My Home Energy Report (MyHER)
Evaluation, measurement and verification actions will provide an independent, third-party report of energy savings attributable to the program including an impact analysis and process evaluation.

The MyHER program involves a control group of customers that is randomly assigned to be used in the impact analysis. The impact evaluation is planned to consist of a billing analysis, specifically a difference in differences regression model to estimate impacts of the treatment group versus the control group. Differences in impacts between the two groups are attributed to the MyHER program. Incremental uptake of energy efficiency measures will be used to adjust savings to be net of other Duke Energy energy efficiency programs.

The process evaluation is planned to include program manager and implementer interviews to assess program effectiveness. A participant survey will be used to collect information on energy efficiency actions taken as a result of the program, prior intentions, and changes in other major end uses, changes in household occupancy, persistence and program satisfaction. A statistically representative sample of participants will be selected for analysis.

Residential Energy Assessments

Evaluation, measurement and verification actions will provide an independent, third-party report of energy savings attributable to the program including an impact analysis and process evaluation.

The impacts analysis includes the verification of deemed savings estimates via an engineering analysis of savings assumptions and calculations. Participant surveys are used to verify installation and in-service rates for each measure. The evaluators use a billing analysis to estimate energy savings and a combination of billing analysis results and engineering analysis to estimate peak demand savings.

The process evaluation is planned to employ program staff interviews and participant surveys. Participant survey questions include perceived barriers to program participation, marketing and outreach tactics, and program satisfaction.

Residential Smart $aver®: HVAC

Evaluation, measurement and verification actions will provide an independent, third-party report of energy savings attributable to the program including an impact analysis and process evaluation.

The impact evaluation utilizes a multi-faceted technique for estimating savings:

- **Engineering Calculations:** The evaluation team may utilize engineering algorithms with field measurement and verification parameters to estimate energy consumption and savings.
- **Billing Analysis:** Comparison of consumption interval data in a baseline environment (prior to program influence) to post-program engagement, utilizing the collected interval data at the premise level. Model specifications derived from statistical regressions will consider normalized temperatures and occupancy, where practical.
- **Deemed Savings:** In some limited cases, the evaluation team may utilize deemed per-unit savings estimates from Ohio technical reference manual, as needed.

The process evaluation includes interviews with program staff, program implementer, and most-active trade allies. Surveys will be conducted among less-active trade allies and with participants to estimate free-ridership and uncover potential issues that might impact customer satisfaction or program effectiveness. A statistically representative sample of participants will be selected for the analysis.

Residential Smart $aver®: Residential Lighting

Evaluation, measurement and verification actions will provide an independent, third-party report of energy savings attributable to the program including an impact analysis and process evaluation.

The impact analysis is planned to use an engineering analysis to determine program savings, utilizing the savings algorithms and parameters provided by the Ohio TRM, with updated values of some parameters using data collected through a participant survey and an engineering analysis. A statistically representative sample of participants will be selected for the analysis. In addition, the impact analysis will include an hours-of-use study to estimate hours of use and coincidence factors for LEDs among DEO program participants.

The process evaluation is planned to include program staff interviews and participants to estimate net-to-gross and uncover potential issues that might impact customer satisfaction or program effectiveness. A statistically representative sample of participants will be selected for the analysis.

Residential Smart $aver®: Multi-Family

Evaluation, measurement and verification actions will provide an independent, third-party report of energy savings attributable to the program including an impact analysis and process evaluation.

The impact analysis is planned to consist of an engineering analysis, utilizing data collected during on-site field verification of program measures. The analysis will stratify the field verification sample by measure type, and include a sufficient number of properties and housing units within each property to gather representative information for the program.

The process evaluation is planned to include program manager, implementer interviews to assess program operations, and property manager and tenant surveys to estimate net-to-gross, assess program awareness and satisfaction. A statistically representative sample of participants will be selected for analysis.

Residential Smart $aver: Save Energy & Water

Evaluation, measurement and verification actions will provide an independent, third-party report of energy savings attributable to the program including an impact analysis and process evaluation.

The impact analysis is planned to use an engineering analysis to determine program savings, utilizing the savings algorithms and parameters provided by the Ohio TRM, with updated values of some parameters using data collected through a participant survey and an engineering analysis. A statistically representative sample of participants will be selected for the analysis.

The process evaluation is planned to include program staff interviews and participants to estimate net-to-gross and uncover potential issues that might impact customer satisfaction or program effectiveness. A statistically representative sample of participants will be selected for the analysis.

Power Manager (Demand Response)

Evaluation, measurement and verification actions will provide an independent, third-party report of demand savings attributable to the program.

The impact evaluation will be conducted using smart meter data and a randomized control trial design. The combination of smart meter data and a randomized control trial yields extremely precise estimates of demand reductions at substantial savings in comparison to end use data collection. It also enables side by side testing of operational strategies and side by side testing of the effect of event dispatch timing on demand reductions.

A process evaluation was conducted in 2016 which included post-event surveys. There will not be a process component in the 2017 evaluation.

Non-Residential Programs

Small Business Energy Saver
Evaluation, measurement and verification actions will provide an independent, third-party report of energy savings attributable to the program including an impact analysis and process evaluation.

The impact analysis is planned to consist of a detailed engineering analysis to estimate impacts. Depending on the distribution of installed measure types, the projects may be stratified into groups and then a sample selected for on-site verification of equipment installation and inputs to the engineering savings estimates.

The process evaluation is planned to include program staff interviews, implementation contractor interviews, and participant surveys to assess correlations between reductions in consumption and certain behavior changes and equipment purchases. The participant survey will be used collect data to estimate net-to-gross for the program.

Smart $aver® Non-Residential Custom
Evaluation, measurement and verification actions will provide an independent, third-party report of energy savings attributable to the program including an impact analysis and process evaluation.

The impact analysis for the Smart $aver Custom program is planned to use a statistically representative sample of participating projects. A blend of selective monitoring and site visits will be performed at each of the selected sample set projects, with engineering-based estimation.

The Process evaluation is planned to include participant surveys to collect information needed to estimate net impacts and participants will be asked about equipment that was replaced, energy efficiency actions taken, prior intentions regarding these measures, changes in other major end uses that impact energy consumption, hours of facility operation, persistence and program satisfaction. A statistically representative sample of participants will be selected for the analysis.

Smart $aver® Non-Residential Prescriptive
Evaluation, measurement and verification actions will provide an independent, third-party report of energy savings attributable to the program including an impact analysis and process evaluation.

The impact analysis for the Smart $aver Prescriptive program is planned to use a statistically representative samples of participants. A sample of facilities will receive a combination of selective monitoring and site visits to develop an engineering-based estimation

The process evaluation is planned to include participant surveys to collect information needed to estimate net impacts, as well as to ask about equipment that was replaced, energy efficiency actions taken, prior intentions regarding these measures, changes in other major end uses that impact energy consumption, hours of facility operation, persistence and program satisfaction. A statistically representative sample of participants will be selected for the analysis. In addition, surveys will be conducted among trade allies' to determine installation practices and the effect, if any, the Smart $aver® Program had on their installation practices to estimate spillover associated with trade allies.

PowerShare® (Demand Response)
The impact analysis is planned to measure and evaluate the short-term changes in load due to the potential and actual interruption of activity or start of on-site generation. The evaluation research includes the collection and processing of interval consumption data and analysis of actual event day load response by program participants.

APPENDIX D

Impact and Process Evaluation of the 2015 Power Manager Program®
Duke Energy Ohio

Final - March 23, 2016

Duke Energy Ohio
139 East 4th Street
Cincinnati, Ohio 45202

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Prepared by:

Cadmus

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Executive Summary

Duke Energy engaged Cadmus to perform a process evaluation and assess the results of Duke Energy Ohio's (DEO) impact evaluation of its Power Manager Program in Ohio. This report outlines the Program Year 2015 (PY2015) impact and process evaluation findings for the evaluation period of May 1, 2015, through April 30, 2016.

Cadmus' process evaluation included interviews with Duke Energy program managers and two sets of surveys with program participants. We fielded the event/non-event survey in the summer, immediately following curtailment events (event) and high temperature days without events (non-event), that was focused on customer response to events. We fielded a participant survey after the end of the cooling season that was focused on the overall participant experience, including topics such as awareness, enrollment, and household demographics.

For the PY2015 impact evaluation, DEO used a variety of commonly accepted, utility industry statistical practices and applications to measure and report program results. These included sample selection and validation, air conditioner duty cycle modeling, model simulations, switch device operability analysis, weather normalization, and monthly capability weighting of expected capacity. As an independent, third-party evaluator, Cadmus reviewed DEO's approaches as commensurate with standard evaluation, measurement, and verification (EM&V) industry practice.

A. Program Description

Power Manager is a voluntary residential load control program available to DEO homeowners with qualified central air conditioning. Each year, program customers receive a monthly bill credit for participating during the summer months of May through September. Participants agree to allow DEO to cycle their air conditioning units during peak periods of energy demand, when energy costs are high, or for emergency purposes when a program-induced full-shed period would aid in the reliability of delivering energy to the region. As shown in Table 1, 44,978 customers participated in PY2015.

Table 1. PY2015 Program Participation as of September 30st, 2015

Enrolled Customers	Enrolled Switches
44,978 total	47,527 total
1.5 kW option: 6,679	1.5 kW option: 7,015
1.0 kW option: 38,237	1.0 kW option: 40,446
0.5 kW option: 62	0.5 kW option[1]: 66

[1] 0.5 kW option is offered to customer who would otherwise cancel participation in the program. It is not an option available to all customers at enrollment. Due to such a small impact and low customer count, the impacts are not calculated for these customers or included in capacity numbers.

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B. High-Level Process Findings

Awareness and Response to Curtailment Events

Only 40% (event/non-event survey n=172) of surveyed participants were aware that their Power Manager devices have been activated since they joined the program. Among event respondents, only 11% (n=66) of those who were at home during the event time period were aware that their device had been activated, which is statistically significantly higher than the 3% (n=36) of non-event survey respondents at home on high temperature days without events who believed there had been an event when there was not.

Similar numbers of respondents who were surveyed after events (13%, n=62) and after high temperature days without events (6%, n=36) reported that comfort levels in their home declined on the afternoon of the event or high temperature day, respectively. Among those that reported a decline in comfort (event/non-event survey n=10), the average comfort ratings declined from 8.3 before the event time period to 5.5 during the event time period, and most respondents blamed rising temperatures for their decline in comfort. Only 2% (n=102) of event survey respondents reported that the activation of their Power Manager device had caused a decline in their comfort; this finding is not significantly different from the 0% (n=70) of non-event survey respondents who reported that activation of their Power Manager device had caused a decline in their comfort during the equivalent afternoon time period.

There are no statistically significant differences in awareness of events, decline in comfort during event time periods, or associating Power Manager device activation with a decline in comfort between PY2015 and PY2013 event/non-event surveys.

More than a third of the respondents who we surveyed after the end of the cooling season (participant survey 38%, n=84) reported that they run electric fans in their home “always” or “most of the time” on weekday afternoons when the outdoor temperature is over 90°F. This is lower than the actual rate of electric fan use measured from responses to surveys conducted on hot days during the cooling season (event/non-event surveys 52%, n=104).

Only 6% (event/non-event survey n=101) of respondents adjusted their thermostats downward during the event time period, and 9% (event/non-event survey n=104) turned on electric fans during the event time period. There were no significant differences between those surveyed following events and those surveyed following high temperature days without events.

Air Conditioner Use and Maintenance

Three-quarters of respondents (participant survey 73%, n=84) reported that they use air conditioning on “most days” or “every day” during the cooling season, and 77% (n=82) reported that their home is typically occupied on weekday afternoons before 6:00 p.m. This is slightly higher than the actual summertime survey result that 61% (event/non-event survey n=172) of surveyed households were occupied during the event time period.

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Only 42% (participant survey n=84) of respondents manually adjust their thermostat, while the majority either have programmed settings or leave the thermostat at the same setting all the time. Respondents' median thermostat set point for every time period during the week was 73°F to 75°F.

Two-thirds of respondents (participant survey 68%, n=80) have had maintenance performed on their air conditioning unit since joining Power Manager. Only 2% of these respondents (participant survey n=54) reported that their Power Manager device had been disconnected during maintenance and not re-connected afterwards, although 67% were not sure if their device had been disconnected or not.

Motivation for Enrollment and Understanding of the Program

The most common main reason given by participants for enrolling in Power Manager was the bill credits (participant survey 34%, n=74) followed by saving money through lower utility bills (30%).

Only 14% (participant survey n=83) indicated that something was unclear to them about how the program works, and 1% (participant survey n=83) contacted Duke Energy to find out more about the program. However, 76% (participant survey n=84) could not estimate how much they receive in bill credits from Power Manager, 69% did not know if they had received any bill credits during 2015, and 83% did not know how many events to expect per year.

Program and Utility Satisfaction

The PY2015 participant satisfaction ratings are similar to past years. In the participant survey, most respondents (58%, n=71) were "very satisfied" while only 3% were "somewhat dissatisfied" or "very dissatisfied." The result from the event/non-event survey was very similar, with 57% (n=158) of respondents giving the program a rating of "very satisfied" and only 3% giving "somewhat dissatisfied" or "very dissatisfied" ratings. Fifty-one percent (n=84) of participant survey respondents gave "very satisfied" ratings for Duke Energy overall, and only 6% were "somewhat dissatisfied" or "very dissatisfied."

The average rating for satisfaction with Power Manager using a 10-point scale was 8.5 in the participant survey (n=74) and 8.4 in the event/non-event survey (n=157). Participants' average rating for their likelihood of recommending the program were 8.4 in the participant survey (n=145) and 8.1 in the event/non-event survey (n=69). Participant survey respondents gave Duke Energy an overall satisfaction rating of 8.3 (n=84) and event/non-event respondents gave an overall rating of 8.4 (n=169).

There were no statistically significant differences in satisfaction or recommendation ratings between participants who were surveyed following curtailment events and those who were surveyed following high temperature days without events.

C. *High-Level Impact Findings*

DEO conducted the impact analysis of the Power Manager Program. Cadmus reviewed the results presented in this report as well as a spreadsheet with a sample of impact figures to ensure proper methodology.

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The section summarizes DEO's key findings for the evaluation period.

- There were 47,527 active switches installed at the end of September 2015
- The DEO operability study conducted in 2013 revealed that Power Manager switch devices were operational at a 85.4% rate (see Table 2)
- For PY2015, the total summer Power Manager Program capacity at the plant, adjusted for peak normal weather and de-rated for operability, was 50.29 MW
- During PY2015, there were five (5) Power Manager events and two (2) test events in DEO.

Table 2. PY2015 Program Summary Table

Program Year	Active Switches as of September 30st, 2015	Summer Capacity	Operability Rate
PY2015	47,527	50.29 MW	85.4%

D. Conclusions and Recommendations

The Power Manager Program is successful as measured by multiple metrics. Participants report they are satisfied with the program, are generally not aware of curtailment events, and that events do not have a significant effect on their home comfort or on their satisfaction with the program. Additionally, participants who experience an event are not more likely to take counter-actions such as lowering thermostat temperatures, turning on secondary window or wall units, or turning on electric fans than they were on days of equivalent high temperature but no curtailment event.

While the program is functioning well overall, the evaluations revealed potential areas Duke Energy could explore to further refine program operations or expand program benefits. Following are the conclusions and recommendations resulting from Cadmus' process evaluation and DEO's impact evaluation activities.

Conclusion #1: **Participants' main motivations for enrolling in Power Manager are monetary, however few were aware of any details about these benefits.** Participant responses indicate that bill credits and lower bills motivated their participation in the program, however few participants know how much bill credit to expect, or whether they have been receiving any bill credit.

Recommendation #1: **Consider exploring payment options and marketing opportunities to raise awareness of Power Manager bill credits.**

Conclusion #2: **Monitoring customer experience through annual event/non-event surveys enhances understanding of program affects during specific summer conditions.** During PY2015, customers in the Midwest experienced moderate summer weather compared to other recent years (in general PY2012 was hotter and PY2014 was cooler). More extreme summer weather may affect participants differently, so results for a given year's surveys may not be predictive of other years. Since the scope of summer weather cannot be predicted in advance, event/non-event surveys should be fielded every year.

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Recommendation #2: **Continue fielding event/non-event surveys to gauge customer response to curtailment events.**

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Introduction

Power Manager is a voluntary residential load control program available to DEO homeowners with qualified central air conditioning. Each year, program customers receive bill credits for participating during the summer months of June through September. Participants agree to allow DEO to cycle their air conditioning units during peak periods of energy demand, when energy costs are high, or for emergency purposes when a program-induced full-shed period would aid in the reliability of delivering energy to the region.

Through the program, DEO allows customers to select a target load reduction of either 1.0 kW or 1.5 kW. During an event, DEO could cycle air conditioners on the 1.5 kW option off for a few minutes longer than the 30 minutes allowed for the 1.0 kW option units. Customers with more than one central air conditioner must have all units controlled in order to participate.

Two types of events may be called for a Power Manager event. First, economic events can be called on days where energy demand and/or energy costs are expected to be high, but there is not necessarily significant concern about system reliability. Second, emergency events can be called by the PJM Regional Transmission Organization when high energy usage on hot days or other conditions threaten the reliability of the transmission system. For such an event, participants' units would be cycled off and on for the duration of the Power Manager emergency event.

Power Manager participants are allowed to opt out of one event per calendar month, by notifying Duke Energy 24 hours in advance through a toll free number.

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Process Evaluation

E. Methodology

The intent of our process evaluation was to document how well the program worked in practice, in order to identify and understand important influences on program operations and overall performance. Cadmus assessed the program strengths, weaknesses, areas for improvement, and use of best practices. As part of the process evaluation, we interviewed Duke Energy program staff and surveyed participants/customers (Table 4 lists the sample populations).

Program Manager Interviews

Cadmus interviewed Duke Energy staff that lead the Power Manager Program for Ohio and the larger Midwest region, to discuss the following research areas:

- Program design and implementation;
- Marketing;
- Enrollment processes;
- Event Calls;
- Quality control.

Participant and Event/Non-Event Surveys

Cadmus fielded two surveys to capture customer feedback; the first was an online participant survey (participant survey) about program participation fielded in the fall, at the end of the cooling season. For the second survey, we conducted telephone calls during the cooling season immediately following curtailment events and hot days without events (event/non-event surveys).

Participant Survey and Sample Design

Cadmus developed a customer survey for Power Manager Program participants, and lauched this via an online platform, Qualtrics, between November 12 and November 24, 2015. The survey timing was after participants had experienced control events during the summer of 2015. We randomly selected 2,000 program participants from the population of 41,895 contactable[2] participants in DEO territory, and

[2] A participant was considered contactable if all of the following were true: (1) the program record included a person's name (not a business or organization), (2) the program record included a telephone number, (3) the customer was not enrolled in the Power Manager Research Group, (4) the customer was not on Duke Energy's do-not-call list, and (5) the customer had not been contacted for any other evaluation surveys in the previous six months.

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invited 854 of those customers with a valid email address to take the survey. Cadmus closed the online survey after two weeks, when we had a sample large enough to meet the targeted precision level.[3]

Event/Non-Event Survey and Sample Design

Cadmus conducted telephone surveys immediately after program control events to collect participant information. We maintained these surveys in a "ready-to-launch" status until being notified of a curtailment event affecting switches used by Duke Energy. Then we launched the surveys following the end of the control event, and continued them until the next evening, attempting all calls during regular surveying hours (10:00 a.m. to 8:00 p.m. Eastern Standard Time [EST], Monday through Saturday). For example, if a control event occurred on a Monday and ended at 5:00 p.m., survey calling hours for that particular event would be:

- Monday 5:00 p.m. – 8:00 p.m. and
- Tuesday 10:00 a.m. – 8:00 p.m.

Cadmus made event survey calls following curtailment events on July 17, July 28, July 29, and September 1, 2015 (the September 1 event was a one-hour PJM test event). We surveyed 102 participants in DEO territory (20 following the PJM test event and 82 following regular events), exceeding the target needed to meet a minimum ±10% precision with 90% confidence for the event survey respondents.

Cadmus also surveyed Power Manager participants on hot days without events. Since there was no activation period for these non-event surveys, we asked respondents about their activities and comfort level between 2:00 p.m. and 5:00 p.m. on the day of high temperature, a time period that is similar to the normal curtailment event time periods. We conducted the non-event surveys following non-event days when the outdoor high temperature was at least 90°F (September 2, September 3, and September 8, 2015). Cadmus surveyed 70 participants in DEO territory, exceeding the target needed to meet a minimum ±10% precision with 90% confidence for the non-event survey respondents.

The schedule of Power Manager event/non-event surveys for DEO are shown in Table 3, along with the high temperatures on those dates.[4]

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[3] Based on the size of the population being surveyed, a sample of at least 68 respondents was necessary to achieve a precision of ±10% or better with 90% confidence. Although the survey achieved the sampling goal of 90/10, precision estimates vary for individual survey questions depending on the number of respondents who answered the individual question and the distribution of their responses.

[4] These high temperatures were recorded at the Cincinnati/Northern Kentucky International airport (airport code CVG) for those dates, as reported in the historical temperature data archive at http://www.wunderground.com/.

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Table 3. Schedule of PY2015 DEO Events and Non-Event High Temperature Days

Event ID	Type	2015 Event or Non-Event Date	Event Hours	2015 Survey Dates	Completed Surveys	High Temp-erature
OH-event1	Event	July 17	2:30 – 4:00 p.m.	July 17-18	34	89
OH-event2	Event	July 28	3:30 – 6:00 p.m.	July 28-29	27	92
OH-event3	Event	July 29	2:30 – 5:00 p.m.	July 30	21	91
OH-event4	Event (1 hour PJM test event)	September 1	3:30 – 5:00 p.m.	September 1-2	20	89
OH-nonevent1	Non-event	September 2	N/A	September 3	18	90
OH-nonevent2	Non-event	September 3	N/A	September 3-4	18	92
OH-nonevent3	Non-event	September 8	N/A	September 8-9	34	90

Survey Response Rates and Precision

Table 4 summarizes the response rates and achieved precision levels for the participant surveys and event/non-event surveys. Cadmus exceded the targeted number of completed surveys for all respondent groups.

Table 4. Process Evaluation Data Collection and Analysis

Evaluation Component	Population	Attempted Contacts	Achieved Completes	Response Rate	Precision at 90% Confidence
Program Managment Staff	N/A	1	1	1	N/A
Participating Customers - Participant Surveys	44,764	854	84	10%	±9.0%
Participating Customers - Event/Non-Event Surveys	44,764	2,771	172 (102 event, 70 non-event)	6%	±6.3% all surveys ±8.1% event ±9.8% non-event

F. Program Manger Interviews

Cadmus interviewed the program manager to gain an in-depth understanding of the program and to identify its successes and challenges. Results of these discussions follow below, presented by topic.

Program Design and Implementation

DEO calls Power Manager events in order to reduce load when there is peak demand. Although the program manager for the Midwest manages three territories, program operations are specific to each, based on different program goals, state regulations, and technology infrastructure.

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The program manager reports that GoodCents is the contractor that installs, removes, and maintains switches for Power Manager in the Midwest. Duke Energy maintains the pager system which transmits control signals to switches, rather than using a contractor for this service.

The program manager reported that Duke Energy is seeking to maintain the load reduction capacity of the program in Ohio.

Marketing

The program manager reported that during PY2015, most outreach for the Power Manager Program was conducted through outbound calling using vendor CustomerLink. The program manager reported that telephone contact has increased the recruitment rate because customers are able to pose questions directly to a representative.

This point was further illustrated when a mail marketing effort to 10,000 customers in June 2015 in conjunction with the HōM Energy Manager Program resulted in only 24 new enrollments. The program manager said that since the Power Manager and HōM programs are both more complicated than most energy efficiency programs, customers are less likely to enroll without being able to ask a representative their program questions.

At this time, Duke Energy does not co-brand or co-market Power Manager with other energy efficiency programs. The program manager stated that a future goal for the utility is to leverage AMI data to target customers for demand response quality control inspections.

Historically, mailings from Duke Energy were the most important channel for recruiting customers to enroll in the program, and most of the current participants recalled learning about the program through the mail (see Figure 1 in the Program Awareness section below).

Enrollment Process

Customers may enroll in Power Manager over the phone, by mail, e-mail, or online. During PY2015, DEO focused on recruiting new participants using telephone and e-mail channels. Once the customer provides their enrollment information, installation vendor GoodCents is able to transmit the information automatically to their work management system.

The current participant dropout rate is around 1% per year according to the Duke Energy program manager, although the rate of recruiting new participants is similarly low. There were 43,928 Ohio customers enrolled in Power Manager according to the PY2013 evaluation, and there were 44,764 participating customers in PY2015, for a net increase of 1.9% over two years.

Duke Energy pays customers who enroll in Power Manager a one-time incentive of $35 for choosing the 1.5 kW option, or $25 for choosing the 1.0 kW option. Duke Energy also provides a minimum annual bill credit for participating in the program of $8.00 per device for the 1.5 kW option, $5 for the 1.0 kW

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option, and $3.00 for the 0.5 kW option.[5] Monthly bill credits are calculated and paid throughout the cooling season as events occur, based on the customers' kW option, the length of events, and price of electricity. However, recent summers have had relatively few high temperature days, and therefore there have been fewer curtailment events. For several years, Ohio participants have been receiving the minimum annual credit, with the balance due after summer monthly payments are applied to their final bill of the season (usually received in October). Current marketing practices do not focus on energy or monetary savings since the program does not deliver significant savings in either of these areas.

Event Calls

Duke Energy program managers meet weekly with their Demand Response Team and company market price planners to determine whether to call an economic curtailment event. Key inputs for this decision include the wholesale price of generation capacity, local weather forecasts (including high temperatures, humidity, and storm activity), as well as Duke Energy's capacity needs and any extraneous considerations such as local outages or maintenance on transmission lines. The program manager reports that the customer experience is a key consideration, and close attention is paid to the length and frequency of events so as to minimize any inconvenience to participants. Events are timed to maximize their impact by activating switches during peak demand hours for the service territory, which is most often from 2:30 p.m. to 5:00 p.m. EST in the DEO territory.

For the PY2015 cooling season, Duke Energy called five curtailment events for the general population of participants: one event occurred on July 17, 2015, two occurred on the consecutive days July 28 and 29, 2015, a PJM test event occurred on September 1, 2015 and the last event occurred on September 4, 2015. Duke Energy also called three curtailment events for their logger research group, which did not affect most program participants.[6]

Quality Control

DEO assures quality for all aspects of the program through internal monitoring and study, and through implementer activities.

Duke Energy staff is able to monitor the load reduction impact of curtailment events in nearly real-time, by observing internal load shapes provided by the utility's system operating center.

Duke Energy performed switch operability and air conditioner duty cycle studies in the past, but operability studies will be performed by Nexant beginning in PY2016.

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5 Customers may not enroll in the program at the 0.5 kW level, but if a participant asks to have their Power Manager device removed, the customer service representative will offer them the option of reducing their kW option instead of leaving the program. Thus, there is a monthly minimum annual payment for the 0.5 kW option, but no enrollment incentive (as these customers were already enrolled and had received an incentive at that time). For PY2015, only 61 Ohio customers were enrolled at the 0.5 kW level.

6 Cadmus removed these research group participants from the survey sample.

The scope of work for program implementer GoodCents was revised effective January 1, 2016, to provide additional checks and balances to improve data entry, verification and reporting. These changes include a new work order management system.

In response to past disruptions in the supply chain affecting the availability of Eaton Cooper switches, Duke Energy maintains an inventory of switches sufficient to supply the program for at least three months. The program manager reports that this was done because they cannot control extraneous events that affect the global supply chain, and also that the switch availability has improved in PY2015.

G. Participant Surveys

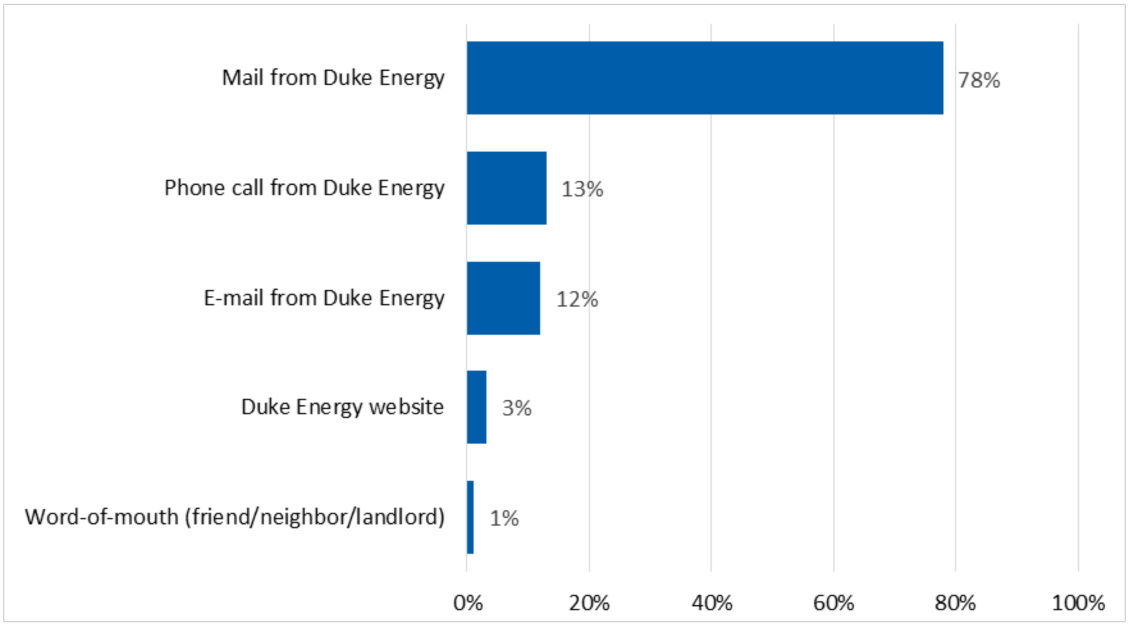
Cadmus analyzed feedback from online surveys completed by 84 Duke Energy customers who participated in the Power Manager Program in PY2015. These participant surveys were designed to cover program-level topics such as awareness, enrollment, and household demographics that are not related to specific curtailment events. Power Manager event/non-event surveys are summarized separately, in the Event/Non-Event Surveys section of this report.

This section presents the results of our analysis by topic. Except where noted, we excluded "don't know" and "refused" responses, which is reflected in accompanying n-values.

Program Awareness

In order to qualify for the survey, respondents had to confirm that they were aware of their household's participation in the Power Manager Program. Most survey respondents (94%; n=79) were involved in their household's decision to participate in the program, while 1% were not involved and 5% joined the program by moving into a home that already had a Power Manager device installed by a previous occupant. Figure 1 shows that most participants who were involved in the decision to join the program first learned about Power Manager through mailings from Duke Energy (78%), with the next most common channels being phone calls (13%) and emails (12%) from Duke Energy .

Figure 1. Source of Power Manager Program Awareness



Source: Participant Survey Question B2. How did you hear about the Power Manager Program? Multiple responses permitted (n=69 respondents involved in household decision to join program).

Program Enrollment

Cadmus asked participants who were involved in the decision to join the program for the reasons they joined the program, first giving a single main reason, then any additional reasons (shown in Figure 2). About one-third (30%; n=74) of respondents mentioned saving money through lower utility bills as their main reason for joining the program, but the largest response was 34% who specifically mentioned the bill credits. Respondents also mentioned saving energy (18%) and avoiding power shortages (12%). When all reasons are combined, saving money, bill credits, and saving energy were each mentioned by 50% or more of survey respondents, followed by 39% who mentioned avoiding power shortages. Eleven percent mentioned building fewer power plants, and only 5% mentioned helping the environment as a reason for their participation.

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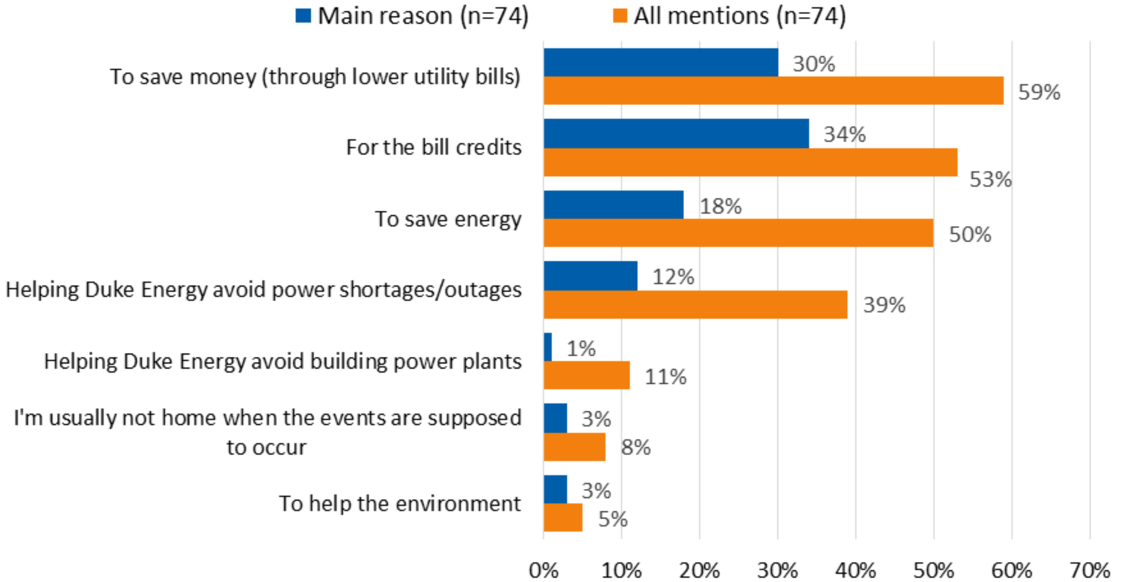
Figure 2. Reasons for Joining the Power Manager Program



Source: Participant Survey Questions B3 and B4. What was the main reason why you chose to participate in the program? (single response) and Were there any other reasons why you chose to participate in this program? (multiple response permitted; n=74 respondents involved in household decision to join program).

Cadmus asked the four respondents who mentioned helping the environment as a reason for their participation what they meant by this response, and only one provided an explanation, saying: “we waste a lot of unnecessary energy.”

We asked respondents who were involved in their household’s enrollment to rate their satisfaction with the enrollment process on a 10-point scale, where 10 is very satisfied and 0 is very dissatisfied. Most (76%; n=71) gave a high rating of 9 or 10, and the overall mean rating was 9.0. Only two participants surveyed in Ohio rated their satisfaction with enrollment lower than 5. When we asked for the reason(s) for their dissatisfaction, one respondent, who gave a rating of 0, said, “They just informed us that they were doing it, and that was it; I don't remember it being a choice.” The other respondent gave a rating of 4, but did not explain the reason for this rating.

Understanding of the Program

During the time of program enrollment, Duke Energy provides new participants with information about how the program works. When asked if they recalled this information, 81% (n=74) of respondents confirmed that they did.[7]

[7] We did not ask this question of participants who joined the program by moving into a home that already had a device installed by a previous occupant.

For respondents who recalled receiving information about the program, we asked them to rate their satisfaction with the information they received on a 10-point scale, where 10 is very satisfied and 0 is very dissatisfied. Seventy-two percent (n=58) gave a high rating of 9 or 10, and the overall mean rating was 8.9. Two respondents rated their satisfaction at 4 or less, both rating it as a 3, so we asked the reason for their low satisfaction. One of these respondents said, "I would like a report with my bill showing me the times that my air conditioner was turned off." The other respondent did not provide an explanation for their dissatisfaction.

When asked, 14% of respondents (n=83) indicated that something was unclear to them about how the program works. Four of these 12 respondents merely expressed a general lack of knowledge of "how the program works," while three specifically wanted to know when or how often their devices are activated, and three were concerned about a lack of notification or feedback from Duke Energy. Another respondent did not know where to look for program credits on their bill, and one recalled joining Power Manager but did not know if it was still ongoing. Some specific questions raised by respondents include:

- When are devices activated?
- How often are devices activated?
- How do participants know when devices are activated?
- Does Duke Energy notify participants when devices are activated?
- How does this program save energy?

Only one Ohio respondent (1%; n=83) reported having contacted Duke Energy to find out more about the Power Manager Program. This respondent used the telephone to reach a Duke Energy representative, but did not provide a rating for the ease of reaching a Duke Energy representative.

Bill Credits

Cadmus asked all survey respondents to estimate the total annual amount of bill credit they receive for participating in Power Manager, and 76% (n=84) did not know. Among the 24% who provided estimates, responses ranged from zero to $500, with an average estimate of $50.32 and median of $12.50.[8] These responses tend to overestimate the amount of annual bill credits.[9]

Only 19% (n=84) of respondents said they received bill credits during PY2015, while 12% said they did not receive any credit for the program, and 69% did not know if they had received any credit. Among those who recalled receiving bill credits, 31% (n=16) could not recall how many times they noticed a credit for Power Manager on their bill, while 25% recalled a credit on one bill, 31% recalled a credit on two bills, and 13% recalled a credit on three or more bills.

Awareness of Device Activation

Cadmus asked respondents how many times per year Duke Energy said they would activate the Power Manager device (i.e., call an event). Only 17% (n=83) of respondents were able to answer this question, while the rest did not know. Among those who answered, the number of expected events ranged from zero to "every day," with zero being the most common response (38%; n=8). The mean number of expected events was three per year and the median was 2.5 per year.

Only 24% (n=80) of surveyed participants were aware of any times their devices have been activated since they joined the program. Figure 3 shows that 44% of these respondents (n=18) reported that they could tell an event occurred because their air conditioning "shut down" temporarily, while 39% noticed credits for events on their bills, and 33% mentioned rising temperatures in the home. One respondent became aware of an event due to a power outage, saying, "My electric clocks were wrong."

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8 When we remove the respondent who estimated $500 in annual bill credits as an outlier, the average estimate from the remaining participants is $26.65, and the median is $10.

9 The minimum annual bill credits are $3.00 for the 0.5 kW target cycle option, $5.00 for the 1.0 kW option, and $8.00 for the 1.5 kW option. Monthly bill credits are calculated and paid throughout the cooling season as events occur, based on the customers' kW option, the length of events, and price of electricity. However, recent summers have had relatively few high temperature days, and therefore there have been fewer curtailment events. For several years, Ohio participants have only been receiving the minimum annual credit, with the balance due after summer monthly payments are applied to their final bill of the season (usually received in October). The one-time enrollment incentive is $25 for the 1.0 kW option and $35 for 1.5 kW (customers may not enroll at the 0.5 kW level).

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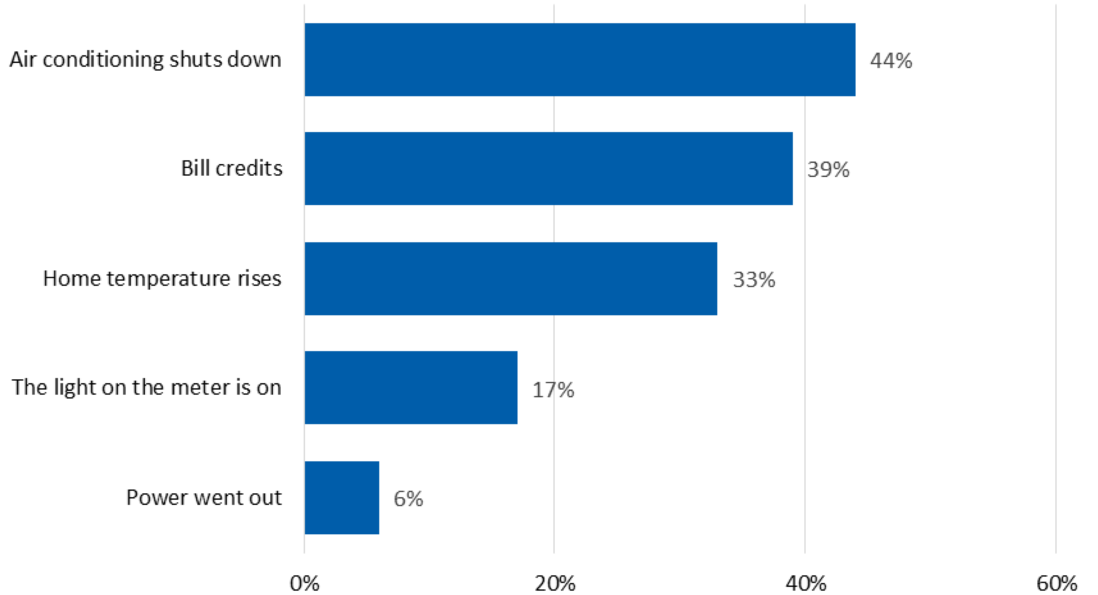
Figure 3. Reasons for Awareness of Device Activation



Source: Participant Survey Question D2. What happened that made you believe that the device had been activated? Multiple responses permitted (n=18 who were aware their device was activated).

Cadmus asked respondents who were aware of their devices being activated since joining the program how many times Duke Energy had activated their devices during the summer of 2015. Half of these respondents (47%; n=19) were able to provide a number, with estimates ranging from zero to 10 events, and an average estimate of 2.4 events with a median estimate of one event. Duke Energy called five curtailment events that affected the entire population of program participants in Ohio during PY2015.

We then asked these same respondents how long Duke Energy is controlling the air conditioning when devices are activated. A minority (37%; n=19) were able to answer the question, with responses ranging from 30 minutes to 4 hours. The mean estimate was that events last 1.9 hours and the median estimate was 2 hours, which closely matches the actual event lengths in PY2015 of 2.5 hours and 1.5 hours.

Cadmus also asked these same respondents who were aware of device activation what time of day events generally end. Only 37% (n=19) were able to answer the question, and their responses ranged from 2:00 p.m. to 10:00 p.m. Figure 4 shows the complete distribution of responses from those who were able to answer. The median response was 6:00 p.m., which corresponds to the latest PY2015 event end time that occurred in Ohio (other events ended earlier at 4:00 p.m. or 5:00 p.m.).

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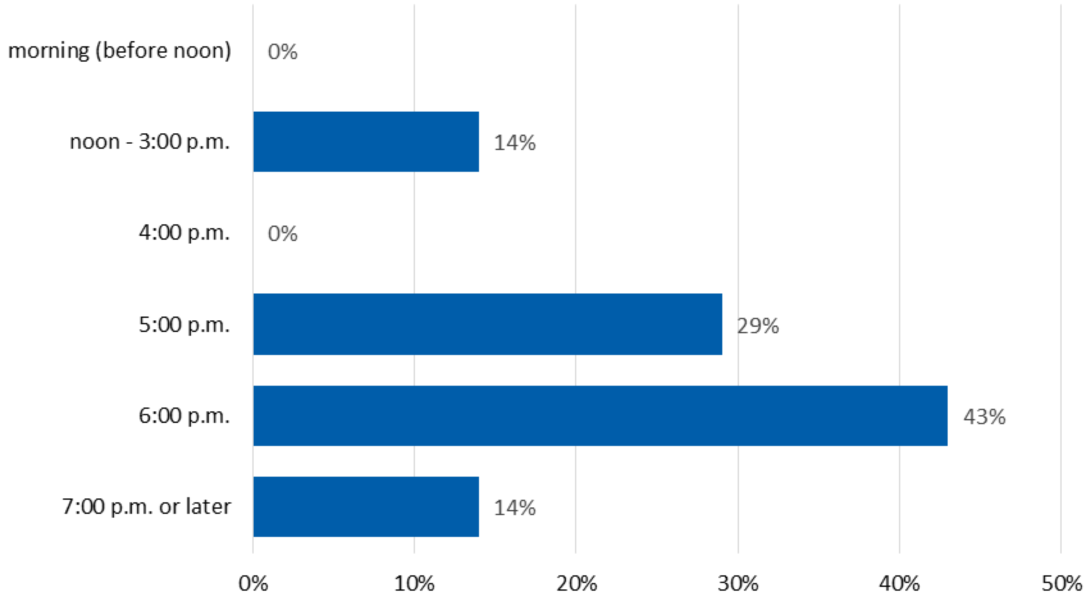
Figure 4. Respondents' Perception of When Events Typically End



Source: Participant Survey Question E7. On a day when Duke Energy activates your Power Manager device, at what time of day do you think that they usually de-activate the control devices and stop controlling your air conditioner? (n=7 who were aware of device activation).

Response to Device Activation

We asked respondents who were aware that their device has ever been activated if they were at home during any events that occurred during 2015, and nine said they were. These respondents rated the comfort level in their home before and during the period when they believe their devices were activated, using a scale of 0 to 10 where 0 means very uncomfortable and 10 means very comfortable. The average rating for comfort before the perceived event was 8.4, and the average comfort rating during the event was 7.9. Nearly half of these respondents (44%; n=9) reported that their comfort declined during the event, with the largest decline being 2 points on the 10-point rating scale.

Cadmus asked the four respondents who reported a decline in comfort during a PY2015 event what they thought had caused this decline, and all four cited rising indoor temperatures. We also asked these respondents how long it took for their comfort level to return to normal after they believe their device had been activated; two reported that it took less than one hour, and the other two said it took one to two hours.

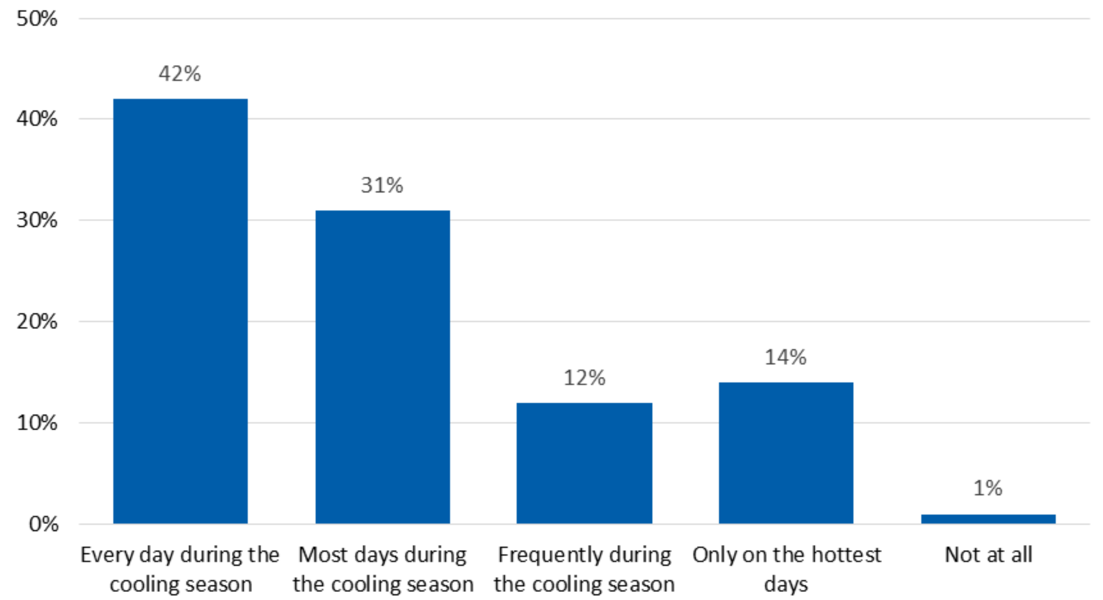
We asked all nine respondents who believe they were at home during an event in 2015 how many times device activation may have affected their comfort during the summer. Responses ranged from zero up to five times, with a mean of being affected 1.9 times and a median of one time.

Seven of the nine respondents who believe they were at home during a 2015 event did not do anything in response to the perceived device activation. One respondent turned on fans and another drank a cool beverage. None of the surveyed participants made thermostat adjustments during the event time period.

Air Conditioner Use

Survey respondents routinely use their air conditioners throughout the cooling season, and are therefore more likely to be affected by curtailment events. Figure 5 shows that 73% (n=84) of respondents use their air conditioning every day or most days during the cooling season, and only 1% said they do not use their air conditioning at all.

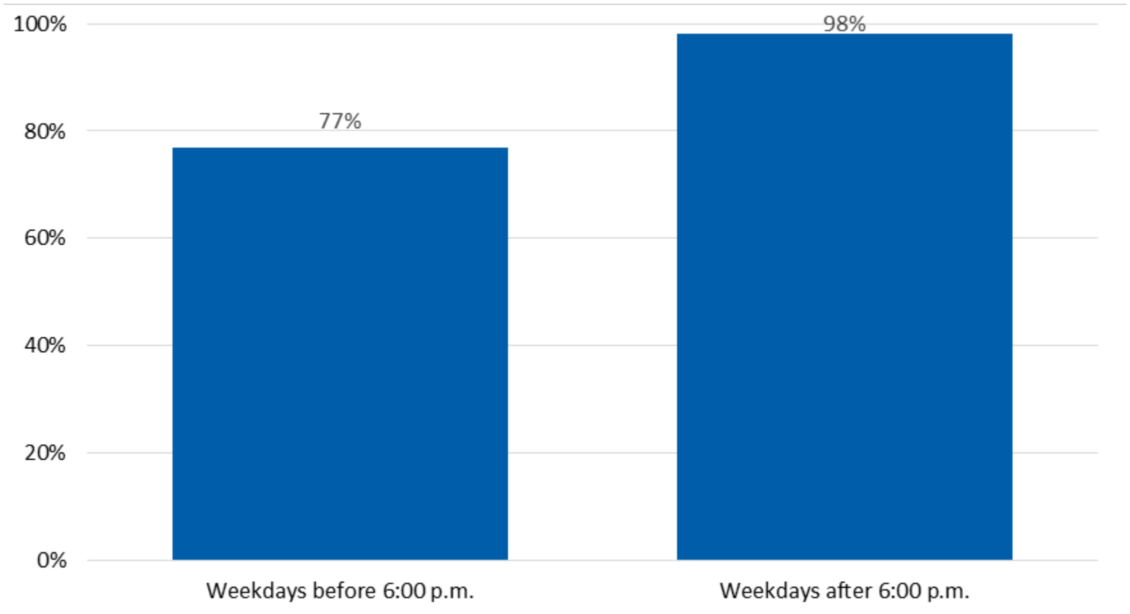
Figure 5. Respondents' Air Conditioner Use



Source: Participant Survey Question G1. How often do you use your central air conditioner? Would you say you use it ...? (n=84).

Figure 6 shows that 77% of surveyed participants (n=82) reported typically using their air conditioning to keep someone comfortable in the home on summer weekday afternoons before 6:00 p.m., and virtually all (98%; n=83) typically use air conditioning in the evenings after 6:00 p.m.

Figure 6. Air Conditioner Use by Time of Day



Source: Participant Survey Questions G6 and G7. Is the air conditioner typically used to keep someone at home comfortable during weekday summer afternoons before 6:00 p.m.? (n=82) and Is the air conditioner typically used to keep someone at home comfortable during weekday summer afternoons after 6:00 p.m.? (n=83).

Personal comfort levels vary, so Cadmus asked respondents at what outdoor temperature they start to feel uncomfortable in their home, and at what outdoor temperature they tend to turn on their air conditioner. Figure 7 indicates that the median outdoor temperature at which respondents start to become uncomfortable is around 80°F, and 99% (n=83) say they are uncomfortable when the outdoor temperatures reaches 88°F to 90°F.

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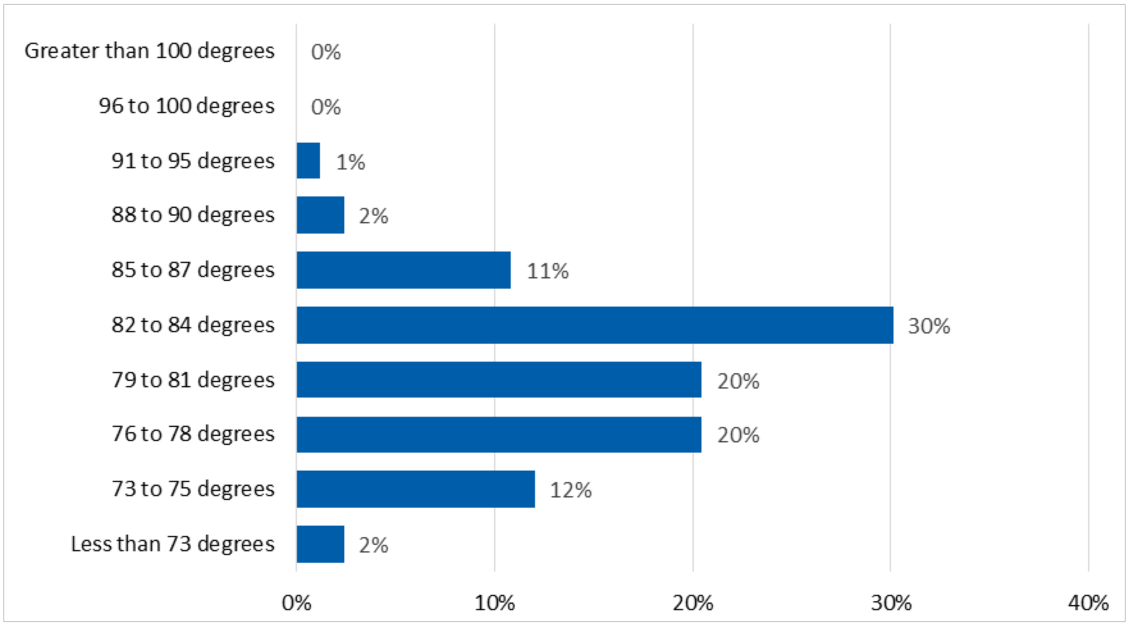
Figure 7. Outdoor Temperature at which Respondents Start to Feel Uncomfortable in their Home



Source: Participant Survey Question G8. When you think of a typical hot and humid summer day, at what outside temperature do you tend to feel uncomfortably warm in your home? (n=83).

Only one respondent (1%; n=84) turns on their air conditioner when the outdoor temperature is less than 73°F, while 98% tend to turn on their unit before the outdoor temperature has reached 96°F (Figure 8). Some respondents (13%; n=84) did not respond with a specific temperature, but said their air conditioner is programmed to turn itself on when the indoor temperature reaches a set point. Among those who answered with a specific temperature, the median response was 82°F to 84°F, one category higher than the median response for the outdoor temperature at which they tend to become uncomfortable in their home.

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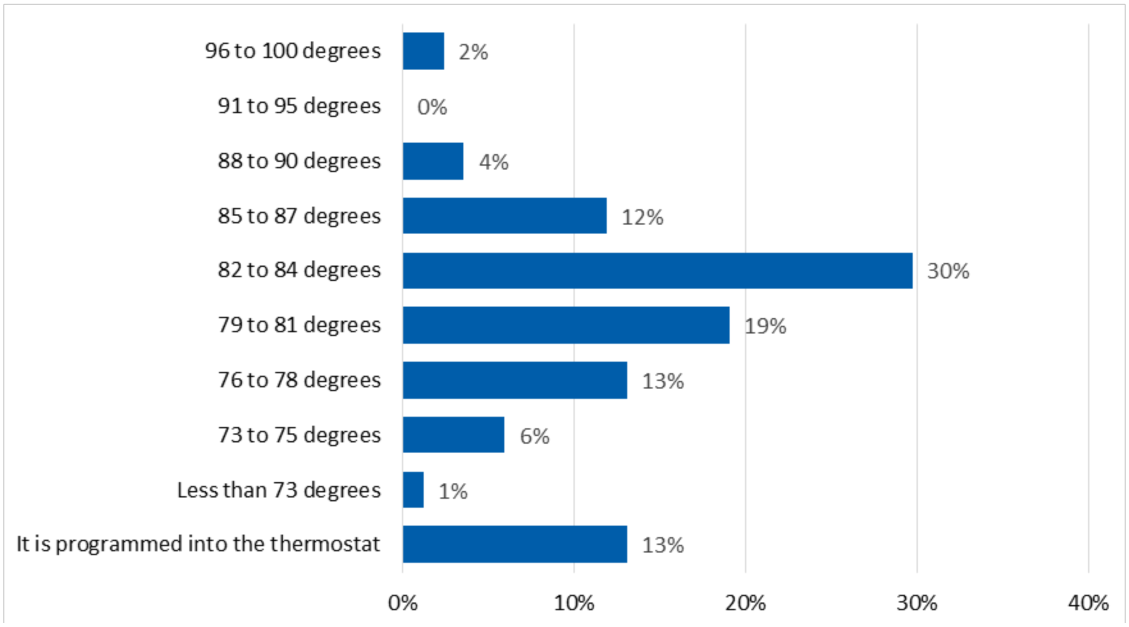
Figure 8. Outdoor Temperature at which Respondents Turn on Air Conditioners



Source: Participant Survey Question G9. At what outside temperature do you tend to turn on the air conditioner? (n=84).

Respondents who said their thermostat is programmed, rather than providing a temperature at which they turn their unit on, were equally likely to report that they program their thermostat based on when the weather gets hot (55%; n=11) or on the season or time of year (45%).

Cadmus cross-tabulated the survey responses to questions about the outdoor temperature at which a respondent becomes uncomfortable with the temperature at which they turn on their air conditioning (Figure 9). The largest percentage of respondents tend to turn on their air conditioner at the same temperature they tend to become uncomfortable (53%; n=75), while 31% turn on their air conditioner when the outdoor temperature is higher than the temperature at which they become uncomfortable, and 16% turn on their air conditioning before the temperature becomes uncomfortable.

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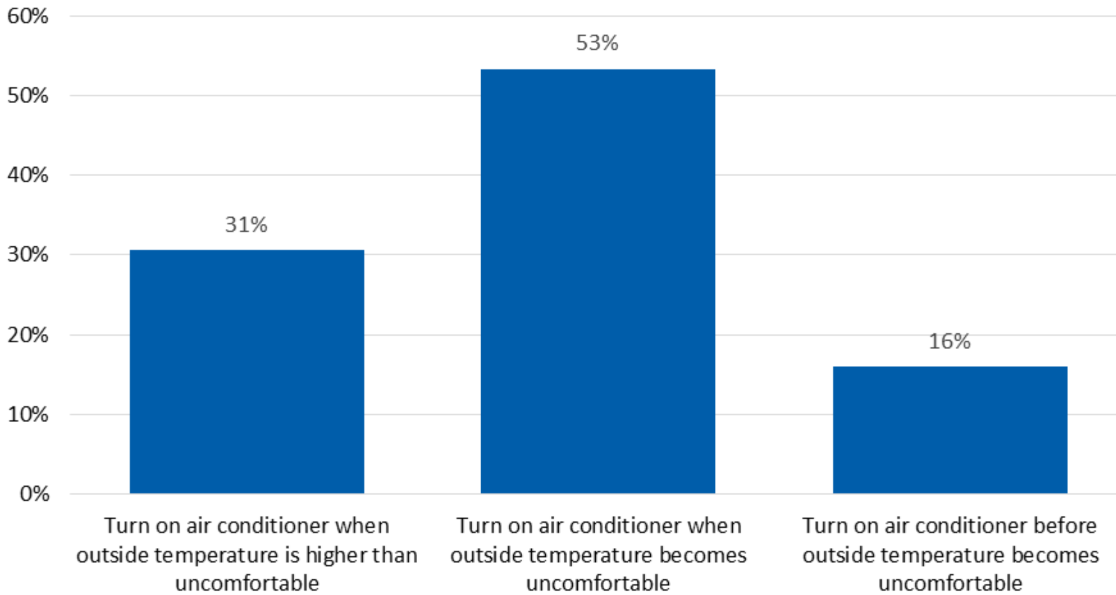
Figure 9. Uncomfortable Outdoor Temperature Compared to Temperature at which Air Conditioners are Turned on



Source: Participant Survey Questions G8 and G9. When you think of a typical hot and humid summer day, at what outside temperature do you tend to feel uncomfortably warm in your home? and At what outside temperature do you tend to turn on the air conditioner? (n=75 who gave a numeric response to both questions).

Air Conditioner Maintenance

Two-thirds of respondents (68%; n=80) reported they have had maintenance performed on their central air conditioning since joining the Power Manager Program. As shown in Figure 10, most of the participants who had their units serviced (67%; n=54) did not know if their Power Manager device was disconnected during maintainence, while 7% reported that their devices were disconnected and 26% reported they were not.[10] Only one of these survey respondent (2%; n=54) said their Power Manager device was disconnected during maintenance then not reconnected afterwards. This respondent explained why the device was not reconnected: “The technician said they won't connect anything that is not theirs.”

10 Eight percent shown in table due to rounding.

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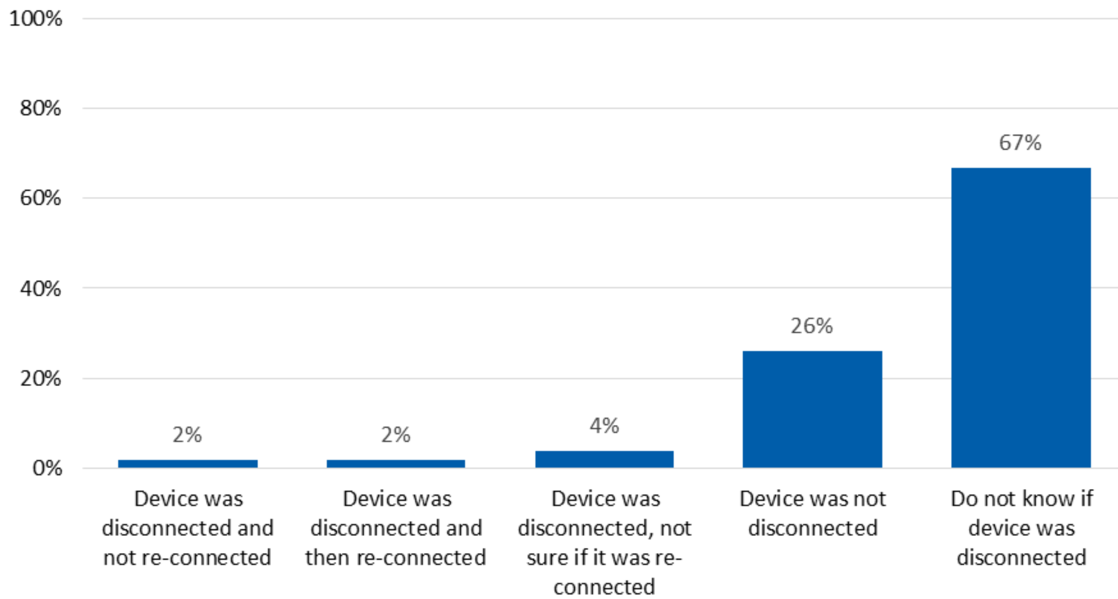
Figure 10. Disconnecting Power Manager Devices for Air Conditioner Maintenance



Source: Participant Survey Questions G3 and G4. Was the Power Manager device disconnected while your air conditioner was being serviced? (n=54) and Was the Power Manager device re-connected after completing service on the air conditioner? (n=4 who said yes to G3).

Thermostat Settings and Electric Fan Use

Cadmus asked respondents how they make adjustments to their thermostat, and 20% (n=84) said they leave their thermostat on the same temperature setting all the time (Figure 11). Another 38% programmed their thermostat to make adjustments automatically (including the use of smart thermostats), while the remaining 42% make manual adjustments. Participants who make manual adjustments are about equally split between those who make adjustments at specific times (19%) and those who make adjustments "as needed" without a pattern or schedule (23%).

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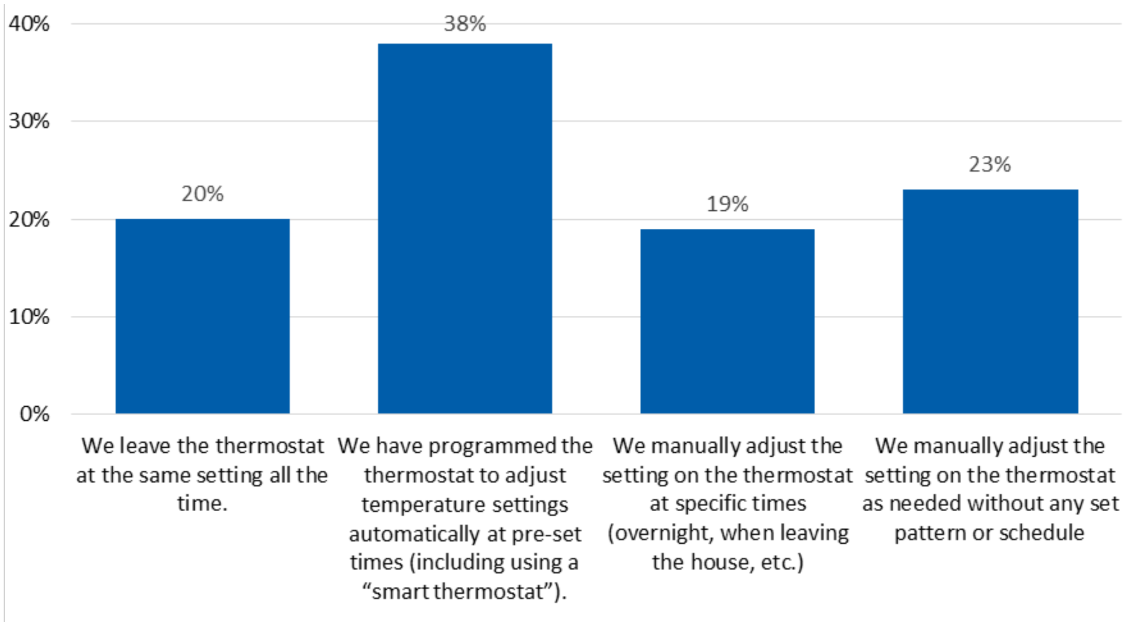
Figure 11. How Respondents Adjust their Thermostat

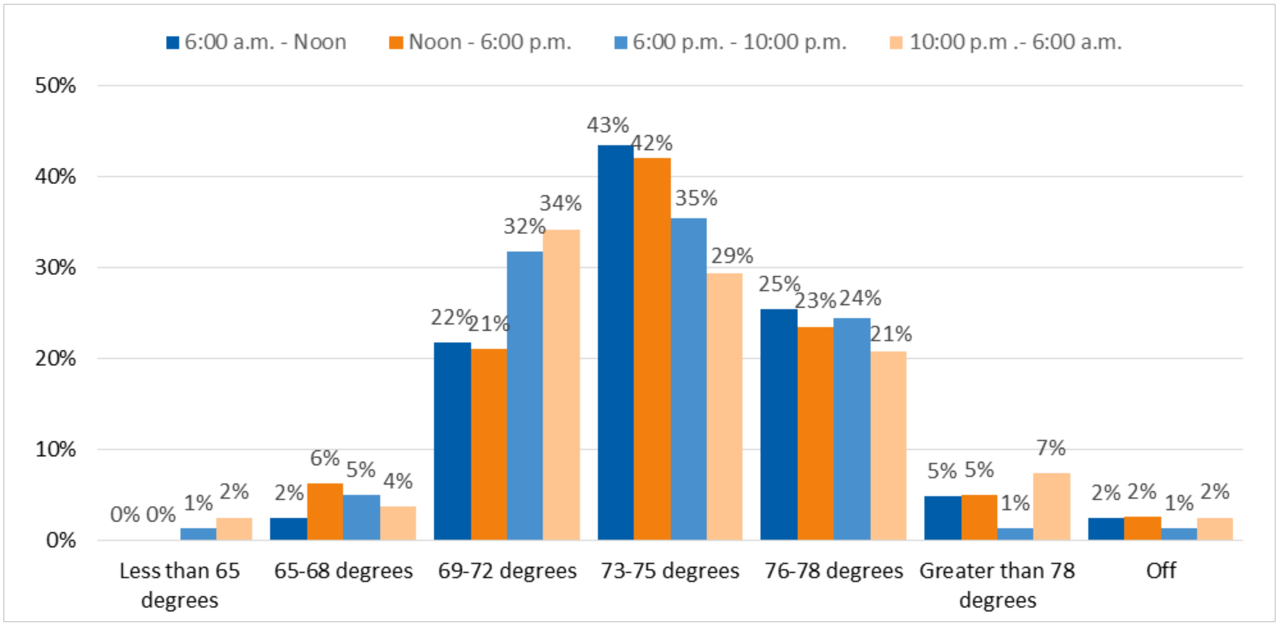


Source: Participant Survey Questions G11. Which of the following best describes how you control the temperature in your home during the summer? (n=84).

Cadmus asked respondents a series of follow-up questions to determine thermostat settings throughout the week. Figure 12 shows that only two respondents surveyed in Ohio set their thermostat lower than 65°F on summer weekdays (2%; n=82 for 10:00 p.m. to 6:00 a.m. time period), while no more than 10% normally have their thermostats set higher than 78°F or turned off. For most sets of times we asked about during the weekday, the largest share of respondents (35% to 43%) set their thermostat between 73°F and 75°F, and several respondents (35%) set their thermostat to 69°F to 72°F degrees overnight. Although many respondents keep consistent thermostat settings throughout the week, the overall pattern shows a clear shift toward lower thermostat set points during the 6:00 p.m. to 10:00 p.m. and 10:00 p.m. to 6:00 a.m. time periods, when participants are most likely to be at home using air conditioning (see Figure 6).

Cadmus also asked respondents about their weekend thermostat set points, and the distribution of responses was almost identical to their weekday set points.

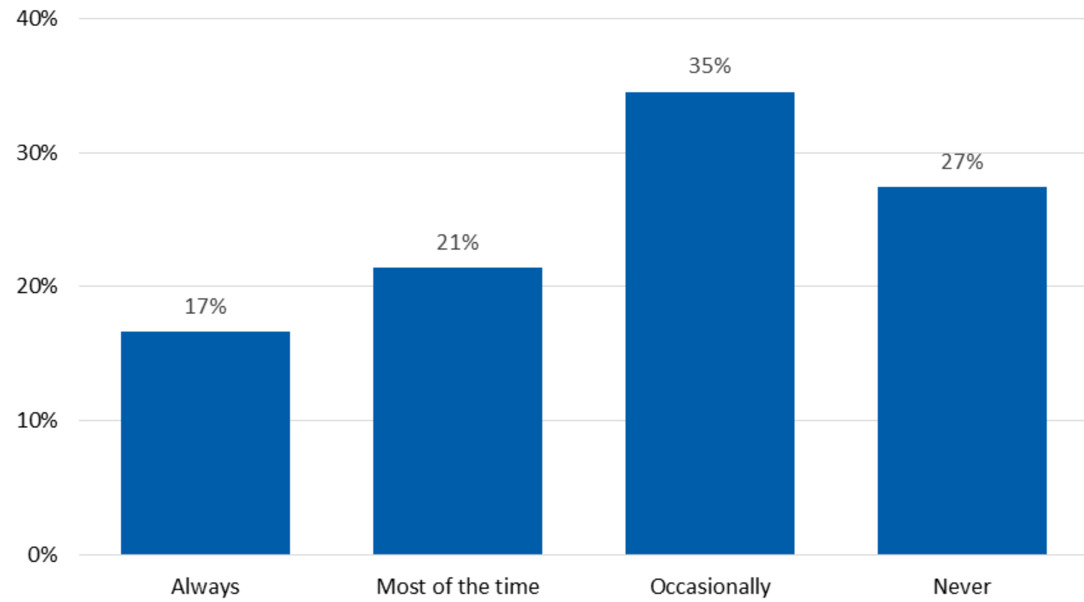
Figure 12. Respondent Thermostat Settings by Time of Day on Weekdays



Source: Participant Survey Questions G12-G16 combined (n=81 to 83 per question).

Figure 13 shows that respondents commonly use electric fans on hot weekday afternoons. More than one-third (38%; n=84) reported that they run electric fans running at least “most of the time” in the afternoon when the outdoor temperature is in the 90s, including 17% who “always” have fans running at such times. Only 27% said they “never” use electric fans in their home.

Figure 13. Electric Fan Use on High Temperature Weekday Afternoons

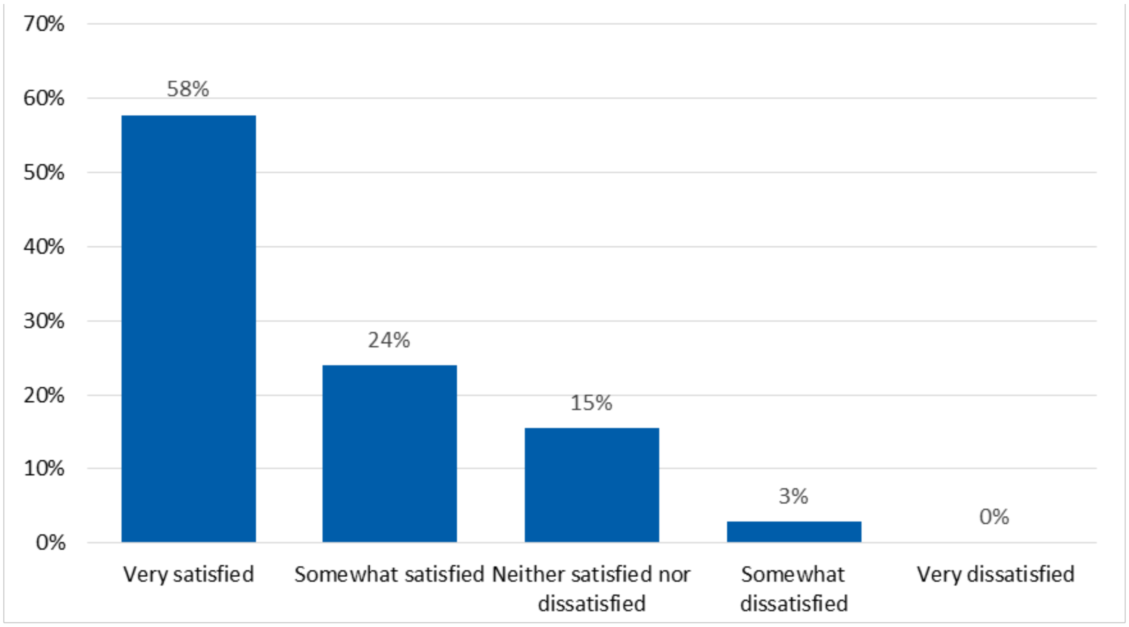


Source: Participant Survey Question G22. On a weekday afternoon when the outdoor temperature is in the 90s, how often do you use electric fans to keep cool in your home? Would you say that you have fans on... (n=84).

Satisfaction with the Program

Cadmus asked respondents to rate their overall satisfaction with the Power Manager Program on a five-point scale, where 5 indicates being "very satisfied." Figure 14 shows that 58% of respondents (n=71) were "very satisfied" with their participation in Power Manager. Only 3% were "somewhat dissatisfied," and no respondents were "very dissatisfied." Of those who were "somewhat dissatisfied," one said they never know when Duke Energy is activating their device and the other reported the bill credit was small.

Figure 14. Power Manager Program Satisfaction Ratings



Source: Participant Survey Question F3. How would you rate your overall satisfaction with the Power Manager Program, would you say you were…? (n=71).

In order to have a comparable satisfaction rating to Duke Energy programs in other territories, Cadmus also asked respondents in Ohio to rate their satisfaction with the program on a scale from 0 to 10, where 10 is very satisfied. Respondents' mean rating on this 10-point scale was 8.5 (n=74) and the median rating was 9.

Cadmus also analyzed program satisfaction scores for different subgroups of respondents in order to identify contributing factors. Participant survey respondents did not give significantly different satisfaction ratings if they were aware of their devices being activated, aware of receiving bill credits in 2015, or if they reported a decline in comfort ratings during a perceived event. Some factors that were associated with lower satisfaction ratings include moving into a home where a Power Manager device was already installed (6.0; n=2) and being unclear about how the program works (7.0; n=8). Both of these groups of respondents gave average satisfaction ratings that were more than one point lower than the average rating given by all respondents.

Cadmus asked respondents how likely they are to recommend the Power Manager Program to others, also using a scale from 0 to 10 where 10 is most likely to recommend. As shown in Figure 15, 41% (n=69) gave the highest possible rating of 10. The average recommendation rating was 8.1, and the median rating was 9.

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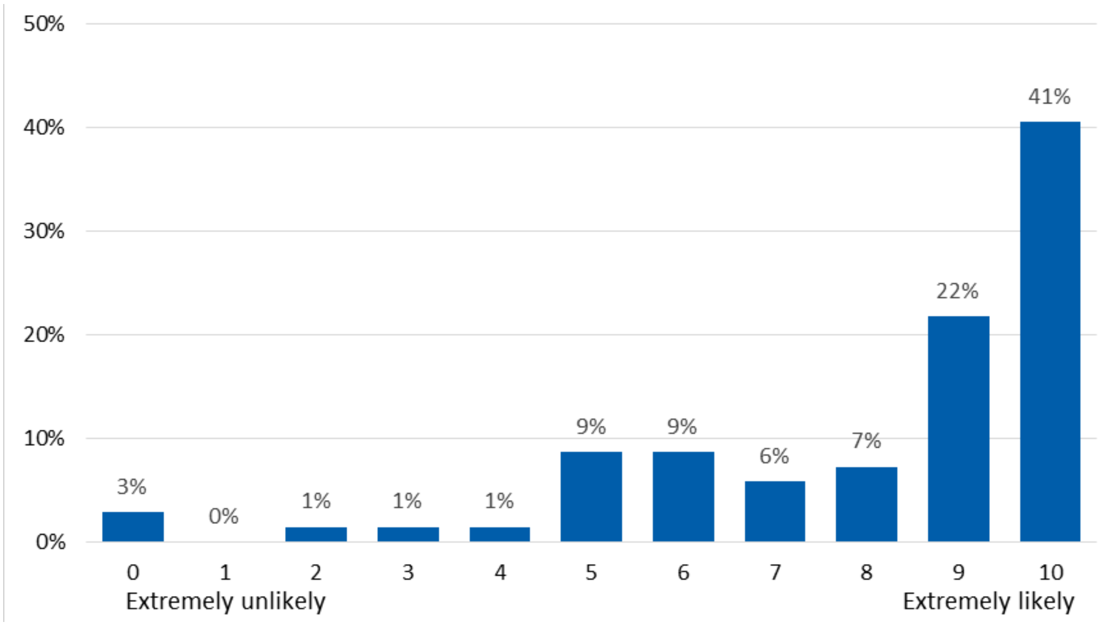
Figure 15. Likelihood of Recommending Power Manager

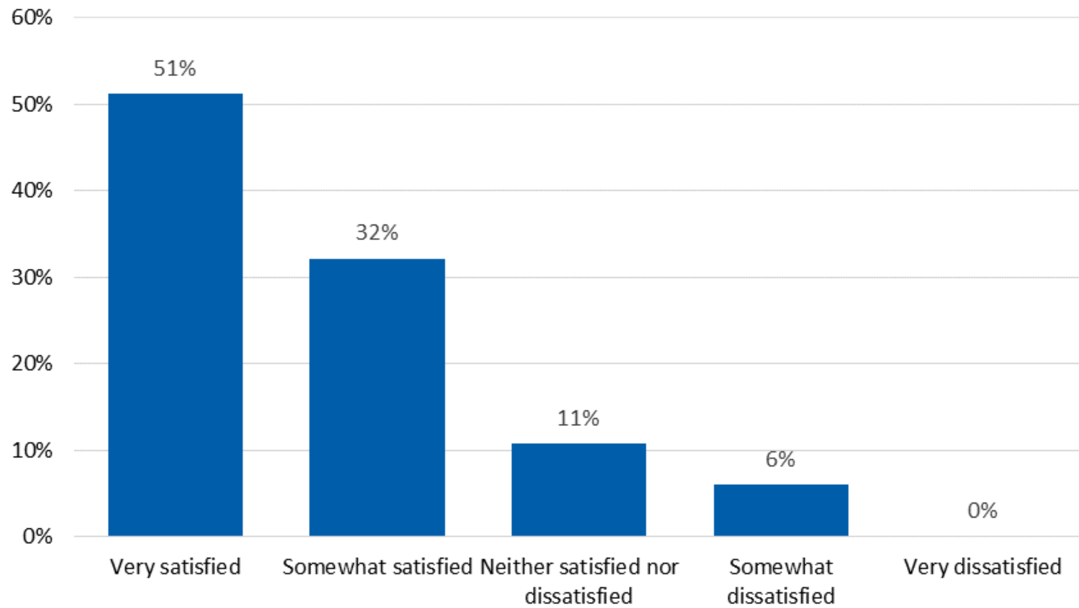


Source: Participant Survey Question F5. Using a scale of 0 to 10, where 0 means "extremely unlikely and 10 means "extremely likely," how likely is it that you would recommend this program to a friend, neighbor, or co-worker? (n=69).

Satisfaction with Duke Energy

Cadmus asked respondents to rate their overall satisfaction with Duke Energy on a five-point scale from "very satisfied" to "very dissatisfied." As shown in Figure 16, 51% (n=84) gave Duke Energy the highest possible rating of "very satisfied," while only 6% were "somewhat dissatisfied" and no survey respondents were "very dissatisfied." When we asked, the five respondents who were "somewhat dissatisfied" with Duke Energy gave the following reasons: three cited increases in electricity rates and their utility bills, one complained about frequent power outages, and one mentioned poor customer service. One of the three respondents who complained about increasing rates also mentioned that Duke Energy "has a monopoly," and another expressed "significant distrust of Duke Energy's meters."

Figure 16. Satisfaction with Duke Energy Overall



Source: Participant Survey Question I3. How would you rate your overall satisfaction with Duke Energy, would you say you were…? (n=84).

In order to have a comparable satisfaction rating to Duke Energy programs in other territories, Cadmus also asked respondents in Ohio to rate satisfaction with their utility on a scale from 0 to 10, where 10 is "very satisfied." Respondents' mean rating on this 10-point scale was 8.3 (n=84) and the median rating was 9.

Cadmus also analyzed program satisfaction scores for different subgroups of respondents in order to identify contributing factors. Participant survey respondents did not give significantly different satisfaction ratings if they were aware of their devices being activated, aware of receiving bill credits in 2015, or if they reported a decline in comfort ratings during a perceived event. Some factors that were associated with lower satisfaction ratings include moving into a home where a Power Manager device was already installed (5.3; n=3) and being unclear about how the program works (7.3; n=12). Both of these groups of respondents gave average satisfaction ratings that were more than one point lower than the average rating given by all respondents.

Awareness and Interest in Other Utility Programs

Cadmus asked respondents if they were aware of any other Duke Energy programs to help them save energy. Figure 17 shows that free CFL programs, My Home Energy Report (MyHER), and the Savings Store (specialty lighting) are the most well-known Duke Energy programs, each mentioned by between 60% and 71% of surveyed Power Manager participants (n=84). Only 6% of respondents were not aware of any other Duke Energy programs.

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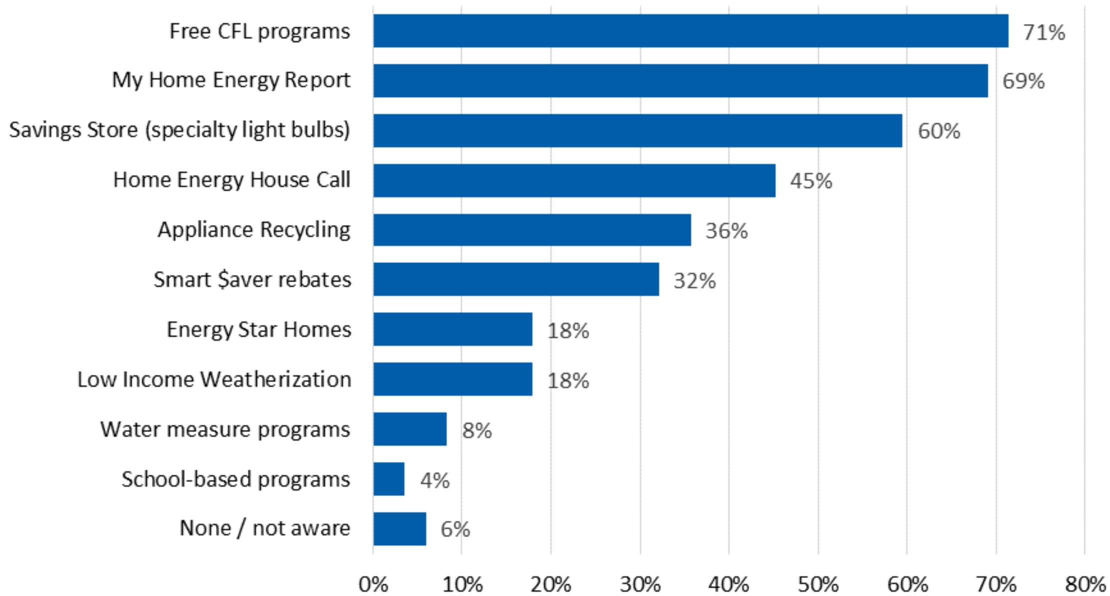
Figure 17. Awareness of Other Duke Energy Programs



Source: Participant Survey Question H1. What, if any, Duke Energy programs or services have you heard of that help customers save energy? Multiple response permitted (n=84).

Cadmus asked respondents if they would be interested in participating in programs to cycle other types of equipment, such as electric water heaters. A majority of 54% (n=84) expressed interest in such a program, while 20% said they would not participate in such a program, and 26% said they were not sure.

Participant Demographics and Household Characteristics

Cadmus asked respondents a number of questions about their household, including questions about demographics and cooling systems. These responses are summarized in Appendix B. Participant Household Characteristics and Demographics.

H. Event/Non-Event Surveys

Cadmus surveyed current Power Manager participants during the cooling season in order to better gauge their awareness of Power Manager events and their perception of discomfort caused by Power Manager curtailment events.

This section outlines the results of Cadmus' analysis of the difference in responses between participants who were surveyed immediately following curtailment events, and those who were surveyed immediately following equivalent high temperature days without events. This is a quasi-experimental study design, where the event surveys constitute the experimental group (those experiencing an event) and the non-event surveys constitute a control group (those not experiencing at event).

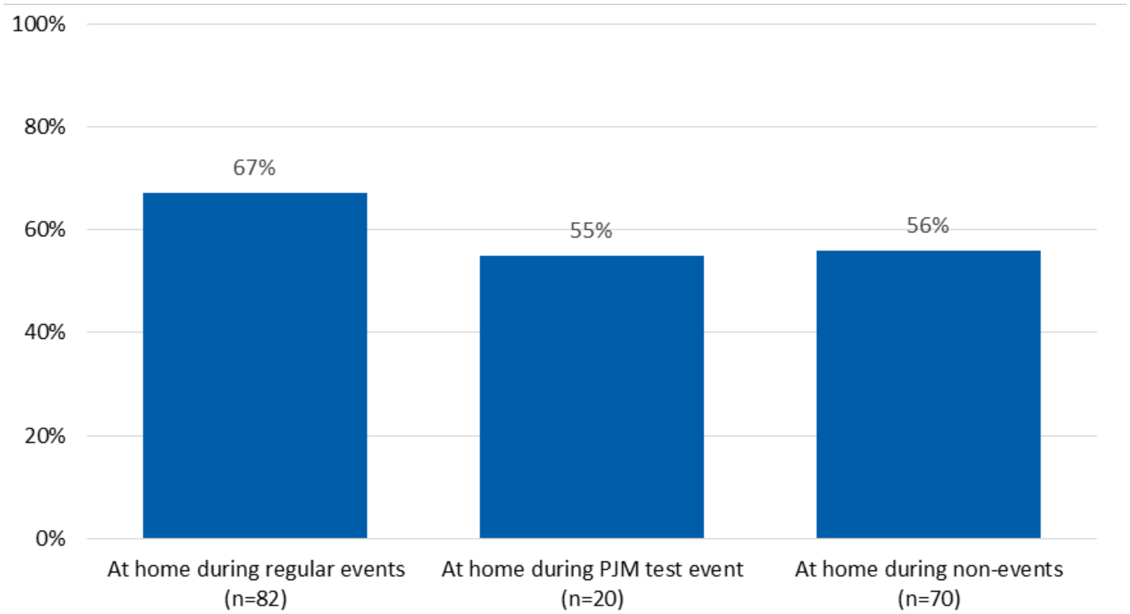
Although the study design controls for the presence of an event, there are many factors which cannot be controlled, such as the range and distribution of temperatures over the summer, other weather events (such as high humidity and storms), and extraneous events that could affect program operations (such as power outages or transmission issues). The opportunities to conduct these surveys were limited by program activities and the weather, thus the results of surveys during a particular summer may not be predictive of other years under different conditions. There were more Power Manager curtailment events and high temperature days in Ohio during the summer of 2015 than during the summer of 2014 (when there was one PJM test event and no regular events), and about as many as during the summers of 2012 and 2013 (five events each).

Except where noted, Cadmus excluded "don't know" and "refused" responses, which is reflected in accompanying n-values.

Home Occupancy During Events

Cadmus asked respondents if there was anybody at home during the actual time period when an event occurred, and during the equivalent hours of 2:00 p.m. to 5:00 p.m. for non-event surveys. Most surveyed households (61%; n=172 combined event and non-event) had someone at home during the afternoon in question (Figure 18).

Figure 18. Home Occupancy During Event Time Period



Source: Event/Non-Event Survey Question B5. Were you or any members of your household home at that time?

Cadmus asked respondents how many people live in their home. Figure 19 shows that respondents surveyed for events and non-events had similar numbers of people living in their home. The overall average number of residents per household for event and non-event surveys was 2.6. In the participant survey, the average number of residents per surveyed household was similar, at 2.7 (see Appendix B. Participant Household Characteristics and Demographics).

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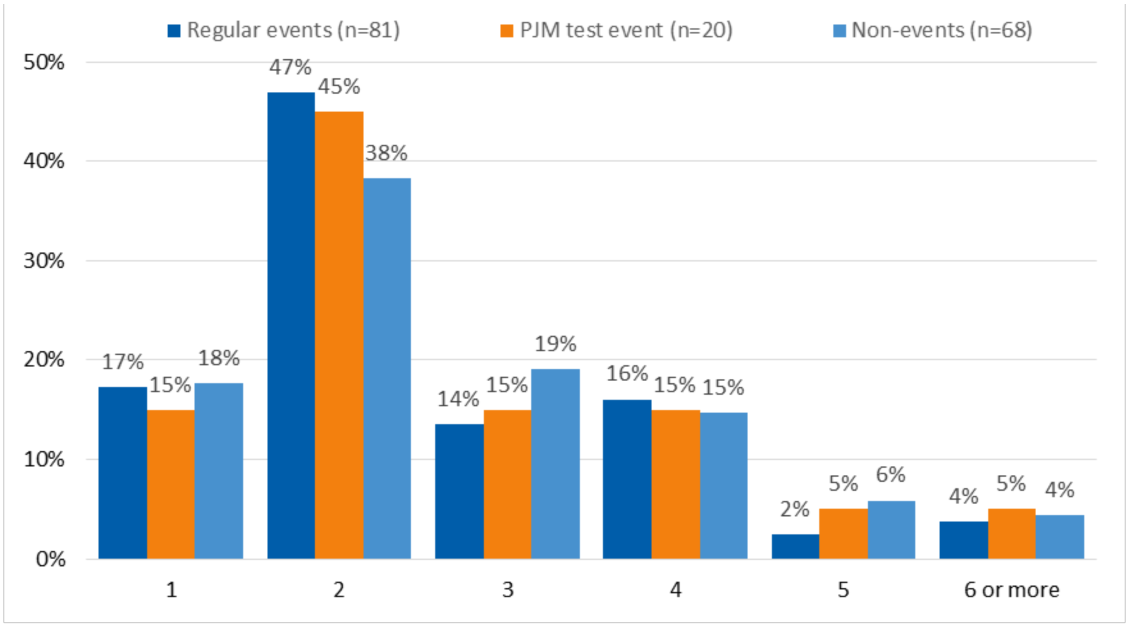
Figure 19. Number of People Living in Respondent Households



Source: Event/Non-Event Survey Question G1. Including you, how many people live in this home?

Awareness of Device Activation

In order to gauge awareness of the Power Manager device activation, Cadmus first asked event and non-event respondents if they were aware of any device activations occurring since they had joined the program. Nearly half of the event respondents said they were aware that their devices have been activated (48%; n=102), while this was true for just 27% (n=70) of the non-event respondents (Figure 20). This difference between event and non-event groups is statistically significant.[11]

[11] This difference is statistically significant at p<0.05 using a binomial t-test.

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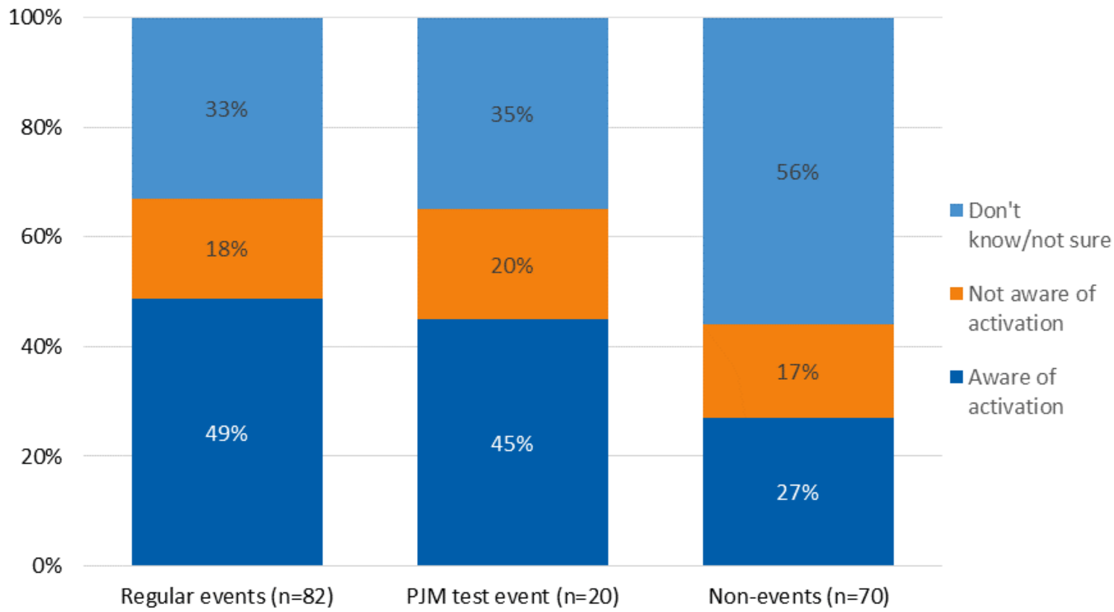
Figure 20. General Awareness of Device Activation



Source: Event Survey/Non-Event Question B1. Has Duke Energy activated the Power Manager device since you joined the program?

Cadmus asked all respondents how they know when their Power Manager device has been activated. Figure 21 shows the distribution of reasons given by respondents who were aware that their devices had been activated. Most event and non-event respondents (combined) were able to give reasons why they were aware of device activation (63%; n=68). The most frequently mentioned reasons for both groups of survey respondents are air conditioning shutting down and rising home temperature, followed by bill credits and notifications from Duke Energy (including e-mail, mail, and directly from Duke Energy employees). Although event respondents were significantly more likely to say they were aware of device activation compared to non-event respondents, event respondents were also significantly more likely to not be able to state a reason why they were aware (43%; n=49) compared to non-event respondents (21%; n=19).[12] This was the only statistically significant difference between groups of survey respondents.

[12] This difference is statistically significant at p<0.10 using a binomial t-test.

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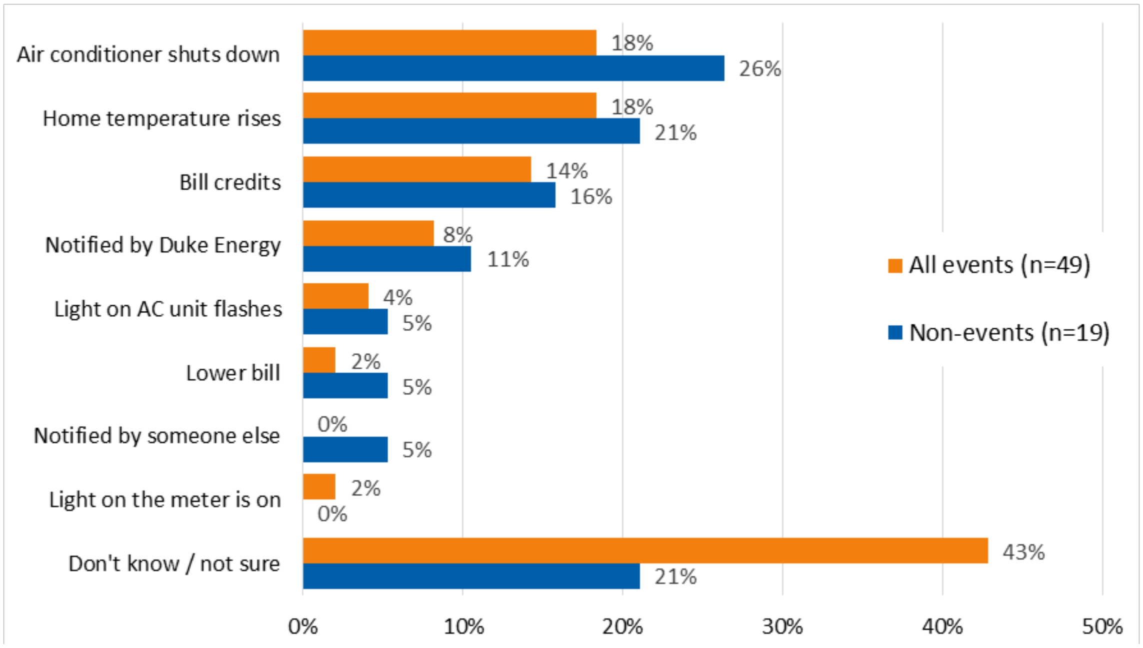
Figure 21. Reasons for Awareness of Device Activation



Source: Event/Non-Event Survey Question B2. How can you tell when the device has been activated?

Most respondents who were not aware that their devices have been activated were unable to state how they would know if the devices had been activated (68%; n=104 combined event and non-event group respondents who were not aware of their devices having been activated since joining the program). The most common reasons given by respondents who were able to answer this question is that the air conditioner shuts down (14%) and home temperature rises (13%).

Cadmus asked respondents if Duke Energy had activated their Power Manager device in the past two days (i.e., the day of the survey call or the day before). For event respondents, there had been device activation (a curtailment event) during this time period, while for non-event respondents there had been no device activation in the past two days. Only 12% (n=82) of regular event respondents and 10% (n=20) of PJM test event respondents answered correctly that their device had been activated, which is statistically significantly higher than 4% (n=70) of non-event respondents who incorrectly believed their device had been activated (Figure 22).[13] However, most respondents in all groups did not know if their devices had been activated or not.

[13] The differences between regular event respondents and non-event respondents, and between all event respondents combined and non-event respondents, are statistically significant at p<0.10 using binomial t-tests. However, the result for PJM test event respondents is based on a small sample (n=20) that does not have enough precision to be statistically significantly different from regular event or non-event respondents.

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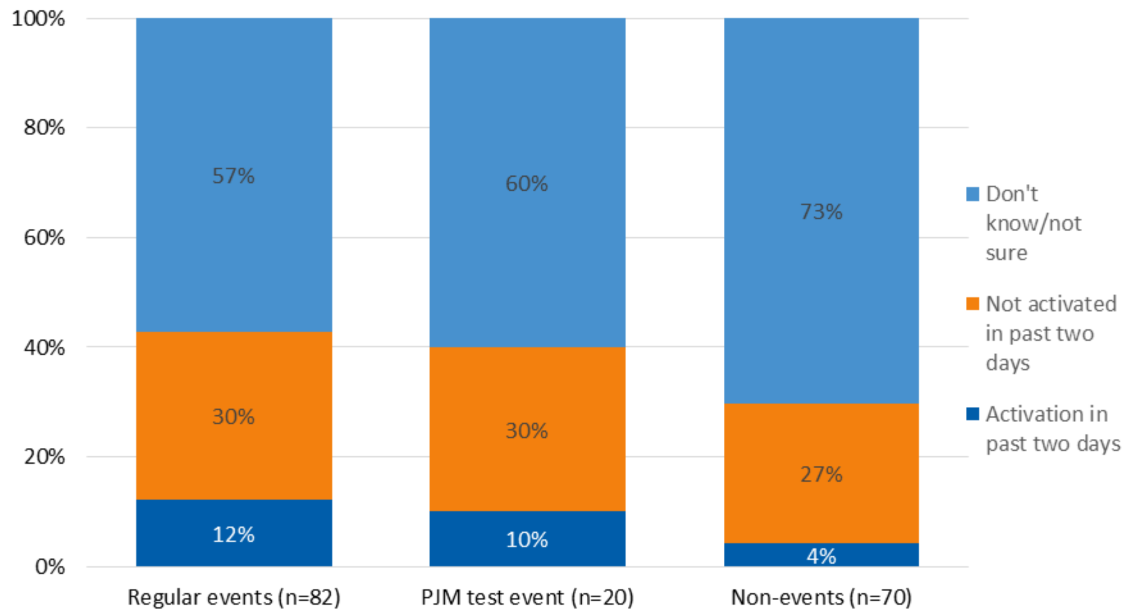
Figure 22. Awareness of Recent Device Activation



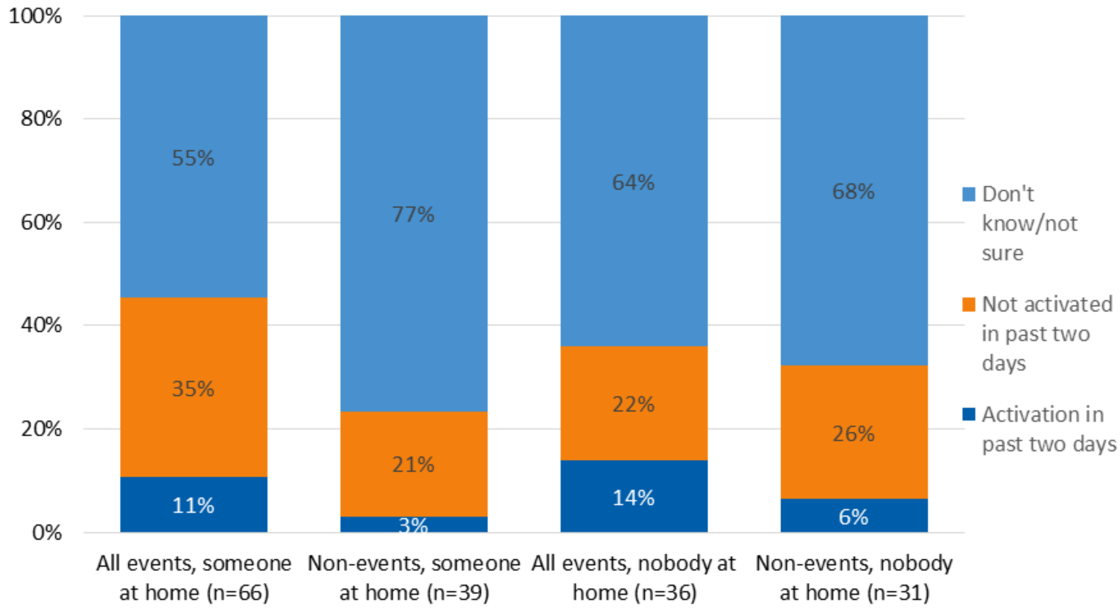
Source: Event/Non-Event Survey Question B3. Has your device been activated in the last two days? [IF NEEDED: Was your device activated yesterday or today?]

Figure 23 shows that whether or not anybody was at home during the event period, event respondents were more likely to believe their devices were activated than non-event respondents.[14] However, both event and non-event respondents, awareness of events was not statistically significantly different if respondents were at home during the event time period compared to not being at home.

14 The difference between event respondents who were home during the event time period (11%; n=66) and non-event respondents who were at home (3%; n=39) is statistically significant at p<0.10 using a binomial t-test. This difference is not statistically significant for event and non-event respondents who were not at home during the event time period.

CADMUS

Figure 23. Awareness of Recent Device Activation for Occupied Homes and Unoccupied Homes



Source: Event/Non-Event Survey Question B3. Has your device been activated in the last two days? [IF NEEDED: Was your device activated yesterday or today?]

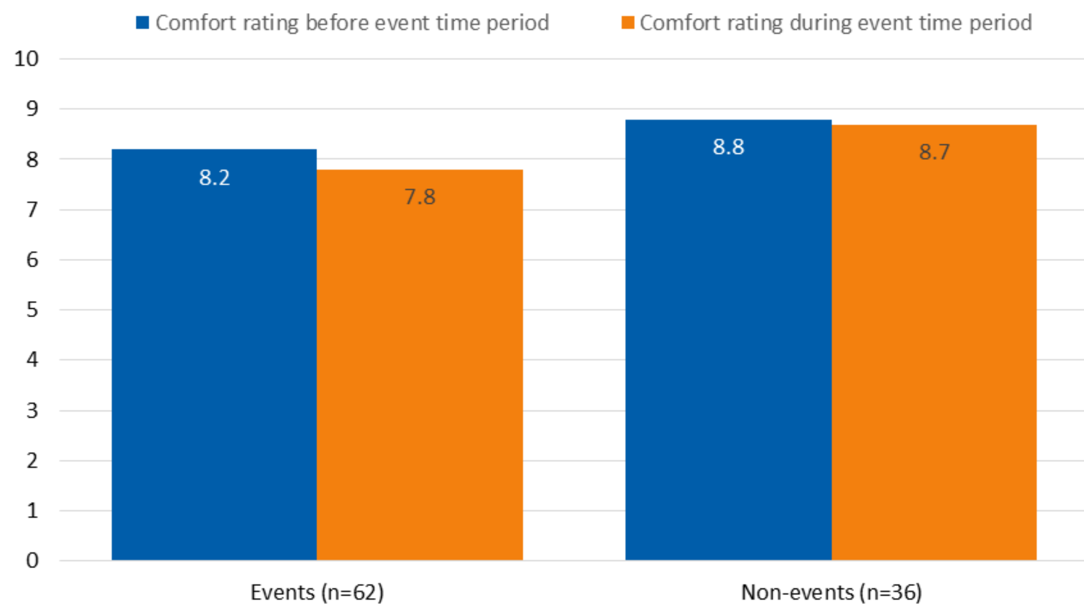
Response to Device Activation

Cadmus asked respondents who were at home during the event time period (when events would occur, whether they did or not) to rate the comfort level of their home before and during the time period on a scale from 0 to 10, where 0 means very uncomfortable and 10 means very comfortable. Cadmus defined the before time period using the actual start time of a curtailment event for event respondents, or 2:00 p.m. for non-event respondents. We defined the event time period as the actual start and end times of an event for event respondents, or from 2:00 p.m. to 5:00 p.m. for the non-event respondents. Figure 24 shows that there was a small, but not statistically significant, decline in comfort ratings from before the event time period to during the event time period for respondents in both survey groups. Event respondents gave significantly lower comfort ratings than non-event respondents.[15]

[15] The differences between event and non-event respondents are statistically significant at p<0.10 or better using ANOVA for both sets of ratings.

CADMUS

Figure 24. Comfort Ratings Before and During Event Time Period



Source: Event/Non-Event Survey Questions C1 and C2. Using a scale of 0 to 10 where 0 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort before [START TIME] on [DATE]? and Using the same scale of 0 to 10 where 0 means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort between [START TIME] and [END TIME] on [DATE]?

Slightly more event respondents (13%; n=62) than non-event respondents (6%; n=36) reported a decline in comfort ratings during the event time period, though this difference is not statistically significant. Event and non-event respondents who reported a decline in comfort provided very similar comfort ratings, overall averaging 8.3 before the event time period and 5.5 during the event time period (n=10 combined), with no statistically significant differences between event and non-event respondents.

Cadmus asked the 10 respondents who reported a decline in comfort during the event time period what had caused their decline in comfort. Figure 25 shows that rising indoor temperatures was the most frequent response for event respondents, and a minority of these respondents (25%; n=8) blamed the activation of their Power Manager device for their decline in comfort.

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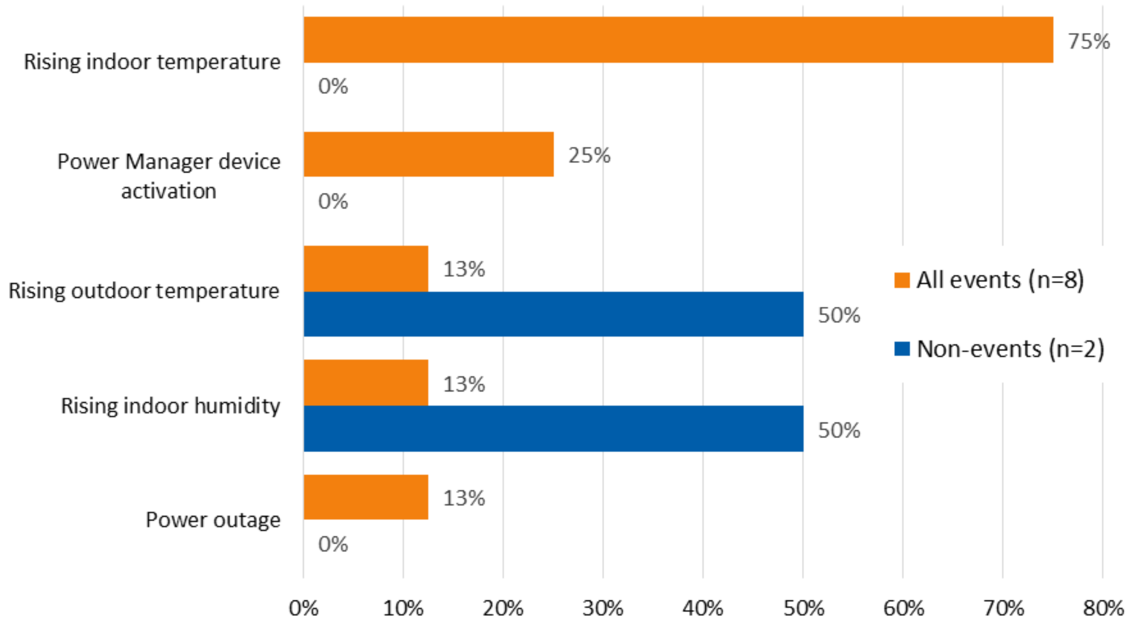
Figure 25. Reasons Given for Decline in Comfort



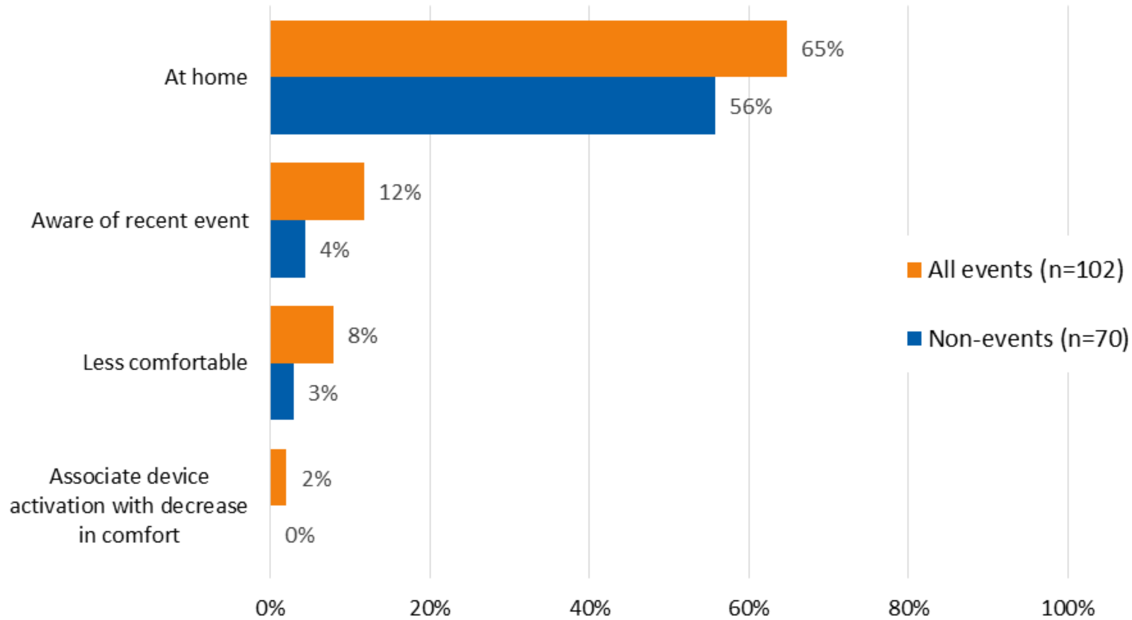
Source: Event/Non-Event Survey Questions C3. What do you feel caused your decrease in comfort? (Multiple response permitted).

Summary of Awareness and Response to Events

Figure 26 summarizes respondents' awareness and response to events using the total survey sample as a base. Although event respondents were more likely to be aware of events (12%; n=102), report a decline in comfort during events (8%), and associate Power Manager device activation with their decline in comfort (2%), the only difference from non-event respondents that is statistically significantly is awareness of a recent event.[16]

[16] This difference is statistically significant at p<0.10 using a binomial t-test.

Figure 26. Summary of Awareness and Response to Events



Source: Event/Non-Event Survey Questions B5, B3, C1, C2, and C3. (See Figure 18, Figure 22, Figure 24 and Figure 25 for question wording).

Figure 27 shows a comparison of PY2015 event/non-event survey results to previous evaluations of the Power Manager Program in Ohio.[17] Since there were no regular curtailment events in Ohio during the summer of 2014, there are no comparable survey results for that year.

There are no statistically significant differences in these key metrics between the PY2015 and PY2013 surveys for event or non-event respondents. Compared to the PY2015 survey results, event respondents in PY2012 were more likely to report a decline in comfort (20%; n=65), and both groups of respondents were more likely to be at home during the event time period (78% for event and 74%; n=62 for non-event).[18]

[17] TecMarket Works. *Process Evaluation of the 2012 Power Manager Program in Ohio*. April 24, 2013. TecMarket Works. *Process Evaluation of the 2013 Power Manager Program in Ohio*. June 16, 2014.

[18] These differences between PY2012 and PY2015 survey results are statistically significant at $p<0.05$ using binomial t-tests.

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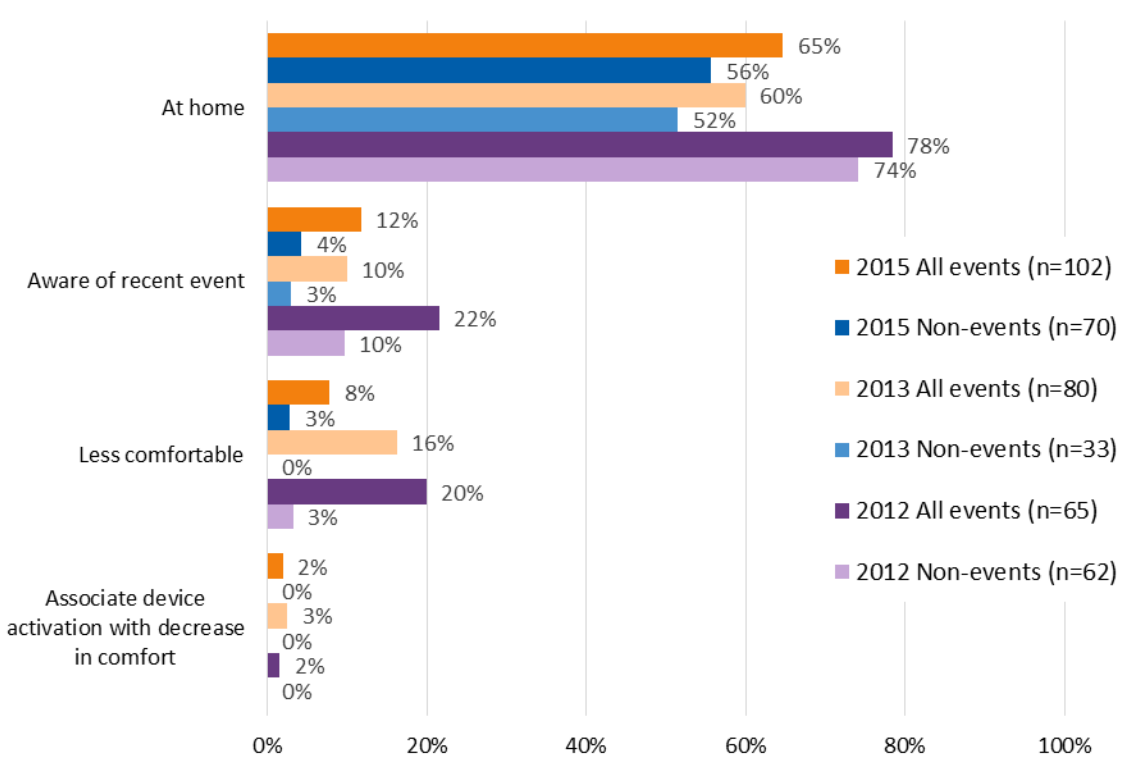
Figure 27. Summary of Awareness and Response to Events Compared to Previous Evaluations



Source: PY2015 Event/Non-Event Survey Questions B5, B3, C1, C2, and C3. (See See Figure 18, Figure 22, Figure 24 and Figure 25 for question wording). PY2012 and PY2013 event group survey questions are included in the TecMarket Works reports cited above.

Behavior During Events

Cadmus asked respondents about their thermostat settings during the event time period. Figure 28 shows that 85% (n=101) of event respondents and 87% (n=68) of non-event respondents had their thermostats set between 69°F and 78°F.[19]

[19] Eighty-six percent shown in table due to rounding.

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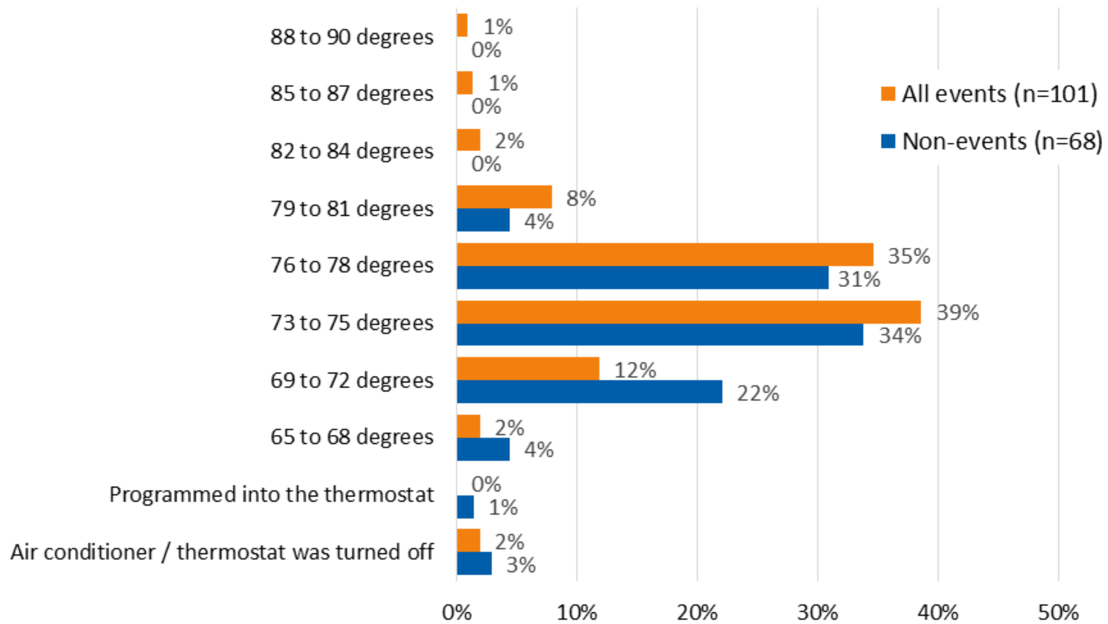
Figure 28. Thermostat Settings During Event Time Period



Source: Event/Non-Event Survey Questions B4. At what temperature was your thermostat set to between [START TIME] and [END TIME] on [DATE]?

Cadmus also asked respondents if they made any adjustments to their thermostat during the event time period, and about their use of electric fans during the event time period.

Figure 29 shows that nine in ten respondents did not adjust their thermostat during the time period. Respondents in the event group (6%; n=64) and non-event group (5%; n=37) were equally likely to set their thermostat to a lower temperature.

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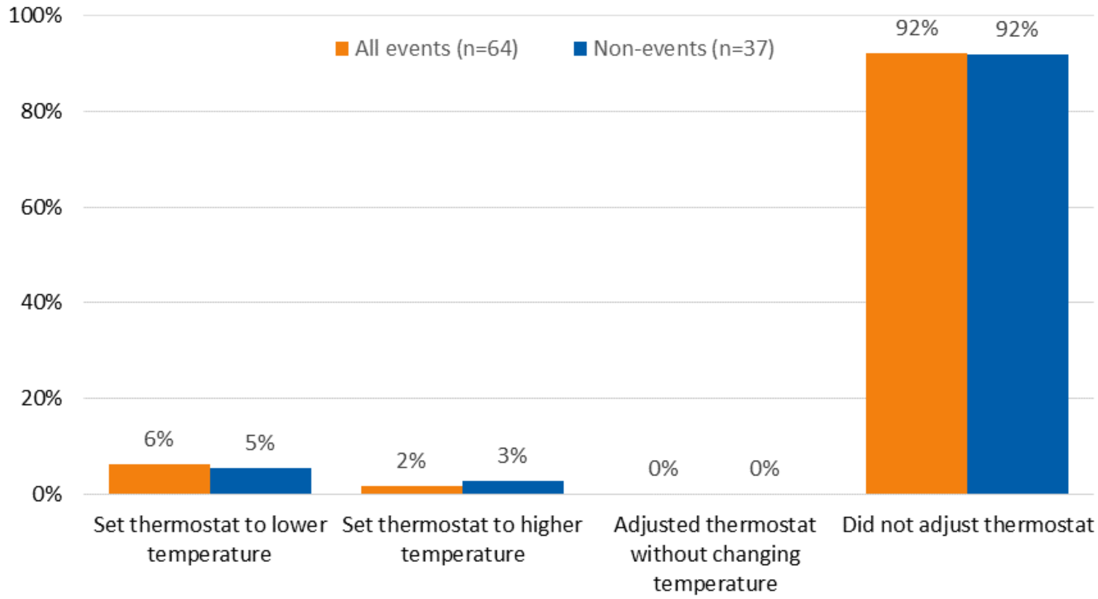
Figure 29. Thermostat Adjustments During Event Time Period



Source: Event/Non-Event Survey Questions C4. Between [START TIME] and [END TIME] on [DATE], did you or any other members of your household adjust the settings on your thermostat?

For event respondents who made thermostat adjustments, the average setting change was 2°F lower and the maximum change was 4°F lower. For the non-event respondents, the average setting change was 1°F lower, and the maximum change was 3°F lower.

About half of respondents (55%; n=65 for event and 46%; n=39 for non-event) had electric fans running in their home during the event time period, though most of these fans were already running before the event time period. Only 9% (n=65) of event respondents and 8% (n=38) of non-event respondents turned fans on during the event time period (Figure 30). There are no statistically significant differences between event and non-event respondents.

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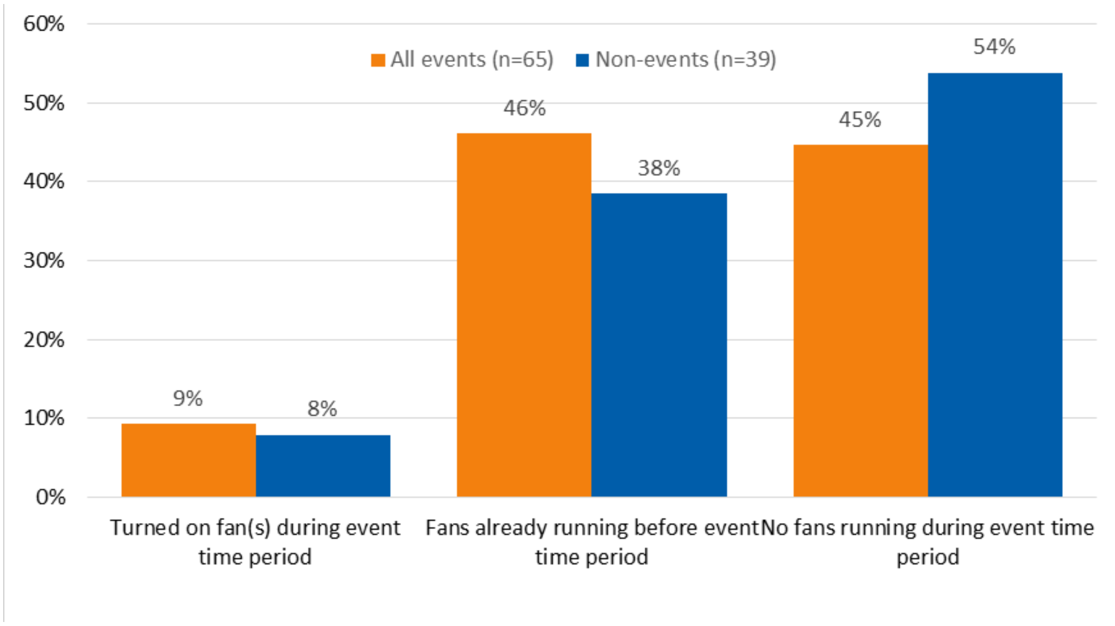
Figure 30. Electric Fan Use During Event Time Period



Source: Event/Non-Event Survey Questions C6 and C7. Between [START TIME] and [END TIME] on [DATE], were any electric fans being used in your home? and Did you or any other members of your household turn any electric fans on between [START TIME] and [END TIME], or were all of the fans already running before [START TIME]?

Cadmus asked respondents what else they or other members of their household did to stay cool during the event time period. Figure 31 indicates that most (83%; n=59 for event and 65%; n=37 for non-event) did not do anything in addition to using electric fans or making thermostat adjustments. Of those who took an action to stay cool, the most common activity was closing blinds and shades (5% for event and 14% for non-event), and only one respondent in each group turned on window or room air conditioners (2% for event and 3% for non-event). Compared to non-event respondents, those surveyed after events were significantly less likely to drink cool beverages and more likely to have continued normal activities.[20]

[20] These differences are statistically significant at p<0.10 or better using a binomial t-test.

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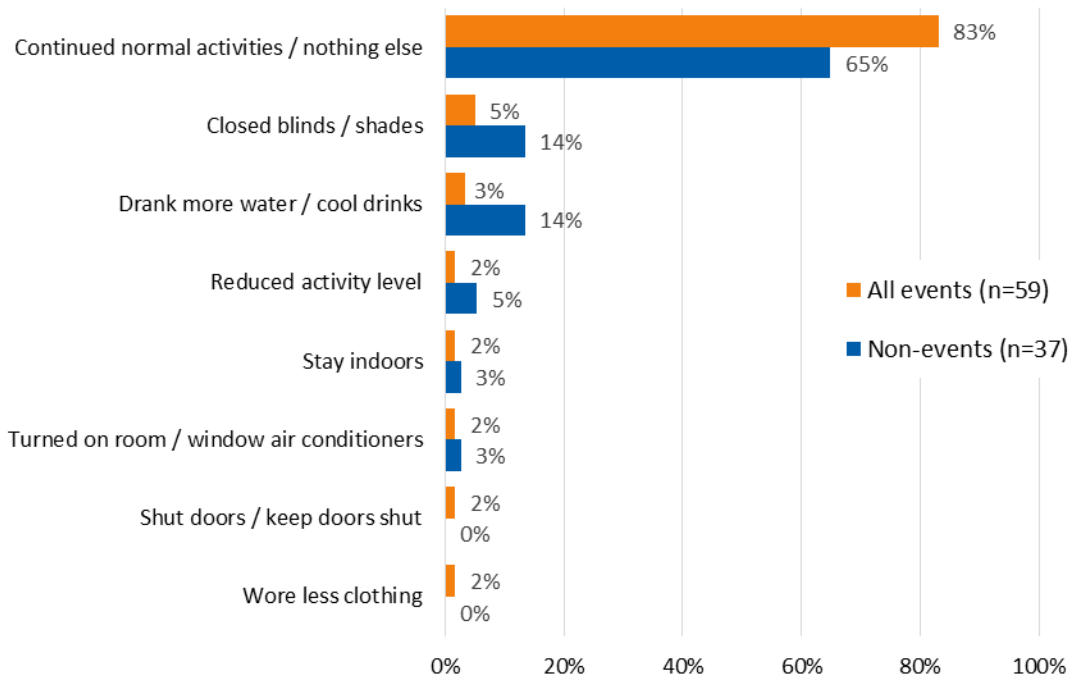
Figure 31. Other Actions During Event Time Period



Source: Event/Non-Event Survey Question C8. What else (if anything) did you or other members of your household do to keep cool between [START TIME] and [END TIME] on [DATE]?

When it is controlling their air conditioner, respondents could mistake their Power Manager device for a power outage, so Cadmus asked respondents if there had been any power outages on the day of the event or high temperature. Four percent (n=99) of event respondents and 1% (n=70) of non-event respondents reported having a power outage on the day in question. This difference is not statistically significant, and indicates that participants are not associating device activation with power outages.

Participant Satisfaction and Recommending the Program

Cadmus asked respondents to rate their overall satisfaction with the Power Manager Program on a five-point scale from “very satisfied” to “very dissatisfied.” Figure 32 shows that a majority (57%; n=158 combined event and non-event) said they were “very satisfied” with their participation in Power Manager. Only 2% were “somewhat dissatisfied” and 1% was “very dissatisfied.” There are no statistically significant differences between survey groups.

We asked the dissatisfied respondents to explain their satisfaction rating. The event respondent who was very dissatisfied with Power Manager explained that “it cuts our power.” Two of the three respondents who were somewhat dissatisfied said that their home gets too warm, one specifying this happened only “in certain areas” of their home, and the other stating that this only happens “sometimes.” The third somewhat dissatisfied respondent did not provide a comment about their program rating.

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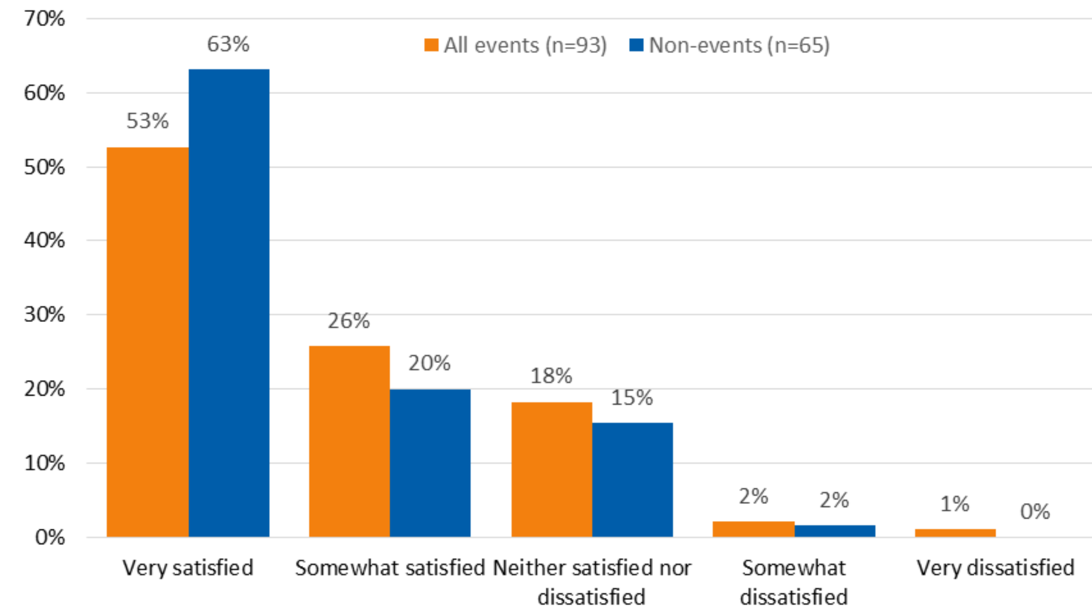
Figure 32. Satisfaction with the Power Manager Program



Source: Event/Non-Event Survey Questions E1. How would you rate your overall satisfaction with the Power Manager Program? Would you say you are…?

In order to have a comparable satisfaction rating to Duke Energy programs in other territories, Cadmus also asked respondents in Ohio to rate their satisfaction with the program on a scale from 0 to 10, where 10 is very satisfied. Respondents' mean ratings on this 10-point scale were 8.4 for both event (n=91) and non-event (n=66) respondents, and the median rating for both groups was 9. Respondents also did not give significantly different satisfaction ratings if they were aware of their devices being activated or not, or if they reported a decline in comfort ratings during an event or not.

Cadmus also asked respondents how likely they would be to recommend the Power Manager Program, also using a scale from 0 to 10 where 10 is most likely to recommend. As shown in Figure 33, 43% (n=145 combined event and non-event) gave the highest possible rating of 10. The average recommendation rating was 8.6 for event respondents and 8.2 for non-event respondents, and the median rating for both groups was 9.

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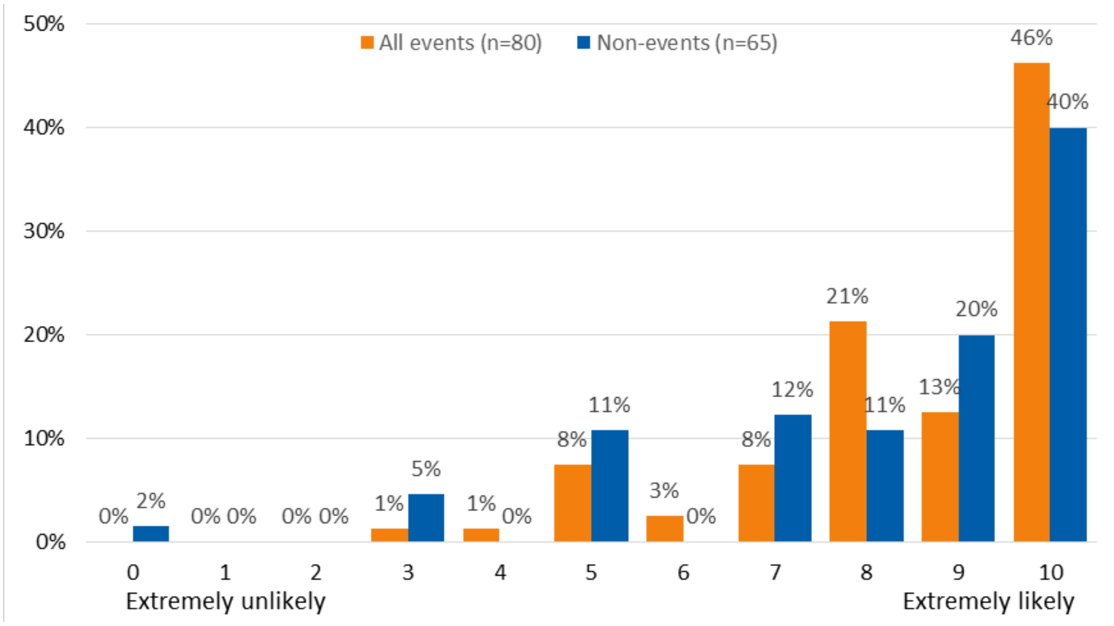
Figure 33. Likelihood of Recommending Power Manager



Source: Event/Non-event Survey Question F3. Using a scale of 0 to 10, where 0 means "extremely unlikely" and 10 means "extremely likely," how likely are you to recommend this program to a friend, neighbor, or co-worker?

Satisfaction with Duke Energy

Cadmus asked respondents to rate their overall satisfaction with Duke Energy using a scale from 0 to 10, where 10 indicates high satisfaction. As shown in Figure 34, 57% of respondents (n=169 combined) gave Duke Energy a high satisfaction rating of 9 or 10. The mean rating from both event and non-event respondents was 8.4, and both groups gave a median rating of 9. Respondents also did not give significantly different satisfaction ratings if they were aware of their devices being activated or not, or if they reported a decline in comfort ratings during an event or not. However, participants who reported that they experienced a power outage on the survey date gave lower satisfaction ratings (6.6; n=5) compared to those who did not report an outage (8.4; n=164).[21]

[21] This difference is statistically significant at $p<0.05$ using ANOVA.

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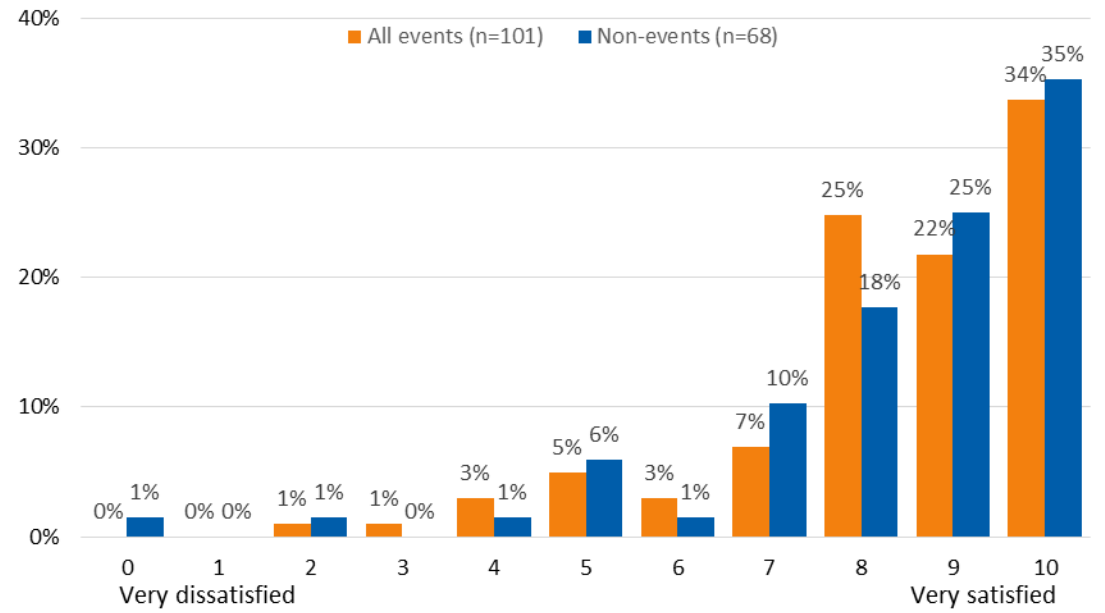
Figure 34. Satisfaction with Duke Energy Overall



Source: Event/Non-Event Survey Question F1. Using a scale of 0 to 10 where 0 indicates "very dissatisfied" and 10 indicates "very satisfied," what what is your overall satisfaction with Duke Energy?

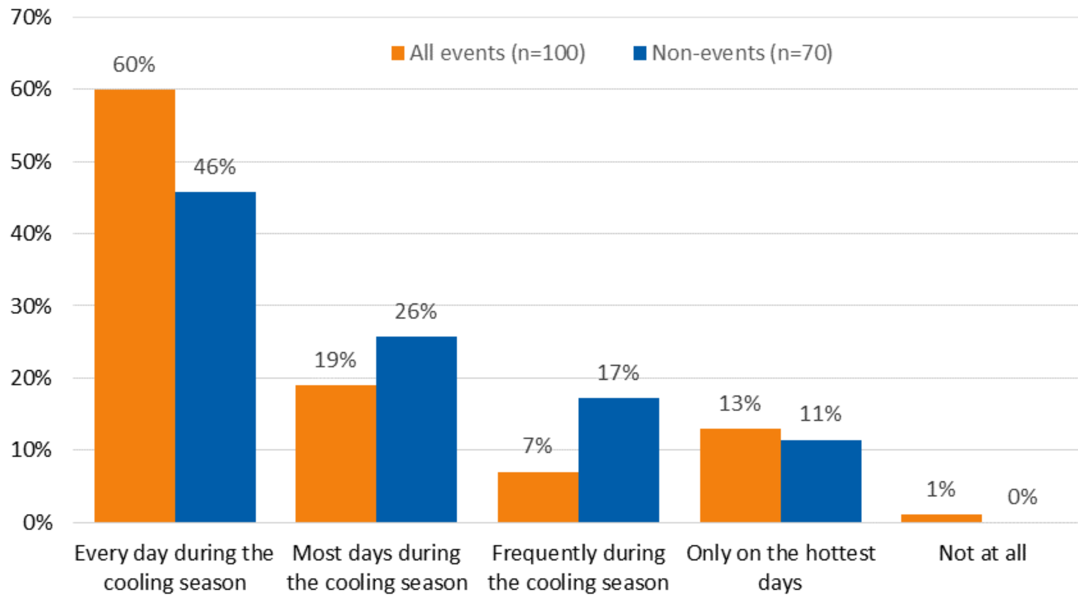
Eight survey respondents (5%; n=169) rated their satisfaction with Duke Energy at 4 or less on a 10-point scale. When we asked why they are dissatisfied, three mentioned frequent power outages, one stated that their utility bills are too expensive, one complained about poor customer service, one mentioned "indiscriminate" tree trimming, one mentioned a lack of utility options, and one complained about a third-party solar company.

Air Conditioner Use

Event/non-event respondents routinely use their air conditioners throughout the cooling season, and are therefore likely to be affected by Power Manager curtailment events, matching the results from the participant survey (see Figure 5). Figure 35 shows that most event (79%; n=100) and non-event (71%; n=70) respondents are using their air conditioning "every day" or "most days" during the cooling season.[22]

[22] Seventy-two percent shown in table due to rounding.

Figure 35. Respondents' Air Conditioner Use



Source: Event/Non-Event Survey Question D1. How often do you use your central air conditioner? Would you say you use it...?

Cadmus asked respondents at what outdoor temperature they start to feel uncomfortable in their home, and at what outdoor temperature they tend to turn on their air conditioners. Figure 36 indicates that the median and modal outdoor temperature at which respondents start to become uncomfortable is 85°F to 87°F, and 91% of event (n=66) and 100% of non-event (n=43) respondents say they are uncomfortable when the outdoor temperatures reaches 91°F to 94°F. Event respondents were significantly more likely to give a temperature of discomfort of 91°F or higher (23%, compared to 5% for non-event respondents) and less likely to give a temperature of 81°F or lower (21%, compared to 42% for non-event respondents).[23]

[23] These differences are statistically significant at p<0.05 or better using a binomial t-test.

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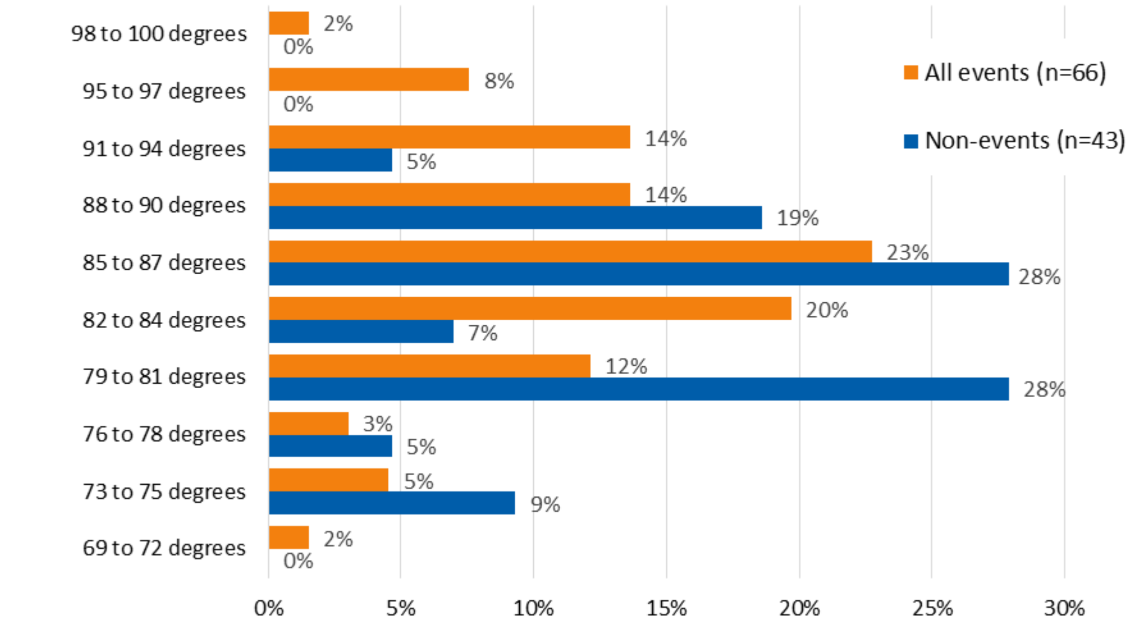
Figure 36. Outdoor Temperature at which Respondents Start to Feel Uncomfortable in their Home



Source: Event/Non-Event Survey Question D2. When you think of a typical hot and humid summer day, at what outside temperature do you tend to feel uncomfortably warm inside your home?

Only 1% of respondents (n=160 combined) said they typically turn on their air conditioner when the outdoor temperature is less than 73°F, while only 2% said they turn on their unit when the outdoor temperature is 91°F or higher (Figure 37). Around one-third of respondents (31%; n=160) did not respond with a specific temperature, saying that their air conditioner is programmed to turn itself on when the indoor temperature reaches a set point. Among those who answered with a specific temperature, there are no significant differences between event and non-event respondents. The median temperature at which respondents turn on air conditioning was around 80°F, which is approximately 5°F lower than the median response for the outdoor temperature at which they tend to become uncomfortable in their home.

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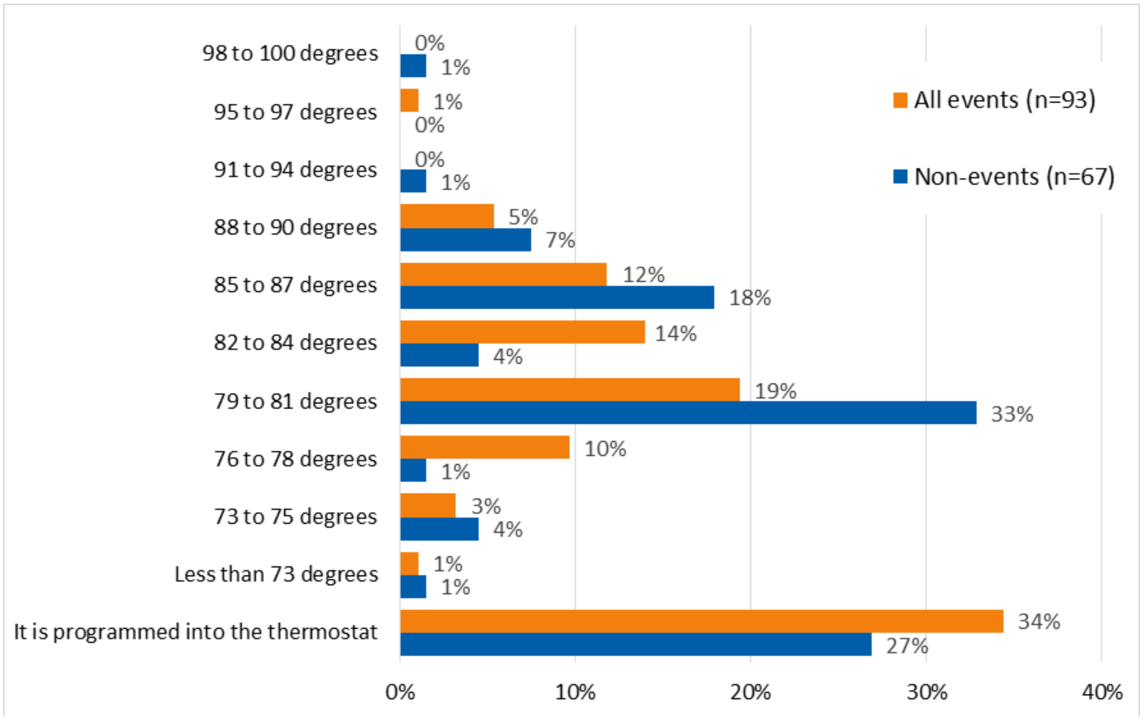
Figure 37. Outdoor Temperature at which Respondents Turn on Air Conditioners



Source: Event/Non-Event Survey Question D3. At what outside temperature do you tend to turn on the central air conditioner?

Cadmus cross-tabulated the responses to outdoor temperature at which a respondent becomes uncomfortable with the temperature at which they turn on their air conditioning (Figure 38). A minority of respondents wait until the outdoor temperature is higher than the temperature at which they become uncomfortable to turn on their air conditioners (9%; n=47 for event and 25%; n=36 for non-event). Event respondents were significantly more likely then non-event respondents to turn on their air conditioning before the outdoor temperature becomes uncomfortable (51%), and less likely to wait until it is higher than uncomfortable. [24]

[24] These differences are statistically significant at p<0.10 or better using a binomial t-test. The participant survey was fielded in November, two months after the end of the cooling season, while the event and non-event surveys were fielded on the hottest days of the summer.

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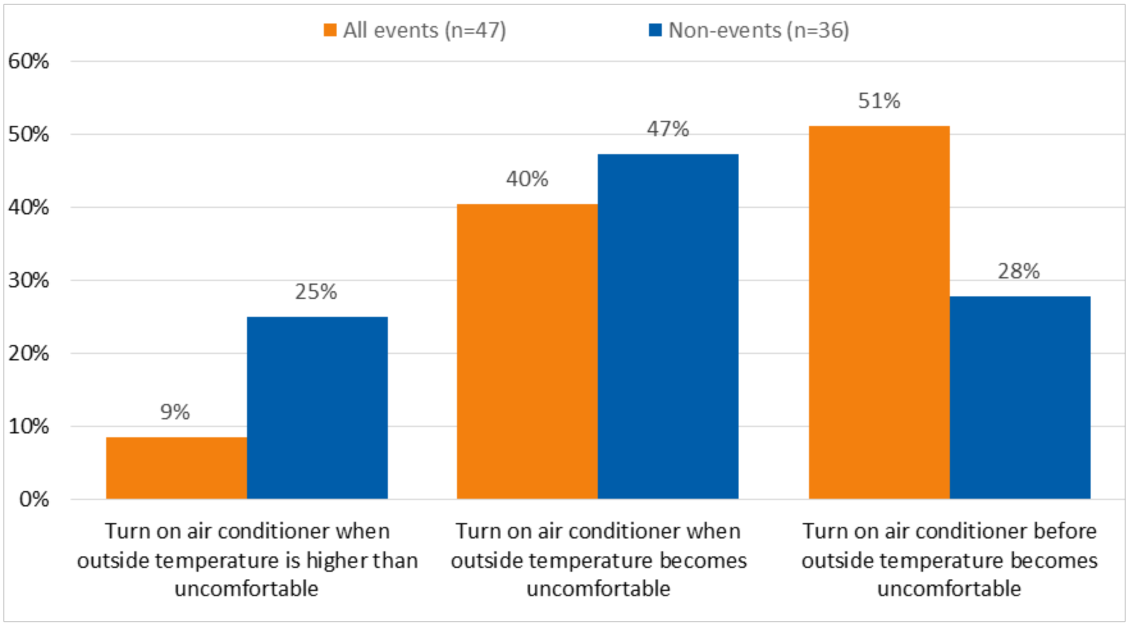
Figure 38. Uncomfortable Outdoor Temperature Compared to Temperature at which Air Conditioners are Turned on



Source: Event/Non-Event Survey Questions D2 and D3. When you think of a typical hot and humid summer day, at what outside temperature do you tend to feel uncomfortably warm in your home? and At what outside temperature do you tend to turn on the central air conditioner? (n=83 who gave numeric responses to both questions).

This result is statistically significantly different from the results of the participant survey (see Figure 9), where only 16% (n=75) said they would turn on their air conditioning before the outdoor temperature reached their level of discomfort, and 31% said they would not turn on air conditioning until the temperature was higher than their level of discomfort.[25]

Age of Air Conditioner

The self-reported median age of participants' air conditioning unit is between 10 and 14 years for event respondents and five to nine years for non-event respondents (Figure 39). Significantly more non-event respondents have air conditioners that are less than 10 years old (63%; n=60) compared to event respondents (46%; n=93).[26]

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[25] The differences between the participant survey (n=75) and combined event/non-event surveys (n=83) are statistically significant at p<0.10 or better using binomial t-tests. The participant survey was fielded in November, two months after the end of the cooling season, while the event and non-event surveys were fielded on the hottest days of the summer.

[26] This difference is statistically significant at p<0.05 using a binomial t-test.

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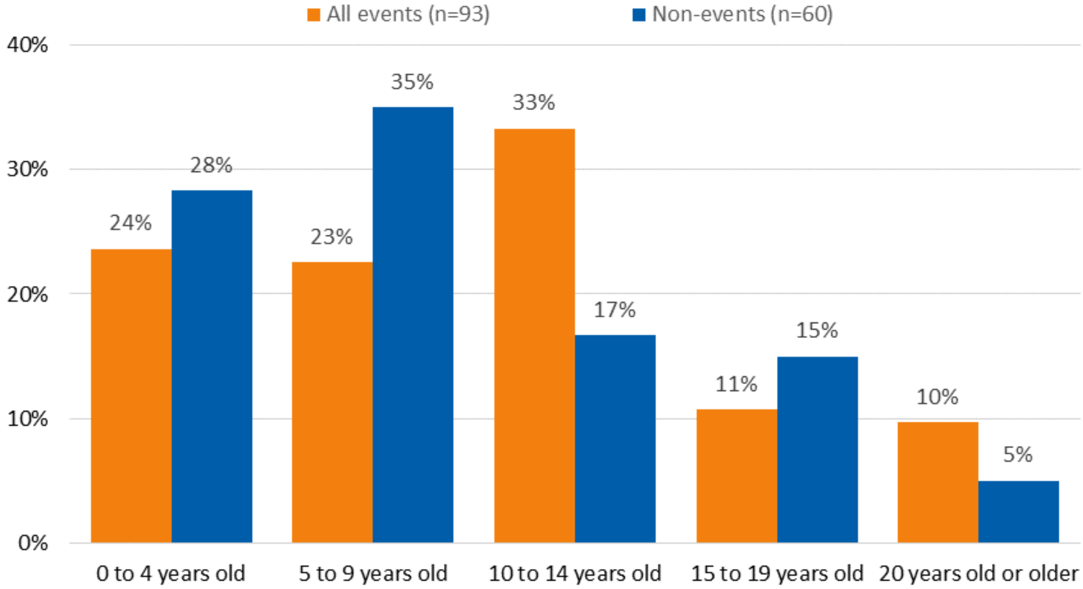
Figure 39. Age of Air Conditioning Unit



Source: Event/Non-Event Survey Question D4. How old is your central air conditioner?

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Impact Evaluation

I. Analytical Methodology

DEO conducted the impact evaluation of the Power Manager Program in a three step approach:

1. Tested the operability of the active switch devices installed at the customer premises.
2. Calculated the impact or demand reduction per switch during events as determined by a duty cycle analysis.
3. Provided documentation to Cadmus for review and approval as the independent EM&V contractor.

J. Operability Study

DEO determined the operability of the active switch devices installed at the customer premises using a representative sample group of customers. There are two components of device operability: the setup factor and the shed factor.

- ***Setup Factor*** - Quantifies the proper installation and configuration of switch devices in the sample group (including the physical installation, wiring, and programming).
- ***Shed Factor*** - Quantifies performance during actual load control events for switches with the correct setup, and measures the switch effectiveness at achieving the programmed load shed.

Combined, the setup and shed factors provide an overall operability rate, which is used to de-rate the program impacts and capacity.

Setup Factor

The setup factor used in this evaluation was established in the 2013 Operability Study, which occurs every four years. In March 2013, DEO selected a random sample of 150 households with 158 switch devices[27] from the population of Power Manager participants in Ohio and Kentucky. The sample size was designed to target ±5% precision at the 90% confidence level. The combination of households selected from the DEO territory met the ±5% precision at the 90% confidence level.

In July 2013, DEO collected switch data from the sample group, downloading it directly from the switch devices. A total of five (5) households were dropped from the operability study (reflecting 5 participating switches) due to the following reasons:

- 3 households due to access problems (gates on households, large dogs)
- 2 households with no data due to the switches not being on

[27] Multiple switch devices are installed at a single household with more than one air conditioning unit enrolled in the program.

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Table 5. PY2013 Operability Group Removals

	Households	Switches
Beginning Sample Group	150	158
Removals from Sample Group	(5)	(5)
Final Sample Group	145	153

The final operability sample group size was 145 households with 153 load control devices. Table 6 summarizes the Operability group observations pertaining to the setup factor.

Table 6. Operability Group Observations of Setup Factor

Reason for Removal from Operability Study	Switch Device Count	Qualifying Multiplier	Weighted Factor
Switch disconnected from air conditioner	14	0.00	0
No switch present at customer premise	3	0.00	0
1.5 kW switch configured as 1.0 kW switch	6	0.67 (2/3)	4
Switch set up correctly	130	1.00	130
Total	**153**		**134**
Set-Up Factor	**0.876**		

DEO calculated the setup factor to be 87.6%.

Setup Factor = Total Weighted Factor / Total Switch Device Count

Shed Factor

As defined in Appendix A: Excerpts from PY2013 Power Manager EM&V Report, DEO used the 97.5% shed factor from the last operability study findings in the PY2013 report.

Shed Factor = Total Weighted Factor / Total Switch Device Count

Operability Study Findings

The operability study performed in 2013 revealed that Power Manager switch devices were operational at a 85.4% rate. DEO applied this de-rate factor to all program switch devices to more accurately represent the available program capacity and kW reduction during events.

The following calculation determined switch operability:

87.6% [2013 sample group setup factor] * 97.5% [2013 sample group shed factor] = 85.4%

The historical operability study results are shown in Table 7.

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Table 7. Historical Operability Study Performance

Program Year	Setup Factor	Shed Factor	De-Rating Factor
PY2013	87.6%	97.5%	85.4%
PY2010	N/A	N/A	93.1%

K. Impact Study

Power Manager load control was activated in DEO during seven days of the summer of 2015. There were two test events and five Power Manager events.

Measurement and Verification Sample

In the research group for DEO, there were 169 households with 180 switches. These households are equipped with Cannon switches and at the end of the season the switch run time data is collected along with interval meter data.

The historical profile is a component of calculating impacts. This information is obtained via downloads from the Cannon switches. The historical profile is a 24-hour run-time profile covering every switch and the percentage of run time for those hours. The run-time profile is made up of 'Saved Dates' which are high temperature dates that are not inclusive of event dates. Each 'Saved Date' goes into the run-time profile with one-eighth weighting.

Adjusters and gears are instructions telling the switch how long to shed. The adjusters are a part of Target Cycling which uses the historical profile to calculate shed time. The lower the adjuster, the greater impact achieved.

Test Events

For operational purposes DEO had two test events for Power Manager. The test event on April 21, 2015 was from 1:30-2:00PM, and the test event on 5/27/2015 was from 10:30-11:30AM. Impacts were not calculated on these test events due to their short duration.

Impact/Switch Realization Rate

Table 8 details the realization rate between the actual impact/switch and expected impact/switch on an event day. The programming of the switch, including gears and adjusters alter the impact/switch during an event.

The calculation for the realization rate is:

$$\text{Realization Rate (\%)} = \text{Actual Impact} / \text{Expected Impact}$$

Table 8. Impact Realization Rate

Date	Hour (EDT)	Expected Impact/Switch	Actual Impact/Switch	Realization Rate (%)
7/17/2015	16	1.5 kW	1.447 kW	96%
		1.0 kW	1.060 kW	106%
7/28/2015	17	1.5 kW	1.771 kW	118%
		1.0 kW	1.161 kW	116%
	18	1.5 kW	1.847 kW	123%
		1.0 kW	1.222 kW	122%
7/29/2015	16	1.5 kW	1.404 kW	94%
		1.0 kW	0.869 kW	87%
	17	1.5 kW	1.217 kW	81%
		1.0 kW	0.692 kW	69%
9/1/2015	17	1.5 kW	1.373 kW	92%
		1.0 kW	0.972 kW	97%
9/4/2015	16	1.5 kW	1.575 kW	105%
		1.0 kW	1.032 kW	103%

PY2015 Load Impact Results

Table 9 details the calculated demand reduction per switch device under peak normal weather and using the de-rated impact from the operability study.

Table 9. Demand Reduction per Switch Device

Switch Type	Control Strategy	Potential Impact (kW)	De-rating Factor	De-rated Impact (kW)
Cannon	Target Cycle 1.5	1.578	0.854	1.35
	Target Cycle 1.0	1.083	0.854	0.92

Table 10. Impact Results by Event Date

Date	Hour (EDT)	OH De-Rated Impact (MW)	OH Switch Count	Temperature (°F)
7/17/2015	16	48.68	47,766	88°
7/28/2015	17	54.53	47,766	90°
	18	57.27		91°
7/29/2015	16	41.31	47,745	75°
	17	33.52		77°
9/1/2015	17	44.73	47,528	87°
9/4/2015	16	48.24	47,528	91°

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PY2015 Program Capacity

Table 11 details the PY2015 total DEO Power Manager Program capacity, adjusted for peak normal weather, de-rated, and calculated at the plant. The last column of Table 11 shows the average capacity of the Power Manager program across the summer months in 2015. The monthly capacity is based on the number of switches at the end of each month.

Table 11. PY2015 Program Capacity, DEO (MWs)

State	Control Strategy	May	June	July	August	September	Summer Capacity
Ohio	Cycling	50.48	50.34	50.34	50.20	50.06	50.29

Table 12 shows the summer monthly load reduction under peak normal weather conditions. Table 13 shows the peak normal weather conditions used to calculate the results in Table 12. The system peak is calculated to occur in the hour 4:00-5:00 pm EDT in DEO.

Table 12. Shed kW/switch with Peak Normal Weather

Switch Type	Control Strategy	Potential Impact	De-rated Impact
Cannon	1.0 kW	1.08	0.92
	1.5 kW	1.58	1.35

Table 13. Peak Normal Weather

Hour	Ohio	
	Temp	Dewpt
11	85.3	71.8
12	87.6	71.9
13	89.9	71.9
14	92.0	71.5
15	93.1	70.7
16	93.9	70.5
17	92.5	70.0
18	92.4	69.5

Cadmus Review of Analytical Approach

Cadmus, as the third-party evaluator, reviewed the files for participation and impacts for the Power Manager program year 2015 provided by Duke Energy. A conservative approach was taken by the Duke Energy measurement and verification team to ensure accurate load reduction. The data reported here align with the information provided in the spreadsheets received. The methods reviewed are comparable with Cadmus' experience in other jurisdictions and confirmed as reliable estimates.

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Appendix A: Excerpts from PY2013 Power Manager EM&V Report

2013 Operability Study for Duke Energy Ohio Cannon Load Control Devices

Cannon devices were instructed to execute a Target Cycle. With Target Cycle, each device calculates a unique shed time for each hour of load control based on the Amps parameter for the attached AC unit (entered into the device at installation) and the expected hourly run-time of the attached AC unit stored in the historical profile registers. Expected run-time is accumulated in the historical profile by saving run-time of the attached AC unit on days with weather conditions similar to load control days.

Table 14 shows the list of events occurred during the summer of 2013 for Cannon switches. The data collection included both device scan data and device data logs. Device data logs contain hourly shed minutes and hourly run-time for the attached AC unit. We obtained shed minutes during each hour of load control from device data logs and this information was used to assess shed performance of devices.

Table 14. OH PM events for Cannon devices

Event Date	Event Duration (EDT)
7/15/2013	2:30 – 5:00 pm
7/16/2013	2:30 – 6:00 pm
7/17/2013	2:30 – 5:00 pm
7/18/2013	2:30 – 5:00 pm

The shed factor measures correct response by properly configured devices to paging signals sent immediately prior to and during a load control event. In the PY2013 study, 136 devices were properly configured to shed. The shed factor was calculated by dividing the total non-zero shed event hours by total event hours for each device. Table 15 summarizes the results pertaining to the shed factor. From this data, the shed factor estimate is 97.5%.

Table 15. Shed Factor

Factor	Count	Weighted Factor
0	1	0
0.17	1	0.17
0.26	1	0.26
0.63	1	0.63
0.83	1	0.83
0.9	2	1.8
0.93	1	0.93
1	128	128
Sum	**136**	**132.62**
Shed Factor	**0.975**	

Shed Factor = Sum of Weighted Factor / Total count

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Appendix B. Participant Household Characteristics and Demographics

Table 16. Participant Household Characteristics and Demographics

Household Characteristics	Ohio
Home Ownership Status	**n=80**
Homeowner	99%
Renter	1%
Type of Home	**n=84**
Single-family home, detached construction	93%
Single-family home, manufactured or modular	2%
Single-family mobile home	0%
Row house	1%
Two- or three-family attached home	1%
Apartment home (4+ families)	0%
Condominium	2%
Home Age	**n=82**
Built before 1960	34%
1960 – 1969	6%
1970 – 1979	10%
1980 – 1989	16%
1990 – 1999	13%
2000 – 2005	17%
2006 – 2015	4%

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Household Characteristics	Ohio
Years Living in Current Residence	**n=84**
Less than 1 year	0%
1 – 3 years	6%
3 – 5 years	7%
5 – 10 years	15%
10 – 15 years	26%
15 – 20 years	12%
20 – 25 years	8%
More than 25 years	25%
Home Size	**n=79**
500 – 999 square feet	1%
1,000 – 1,499 square feet	16%
1,500 – 1,999 square feet	33%
2,000 – 2,499 square feet	29%
2,500 – 2,999 square feet	4%
3,000 – 3,499 square feet	10%
3,500 – 3,999 square feet	1%
4,000 or more square feet	5%
Home Heating System	**n=83 (multiple responses permitted)**
Central forced air furnace	90%
Heat pump	10%
Electric baseboard heat	0%
Geothermal heat pump	0%
Other systems	2%
Primary Fuel Used for Heating	**n=82**
Electricity	18%
Natural gas	76%
Oil or kerosene	4%
Propane	2%
None	0%

Household Characteristics	Ohio
Age of Heating System	**n=83**
0 – 4 years	8%
5 – 9 years	30%
10 – 14 years	33%
15 – 19 years	20%
20 years or older	8%
Home Cooling System	**n=84 (multiple responses permitted)**
Central air conditioning	86%
Heat pump for cooling	13%
Wall or window air conditioning unit(s)	1%
None, do not cool the home	1%
Fuel Used for Cooling	**n=80 (multiple response permitted)**
Electricity	91%
Natural gas	9%
Propane	0%
Age of Cooling System	**n=78**
0 – 4 years	15%
5 – 9 years	32%
10 – 14 years	31%
15 – 19 years	18%
20 years or older	4%
Number of Wall or Window Air Conditioning Units	**n=84**
None	99%
1	1%
2	0%
Number of Thermostats	**n=83**
1	93%
2	7%
3 or more	0%
Have a Programmable Thermostat	**n=81**
Yes	72%
No	28%

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Household Characteristics	Ohio
Primary Fuel Used for Water Heating	**n=82 (multiple responses permitted)**
Natural gas	70%
Electricity	30%
Propane	1%
Age of Water Heater	**n=83**
0 – 4 years	29%
5 – 9 years	39%
10 – 14 years	18%
15 – 19 years	8%
20 years or older	6%
Number of People Living in Home	**n=81**
1	15%
2	40%
3	20%
4	15%
5	7%
6 or more	4%
Number of Teenagers (Age 13 – 19) Living in Home	**n=62**
None	74%
1	13%
2	10%
3	2%
4 or more	2%
Age of Respondent	**n=81**
18 – 34	4%
35 – 49	27%
50 – 59	27%
60 – 64	11%
65 – 74	27%
75 or older	4%

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Household Characteristics	Ohio
Annual Household Income	**n=59**
Under $15,000	2%
$15,000 – $29,999	5%
$30,000 – $49,999	15%
$50,000 – $74,999	19%
$75,000 – $99,999	31%
Over $100,000	29%

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Appendix C: Process Instruments Used for the PY2015 Evaluation

Three survey instruments and the management interview guide are included on the following pages:

- Participant Survey Instrument
- Event Survey Instrument
- Non-Event Survey Instrument
- Program Manager Interview Guide

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Duke Energy
Participant Survey 2015

Researchable Questions	Item
Introduction / screening	A1-3
Program participation and enrollment	B1-9
Program information	C1-6
Awareness of activation	D1-4
Response to activation	E1-10
Satisfaction with the program	F1-5
Air conditioner usage	G1-22
Participation and interest in other programs	H1-2
Satisfaction with Duke Energy	I1-4
Bill credits	J1-3
Household demographics and characteristics	K1-20
Closing (confirm incentive address)	L1-2

Target Quota = [80 completes for OH]

A. *Introduction*

Welcome! We are following up with participants of Duke Energy's Power Manager® Program to help Duke Energy understand opinions that will help improve this Program. This survey will take approximately 20 minutes to complete. Please complete the survey by November 30th. Thank you in advance.

As a token of our appreciation we will enter your name into a drawing for a $100 gift card once the survey is complete. Instructions for accepting the gift card are provided at the end of the survey. Winners will be notified in 4 to 6 weeks.

This survey is administered by The Cadmus Group, an independent consulting firm. The survey is designed for appearance on a computer screen rather than a mobile or tablet device. If you experience technical difficulties completing the survey, please email The Cadmus Group at David.Ladd@CadmusGroup.com.

If you have any questions or need to contact Duke Energy, you may reach out to Frankie.diersing@duke-energy.com.

Please click Next to enter the survey.

A1. Please identify the state in which you live.

1. North Carolina
2. South Carolina
3. Ohio
4. Indiana

A2. Are you aware of your participation in the Power Manager® program?

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

[ASK IF A2 <>1]

A3. Just to confirm, in the Power Manager program, Duke Energy installs a device outside on your central air conditioner or heat pump which allows the utility to cycle your cooling on and off for a few minutes during periods of critical need for electricity. Are you aware of your participation in the Power Manager program (is there a device installed outside on your air conditioner or heat pump)?

1. Yes
2. No [TERMINATE]
98. (Don't know) [TERMINATE]

B. Program Participation and Enrollment

B1. Were you involved in the decision to participate in Duke Energy's Power Manager Program?

1. (Yes)
2. (No)
3. (It was already installed when I moved in)
98. (Don't know)
99. (Refused)

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[ASK IF B1=1]

B2. How did you hear about the Power Manager Program? [DO NOT READ LIST; RECORD ALL THAT APPLY]

1. (Something in the mail from Duke Energy)
2. (Phone call from Duke Energy (telemarketing)
3. (Email from Duke Energy)
4. (Duke Energy website)
5. (Other website,) [SPECIFY]
6. (Word-of-mouth (friend/neighbor/landlord))
7. (Newspapers)
8. (Television)
9. (Radio)
10. (Social media network) [SPECIFY]
11. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

[ASK IF B1=1]

B3. What was the main reason why you chose to participate in the program? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (For the bill credits)
2. (Helping Duke avoid power shortages/outages)
3. (Helping Duke avoid building power plants)
4. (To save energy)
5. (To save money (through lower utility bills))
6. (To help the environment) [ASK: Please explain]
7. (I don't use the air conditioner much)
8. (I'm usually not home when the events are supposed to occur)
9. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

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[ASK IF B1=1]

B4. Were there any other reasons why you chose to participate in this program? [DO NOT READ LIST; RECORD ALL THAT APPLY]

1. (No other reasons)
2. (For the bill credits)
3. (Helping Duke avoid power shortages/outages)
4. (Helping Duke avoid building power plants)
5. (To save energy)
6. (To save money (through lower utility bills))
7. (To help the environment) [ASK: Please explain]
8. (I don't use the air conditioner much)
9. (I'm usually not home when the events are supposed to occur)
10. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

B5. During the time you enrolled, Duke Energy provided you with information that described how the Power Manager program works. Do you recall this information?

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

[ASK IF B5=1]

B6. Using a scale of 0 to 10 where zero 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. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

[ASK IF B6 IS 4 OR BELOW]

B7. Why do you say you are dissatisfied with this information?

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

B8. Using a scale of 0 to 10 where zero indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", how satisfied were you with the process of enrolling in the program?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

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[ASK IF B8 IS 4 OR BELOW]

B9. Why do you say you are dissatisfied with this enrollment process?

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

C. Program Information

C1. How many times per year did Duke Energy tell you it would activate the Power Manager device on your air conditioner?

1. [RECORD NUMBER]
98. (Don't know)
99. (Refused)

C2. Is anything unclear to you about how the program works?

1. (Yes) [ASK C2a]
   C2a. What is unclear to you? [RECORD RESPONSE]
2. (No)
98. (Don't know)
99. (Refused)

C3. Did you ever contact Duke Energy to find out more about the Power Manager Program?

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

[ASK IF C3=1]

C4. What method did you use to contact Duke Energy? [DO NOT READ LIST; RECORD ALL THAT APPLY]

1. (Phone)
2. (Email)
3. (In person)
4. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

[ASK IF C3=1]

C5. Using a scale of 0 to 10 where zero indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", how satisfied were you with how the Duke Energy representative responded to your questions?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

[ASK IF C5 IS 4 OR BELOW]

C6. Why do you say you are dissatisfied? [RECORD ALL THAT APPLY; DO NOT READ LIST]

1. (Didn't respond to my questions/ concerns)
2. (Unable to answer/address my questions/concerns)
3. (Not professional/not courteous)
4. (Other) [SPECIFY]

98. (Don't know)

99. (Refused)

D. *Awareness of Device Activation*

D1. Are you aware of any times when Duke Energy may have activated your Power Manager device since you joined the program? [IF ASKED WHAT THIS MEANS SAY, "Has your air conditioner been controlled so that it cycles off and on when energy demand is high?"]

1. (Yes)
2. (No) [SKIP TO F1]

98. (Don't know) [SKIP TO F1]

99. (Refused) [SKIP TO F1]

[ASK IF DD1=1]

D2. What happened that made you believe that the device had been activated? [RECORD ALL THAT APPLY; DO NOT READ LIST]

1. (A/C shuts down)
2. (Home temperature rises)
3. (The light on the meter is on)
4. (Light on AC unit flashes)
5. (Bill credits)
6. (Lower bill)
7. (Contact or notification from Duke Energy (other than bill))
8. (Customer called the Power Manager 800 number)
9. (Other) [SPECIFY]

98. (Don't know)

99. (Refused)

[ASK IF D1=1]

D3. During the summer of 2015, about how many times do you believe Duke Energy activated your Power Manager device?

1. [RECORD NUMERIC RESPONSE >0]
2. (None) [SKIP TO E6]

98. (Don't know)

99. (Refused)

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[ASK IF D1=1]

D4. Were you or any members of your household home when Duke Energy activated your Power Manager device this past summer?

1. (Yes)
2. (No) [SKIP TO E6]
98. (Don't know) [SKIP TO E6]
99. (Refused) [SKIP TO E6]

E. *Response to Activation*

[ASK IF D4=1]

E1. Using a scale of 0 to 10 where zero means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort <u>before</u> your device was activated?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

[ASK IF D4=1]

E2. Using the same scale of 0 to 10 where zero means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort <u>during</u> the period when the device was activated?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

[ASK IF E2 IS LESS THAN E1]

E3. What do you feel was the main reason for your decrease in comfort? [RECORD ALL THAT APPLY] [IF CUSTOMER SAYS "rising temperature" or "rising humidity" ASK WHERE THEY ARE REFERRING TO INDOOR OR OUTDOOR OR BOTH.]

1. (Power Manager device activation)
2. (Rising outdoor Temperature)
3. (Rising indoor temperature)
4. (Rising outdoor Humidity)
5. (Rising indoor humidity)
6. (Power Outage)
7. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

[ASK IF D4=1]

E4. After your comfort level decreased during the Power Manager device activation, how long did it take for the comfort level in your home to return to normal? Would you say…

1. Less than one hour
2. More than 1 but less than 2 hours
3. More than 2 but less than 3 hours
4. More than 3 but less than 4 hours
5. Or more than 4 hours

98. (Don't know)
99. (Refused)

E5. Thinking about this summer, how many times do you think the activation of the Power Manager program affected your level of comfort?

1. [RECORD RESPONSE]

98. (Don't know)
99. (Refused)

[ASK IF D1=1]

E6. On a day when Duke Energy activates your Power Manager device, for how many hours do you think they are typically controlling your air conditioner?

1. [RECORD NUMBER OF HOURS]

98. (Don't know)
99. (Refused)

[ASK IF D1=1]

E7. On a day when Duke Energy activates your Power Manager device, at what time of day do you think that they usually de-activate and stop controlling your air conditioner?

1. [RECORD TIME OF DAY]

98. (Don't know)
99. (Refused)

[ASK IF D4=1]

E8. When Duke Energy activated your Power Manager device, did you or any other members of your household adjust the settings on your thermostat?

1. (Yes)
2. (No)

98. (Don't know)
99. (Refused)

[ASK IF E8=1]

E9. At what temperature was it originally set, and what temperature did you set it to during the control event?

E9b. (ORIGINAL TEMPERATURE SETTING) [RECORD DEGREES F]

E9c. (ADJUSTED TEMPERATURE SETTING) [RECORD DEGREES F]

[ASK IF D4=1]

E10. Did you or other members of your household do anything else to keep cool? [RECORD ALL THAT APPLY; DO NOT READ LIST]

1. (Continued normal activities/did not do anything else)
2. (Turned on room/window air conditioners)
3. (Turned on fan(s))
4. (Closed blinds/shades)
5. (Moved to a cooler part of the house)
6. (Left the house and went somewhere cool)
7. (Wore less clothing)
8. (Drank more water/cool drinks)
9. (Cooled off with water (shower, bath, sprinkler, hose, pool))
10. (Opened windows)
11. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

F. *Satisfaction with the Program*

[ASK EVERYONE]

F1. Using a scale of 0 to 10 where zero indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", how satisfied are you with the Power Manager program in general?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

[ASK IF F1 IS 4 OR BELOW AND STATE IS NC, SCOR IN; DO NOT ASK FOR OHIO]

F2. Why do you say you are dissatisfied with the Power Manager Program? [DO NOT READ LIST; RECORD ALL THAT APPLY]

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

[ASK IF STATE = OHIO]

F3. How would you rate your overall satisfaction with the Power Manager Program, would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied, or Very Dissatisfied?

1. Very satisfied
2. Somewhat satisfied
3. Neither satisfied nor dissatisfied
4. Somewhat satisfied
5. Very dissatisfied
98. (Don't know)
99. (Refused)

[ASK IF F3=1, 2, 3, 4 or 5]

F4. Why do you give it that rating?

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

F5. Using a scale of 0 to 10, where zero 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. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

G. Air Conditioner Use

Next are a few questions about your air conditioning use.

G1. How often do you use your central air conditioner? Would you say you use it ... [READ LIST UNTIL THEY REPLY]

1. Not at all
2. Only on the hottest days
3. Frequently during the cooling season
4. Most days during the cooling season
5. Every day during the cooling season
98. (Don't know)
99. (Refused)

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G2. Have you had your central air conditioner tuned-up or serviced since you enrolled in the Power Manager program?

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

[ASK IF G2=1]

G3. Was the Power Manager device disconnected while your air conditioner was being serviced?

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

[ASK IF G3=1]

G4. Was the Power Manager device re-connected after completing service on the air conditioner?

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

[ASK IF G4=2]

G5. Why wasn't the Power Manager device re-connected?

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

G6. Is the central air conditioner typically used to keep someone at home comfortable during summer weekdays before 6 P.M.? [IF NEEDED: SOMEONE INCLUDES PETS, IF APPLICABLE]

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

G7. Is the air conditioner typically used to keep someone at home comfortable during summer weekdays after 6 P.M.? [IF NEEDED: SOMEONE INCLUDES PETS, IF APPLICABLE]

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

G8. When you think of a typical hot and humid summer day, at what outside temperature would you start to feel uncomfortably warm in your home? [DO NOT READ LIST AND RECORD ONE RESPONSE]

1. (Less than 73 degrees)
2. (73 to 75 degrees)
3. (76 to 78 degrees)
4. (79 to 81 degrees)
5. (82 to 84 degrees)
6. (85 to 87 degrees)
7. (88 to 90 degrees)
8. (91 to 95 degrees)
9. (96 to 100 degrees)
10. (Greater than 100 degrees)
98. (Don't know)
99. (Refused)

G9. At what outside temperature do you tend to turn on the central air conditioner? [DO NOT READ LIST AND RECORD ONE RESPONSE]

1. (It is programmed into the thermostat)
2. (Less than 73 degrees)
3. (73 to 75 degrees)
4. (76 to 78 degrees)
5. (79 to 81 degrees)
6. (82 to 84 degrees)
7. (85 to 87 degrees)
8. (88 to 90 degrees)
9. (91 to 95 degrees)
10. (96 to 100 degrees)
11. (Greater than 100 degrees)
98. (Don't know)
99. (Refused)

[ASK IF G9=1]

G10. Do you set your thermostat based on the season or when the weather gets hot? [DO NOT READ LIST AND RECORD ONE RESPONSE]

1. (Based on the season)
2. (When the weather gets hot)
3. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

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G11. Which of the following best describes how you control the temperature in your home during the summer? [CHECK ONE]

1. We leave the thermostat at the same setting all the time.
2. We have programmed the thermostat to adjust temperature settings automatically at pre-set times (including using a "smart thermostat").
3. We manually adjust the setting on the thermostat at specific times (overnight, when leaving the house, etc.)
4. We manually adjust the setting on the thermostat as needed without any set pattern or schedule.

98. (Don't know)
99. (Refused)

[ASK IF G11=1]

G12. What temperature is your thermostat usually set to during the summer? [DO NOT READ LIST AND SELECT ONE RESPONSE]

1. (less than 65 degrees)
2. (65-68 degrees)
3. (69-72 degrees)
4. (73-75 degrees)
5. (76-78 degrees)
6. (greater than 78 degrees)
7. (Off)

98. (Don't know)

[ASK IF G11<>1]

G13. On a hot weekday morning from 6 am to noon, what temperature do you set your thermostat to? [DO NOT READ LIST AND SELECT ONE RESPONSE]

1. (less than 65 degrees)
2. (65-68 degrees)
3. (69-72 degrees)
4. (73-75 degrees)
5. (76-78 degrees)
6. (greater than 78 degrees)
7. (Off)

98. (Don't know)
99. (Refused)

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[ASK IF G11<>1]

G14. On a hot weekday afternoon from noon to 6 pm, what temperature do you set your thermostat to?

[DO NOT READ LIST AND SELECT ONE RESPONSE]

1. (less than 65 degrees)
2. (65-68 degrees)
3. (69-72 degrees)
4. (73-75 degrees)
5. (76-78 degrees)
6. (greater than 78 degrees)
7. (Off)
98. (Don't know)
99. (Refused)

[ASK IF G11<>1]

G15. On a hot weekday evening from 6 pm to 10pm, what temperature do you set your thermostat to?

[DO NOT READ LIST AND SELECT ONE RESPONSE]

1. (less than 65 degrees)
2. (65-68 degrees)
3. (69-72 degrees)
4. (73-75 degrees)
5. (76-78 degrees)
6. (greater than 78 degrees)
7. (Off)
98. (Don't know)
99. (Refused)

[ASK IF G11<>1]

G16. During a hot weekday night from 10pm to 6am, what temperature do you set your thermostat to?

[DO NOT READ LIST AND SELECT ONE RESPONSE]

1. (less than 65 degrees)
2. (65-68 degrees)
3. (69-72 degrees)
4. (73-75 degrees)
5. (76-78 degrees)
6. (greater than 78 degrees)
7. (Off)
98. (Don't know)
99. (Refused)

CADMUS

[ASK IF G11<>1]

G17. Do you use the same thermostat settings on summer weekends that you use on weekdays, or are your settings different on the weekend? [CHECK ONE]

1. Same settings on weekdays and weekends.
2. Different settings on weekends.
98. (Don't know)
99. (Refused)

[ASK IF G17=2]

G18. On a hot weekend morning from 6 am to noon, what temperature do you set your thermostat to? [DO NOT READ LIST AND SELECT ONE RESPONSE]

1. (less than 65 degrees)
2. (65-68 degrees)
3. (69-72 degrees)
4. (73-75 degrees)
5. (76-78 degrees)
6. (greater than 78 degrees)
7. (Off)
98. (Don't know)
99. (Refused)

[ASK IF G17=2]

G19. On a hot weekend afternoon from noon to 6 pm, what temperature do you set your thermostat to? [DO NOT READ LIST AND SELECT ONE RESPONSE]

1. (less than 65 degrees)
2. (65-68 degrees)
3. (69-72 degrees)
4. (73-75 degrees)
5. (76-78 degrees)
6. (greater than 78 degrees)
7. (Off)
98. (Don't know)
99. (Refused)

CADMUS

[ASK IF G17=2]

G20. On a hot weekend evening from 6 pm to 10pm, what temperature do you set your thermostat to?
[DO NOT READ LIST AND SELECT ONE RESPONSE]

1. (less than 65 degrees)
2. (65-68 degrees)
3. (69-72 degrees)
4. (73-75 degrees)
5. (76-78 degrees)
6. (greater than 78 degrees)
7. (Off)
98. (Don't know)
99. (Refused)

[ASK IF G17=2]

G21. During a hot weekend night from 10pm to 6am, what temperature do you set your thermostat to?
[DO NOT READ LIST AND SELECT ONE RESPONSE]

1. (less than 65 degrees)
2. (65-68 degrees)
3. (69-72 degrees)
4. (73-75 degrees)
5. (76-78 degrees)
6. (greater than 78 degrees)
7. (Off)
98. (Don't know)
99. (Refused)

G22. On a weekday afternoon when the outdoor temperature is in the 90's, how often do you use electric fans to keep cool in your home? Would you say that you have fans on . . .

1. Always
2. Most of the time
3. Occasionally
4. Or never?
98. (Don't know)
99. (Refused)

CADMUS

H. Participation and Interest in Other Programs

H1. What, if any, Duke Energy programs or services have you heard of that help customers save energy? [PROBE:] Any others? [RECORD ALL THAT APPLY; DO NOT READ LIST]

1. (Smart Saver (other than CFL) – rebates for HVAC equipment and maintenance, including duct sealing and attic insulation)
2. (Free CFL Programs (Smart Saver CFLs / CFLs by mail))
3. (Savings Store (specialty light bulbs sold online))
4. (Water Measures (water and energy saving kit or rebates for heat pump water heaters, pool pumps))
5. (Home Energy House Call (auditor visits home to give advice and install measures)
6. (My Home Energy Report (mailed or online report about household energy usage)
7. (Energy Star Homes)
8. (Low Income, Weatherization, or Low Income Weatherization)
9. (School-based programs: school performances, kits by mail)
10. (Appliance Recycling (remove old refrigerators and freezers)
11. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

H2. Duke Energy is always looking for other ways to help their customers. If Duke were to offer a program that cycles on and off other equipment at your home such as an electric water heater, would you be interested in participating?

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

I. Satisfaction with Duke Energy

I1. Using a scale of 0 to 10 where zero indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", what is your overall satisfaction with Duke Energy?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

[ASK IF I1 IS 4 OR BELOW AND STATE IS NC, SC OR IN (do not ask for OH)]

I2. Why do you say you are dissatisfied with Duke Energy?

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

[ASK IF STATE = OHIO]

I3. How would you rate your overall satisfaction with Duke Energy, would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied, or Very Dissatisfied?

1. Very satisfied
2. Somewhat satisfied
3. Neither satisfied nor dissatisfied
4. Somewhat satisfied
5. Very dissatisfied
98. (Don't know)
99. (Refused)

[ASK IF I3=1, 2, 3, 4 or 5]

I4. Why do you give it that rating?

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

J. Bill credits

J1. 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?

1. [RECORD DOLLAR AMOUNT]
98. (Don't know)
99. (Refused)

J2. Have you received any bill credits this year from Duke Energy for participating in this program?

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

[ASK IF J2=1]

J3. How many times have you noticed the Power Manager credits on your bill this summer? [DO NOT READ LIST AND RECORD ONE RESPONSE]

1. (Every bill this summer)
2. (Once)
3. (Twice)
4. (Three times)
5. (Four or more times)
6. (Other) [SPECIFY]
7. (Don't know)
8. (Refused)

K. Demographics

Finally, we have some questions about your household.

K1. In what type of building do you live? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (Single-family home, detached construction)
2. (Single-family home, factory manufactured/modular)
3. (Single family, mobile home)
4. (Row House)
5. (Two or Three family attached residence-traditional structure)
6. (Apartment (4 + families)---traditional structure)
7. (Condominium---traditional structure)
8. (Other) [SPECIFY]

98. (Don't know)
99. (Refused)

K2. Approximately when was your home constructed? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (Before 1960)
2. (1960-1969)
3. (1970-1979)
4. (1980-1989)
5. (1990-1999)
6. (2000-2005)
7. (2006-present)

98. (Don't know)
99. (Refused)

CADMUS

K3. How long have you been living in your current residence? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (less than 1 year)
2. (1 to 3 years)
3. (3 to 5 years)
4. (5 to 10 years)
5. (10 to 15 years)
6. (15 to 20 years)
7. (20 to 25 years)
8. (more than 25 years)
98. (Don't know)
99. (Refused)

K4. Which of the following best describes your home's heating system? [READ LIST; RECORD ALL THAT APPLY]

1. Central forced air furnace
2. Electric Baseboard
3. Heat Pump
4. Geothermal Heat Pump
5. Other [SPECIFY]
6. (None; home has no heating system)
98. (Don't know)
99. (Refused)

[ASK IF K4 <>6]

K5. How old is your heating system? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (0-4 years)
2. (5-9 years)
3. (10-14 years)
4. (15-19 years)
5. (20 years or older)
6. (Do not have)
98. (Don't know)
99. (Refused)

CADMUS

[ASK IF K4 <>6]

K6. What is the primary fuel used in your heating system? Is it…[READ LIST; RECORD ONE RESPONSE]

1. Electricity
2. Natural Gas
3. Oil
4. Propane
5. Other [SPECIFY]
98. (Don't know)
99. (Refused)

K7. Do you use one or more of the following to cool your home? [READ LIST; RECORD ALL THAT APPLY]

1. Heat pump for cooling
2. Central air conditioning
3. Through the wall or window air conditioning unit
4. Geothermal Heat pump
5. Other [SPECIFY]
6. (None; do not cool the home)
98. (Don't know)
99. (Refused)

[ASK IF K7=3]

K8. How many window-unit or "through the wall" air conditioner(s) do you use? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (None)
2. (1)
3. (2)
4. (3)
5. (4)
6. (5)
7. (6)
8. (7)
9. (8 or more)
98. (Don't know)
99. (Refused)

CADMUS

[ASK IF K7 <>6]

K9. What is the fuel used in your cooling system? Is it… [READ LIST; RECORD ONE RESPONSE]

1. Electricity
2. Natural Gas
3. Oil
4. Propane
5. (Other) [SPECIFY]
6. (None)
98. (Don’t know)
99. (Refused)

[ASK IF K7 <>6]

K10. How old is your cooling system? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (0-4 years)
2. (5-9 years)
3. (10-14 years)
4. (15-19 years)
5. (20 years or older)
6. (Do not have)
98. (Don’t know)
99. (Refused)

K11. What is the fuel used by your water heater? [DO NOT READ LIST; RECORD ALL THAT APPLY]

1. (Electricity)
2. (Natural Gas)
3. (Oil)
4. (Propane)
5. (Other) [SPECIFY]
6. (No water heater)
98. (Don’t know)
99. (Refused)

CADMUS

[ASK IF K11 <>6]

K12. How old is your water heater? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (0-4 years)
2. (5-9 years)
3. (10-14 years)
4. (15-19 years)
5. (20 years or older)
98. (Don't know)
99. (Refused)

K13. About how many square feet of living space are in your home? [IF NEEDED: DO NOT INCLUDE GARAGES OR OTHER UNHEATED AREAS. A 10-FOOT BY 12-FOOT ROOM IS 120 SQUARE FEET.]

1. (Less than 500)
2. (500 to 999)
3. (1000 to 1499)
4. (1500 to 1999)
5. (2000 to 2499)
6. (2500 to 2999)
7. (3000 to 3499)
8. (3500 to 3999)
9. (4000 or more)
98. (Don't know)
99. (Refused)

K14. Do you own or rent your home?

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

K15. How many thermostats are there in your home?

1. (0)
2. (1)
3. (2)
4. (3)
5. (4 or more)
98. (Don't know)
99. (Refused)

CADMUS

K16. Do you have a programmable thermostat?

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

K17. Including yourself, how many people live in this home?

1. (1)
2. (2)
3. (3)
4. (4)
5. (5)
6. (6)
7. (7)
8. (8 or more)
98. (Don't know)
99. (Prefer not to answer)

K18. How many of the people living in your home are teenagers between ages 13 and 19?

1. (none)
2. (1)
3. (2)
4. (3)
5. (4)
6. (5)
7. (6)
8. (7)
9. (8 or more)
98. (Don't know)
99. (Prefer not to answer)

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.

K19. Please select your age group. [READ LIST; RECORD ONE RESPONSE]

1. 18 to 34
2. 35 to 49
3. 50 to 59
4. 60 to 64
5. 65 to 74
6. Over 74
99. (Prefer not to answer)

K20. Please select your annual household income. [RECORD ONE RESPONSE]

1. Under $15,000
2. $15,000-$29,999
3. $30,000-$49,999
4. $50,000-$74,999
5. $75,000-$100,000
6. Over $100,000

98. (Don't know)
99. (Prefer not to answer)

L. Closing

L1. Please let us know if the email used to send you this survey is the best way to contact you about future surveys.

1. The email this survey was sent to is correct.
2. Please contact me in the future at (enter new email): [SPECIFY]

L2. Those were all the questions we have for you. Before you go, we need to verify your address for the $100 drawing. Please enter the best address for use to use.

1. [SPECIFY NAME, STREET ADDRESS, CITY, STATE, ZIP CODE]

Thanks again for your time today! We will notify the winner of the Visa gift card in about 4-6 weeks.

CADMUS

Duke Energy
Power Manager Event Survey 2015

Researchable Questions	Item
Introduction / screening	A1-5
Device activation awareness	B1-5
Response to activation	C1-9
AC usage	D1-4
Satisfaction with program	E1-4
Satisfaction with Duke Energy	F1-3
Demographics (number of occupants)	G1

General Instructions

- Interviewer instructions are in green **[LIKE THIS]** (the style is “Survey: Interviewer Instructions”).
- CATI programming instructions are in red **[LIKE THIS]** (the style is “Survey: Programming”).
- Items that should not be read by the interviewer are in parentheses like this ( ).

Variables defined in survey programming (update for each event)

- [DATE OF EVENT]
- [EVENT START TIME]
- [EVENT END TIME]

Calling Instructions:

Only calls to homes, please. Businesses are not eligible for this survey.

Make one call attempt per contact within 28 hours of the end of the event. Callbacks are OK as long as the survey is completed within 28 hours of the end of the event. Call times are from 10:00 a.m. to 8:00 p.m. EST Monday through Saturday. No calls on Sunday. For example, if a control event occurs on a Monday ending at 5 p.m., calling hours for that particular event would be:

Monday 5 p.m.-8 p.m. Eastern

Tuesday 10 a.m.-8 p.m. Eastern

CADMUS

A. Introduction

A1. Hello, my name is _____, and I'm calling on behalf of Duke Energy with a short customer satisfaction survey. This survey will take about five minutes to complete; do you have five minutes to answer some questions for us today?

1. Yes
2. No or not a convenient time **[THANK AND TERMINATE]**

99. (Refused) **[THANK AND TERMINATE]**

A2. Thank you. The information you provide will be confidential and will help to improve service. This call may be monitored or recorded for quality assurance puposes. According to our information, you participate in the Power Manager® Program. This program allows Duke Energy to cycle your air conditioner on and off during periods of critical need for electricity. Are you aware of your participation in the Power Manager program?

1. Yes
2. No **[ASK IF THERE IS SOMEONE ELSE AVAILABLE WHO WOULD KNOW AND RESTART SURVEY WITH THAT PERSON; IF NO ONE ELSE IS AVAILABLE THANK AND TERMINATE]**

98. (Don't know) **[ASK IF THERE IS SOMEONE ELSE AVAILABLE WHO WOULD KNOW AND RESTART SURVEY WITH THAT PERSON; IF NO ONE ELSE IS AVAILABLE THANK AND TERMINATE]**

A3. Just to confirm, do you still live at **[ADDRESS FROM CALL SHEET]**?

1. Yes
2. No **[THANK AND TERMINATE]**

98. (Don't know) **[THANK AND TERMINATE]**

CADMUS

A4. **[CHECK STATE FROM CALL SHEET]**

1. North Carolina / South Carolina
2. Ohio
3. Indiana

A5. **[COPY RESPONDENT ID NUMBER FROM CALL SHEET]**

1. **[PASTE RESPONDENT ID NUMBER HERE]**

B. Device Activation Awareness

B1. 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 when there is peak demand foir electricity.*" THEN REPEAT THE QUESTION.]*

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

B2. How can you tell (how would you be able to tell) when the device has been activated? [RECORD ALL THAT APPLY; DO NOT READ LIST]

1. (A/C shuts down)
2. (Home temperature rises)
3. (The light on the meter is on)
4. (Light on AC unit flashes)
5. (Bill credits)
6. (Lower bill)
7. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

B3. Has your device been activated in the last two days? [IF NEEDED: Was your device activated yesterday or today?]

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

B4. At what temperature was your thermostat set to between [EVENT START TIME] and [EVENT END TIME] on [EVENT DATE]? [DO NOT READ LIST]

1. (Less than 65 degrees)
2. (65 to 68 degrees)
3. (69 to 72 degrees)
4. (73 to 75 degrees)
5. (76 to 78 degrees)
6. (79 to 81 degrees)
7. (82 to 84 degrees)
8. (85 to 87 degrees)
9. (88 to 90 degrees)
10. (91 to 94 degrees)
11. (95 to 97 degrees)
12. (98 to 100 degrees)
13. (Greater than 100 degrees)
14. (It's programmed into the thermostat)
15. (Thermostat was turned off)
16. (Air conditioner was turned off)
98. (Don't know)
99. (Refused)

B5. Were you or any members of your household home at that time?

1. (Yes)
2. (No) [SKIP TO D1]
98. (Don't know) [SKIP TO D1]
99. (Refused) [SKIP TO D1]

C. Response to Activation

[ASK IF B5=1]

C1. Using a scale of 0 to 10 where zero means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort before [EVENT START TIME] on [EVENT DATE]?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

CADMUS

[ASK IF B5=1]

C2. Using the same scale of 0 to 10 where zero means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort between [EVENT START TIME] and [EVENT END TIME] on [EVENT DATE]?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

[ASK IF C2<C1]

C3. What do you feel caused your decrease in comfort? [RECORD ALL THAT APPLY; DO NOT READ LIST] [IF CUSTOMER SAYS "rising temperature" or "rising humidity" ASK WHETHER THEY ARE REFERRING TO INDOOR OR OUTDOOR OR BOTH.]

1. (Power Manager device activation)
2. (Rising outdoor Temperature)
3. (Rising indoor temperature)
4. (Rising outdoor Humidity)
5. (Rising indoor humidity)
6. (Power Outage)
7. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

[ASK IF B5=1]

C4. Between [EVENT START TIME] and [EVENT END TIME] on [EVENT DATE], did you or any other members of your household adjust the settings on your thermostat?

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

[ASK IF C4=1]

C5. At what temperature was it originally set, and what temperature did you set it to during the event?

C5a. (ORIGINAL TEMPERATURE SETTING) [RECORD DEGREES F]

C5b. (ADJUSTED TEMPERATURE SETTING) [RECORD DEGREES F]

CADMUS

[ASK IF B5=1]

C6. Between [EVENT START TIME] and [EVENT END TIME] on [EVENT DATE], were any electric fans being used in your home?

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

[ASK IF C6=1]

C7. Did you or any other members of your household turn any electric fans on between [EVENT START TIME] and [EVENT END TIME], or were all of the fans already running before [EVENT START TIME]?

1. (Yes, turned fan(s) on during time period)
2. (No, all fans were already running before time period)
98. (Don't know)
99. (Refused)

[ASK IF B5=1]

C8. What else, if anything, did you or other members of your household do to keep cool between [EVENT START TIME] and [EVENT END TIME] on [DAY OF HIGH TEMPERATURE]? [RECORD ALL THAT APPLY; DO NOT READ LIST]

1. (Continued normal activities/did not do anything else)
2. (Turned on room/window air conditioners)
3. (Closed blinds/shades)
4. (Moved to a cooler part of the house)
5. (Left the house and went somewhere cool)
6. (Wore less clothing)
7. (Drank more water/cool drinks)
8. (Cooled off with water (shower, bath, sprinkler, hose, pool))
9. (Opened windows)
10. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

C9. Did you experience any power outage issues on [DATE OF EVENT]?

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

D. AC Usage

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

D1. How often do you use your central air conditioner? Would you say you use it ... [READ LIST]

1. Not at all
2. Only on the hottest days
3. Frequently during the cooling season
4. Most days during the cooling season
5. Every day during the cooling season

98. (Don't know)
99. (Refused)

D2. When you think of a typical hot and humid summer day, at what outside temperature do you tend to feel uncomfortably warm inside your home? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (Less than 65 degrees)
2. (65 to 68 degrees)
3. (69 to 72 degrees)
4. (73 to 75 degrees)
5. (76 to 78 degrees)
6. (79 to 81 degrees)
7. (82 to 84 degrees)
8. (85 to 87 degrees)
9. (88 to 90 degrees)
10. (91 to 94 degrees)
11. (95 to 97 degrees)
12. (98 to 100 degrees)
13. (Greater than 100 degrees)

98. (Don't know)
99. (Refused)

CADMUS

D3. At what <u>outside temperature</u> do you tend to turn on the central air conditioner? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (Less than 65 degrees)
2. (65 to 68 degrees)
3. (69 to 72 degrees)
4. (73 to 75 degrees)
5. (76 to 78 degrees)
6. (79 to 81 degrees)
7. (82 to 84 degrees)
8. (85 to 87 degrees)
9. (88 to 90 degrees)
10. (91 to 94 degrees)
11. (95 to 97 degrees)
12. (98 to 100 degrees)
13. (Greater than 100 degrees)
98. (Don't know)
99. (Refused)

D4. How old is your central air conditioner? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (0 to 4 years old)
2. (5 to 9 years old)
3. (10 to 14 years old)
4. (15 to 19 years old)
5. (20 years old or older)
98. (Don't know)
99. (Refused)

E. Satisfaction with Program

[ASK IF STATE=OHIO]

E1. How would you rate your overall satisfaction with the Power Manager Program, would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied, or Very Dissatisfied?

1. Very satisfied
2. Somewhat satisfied
3. Neither satisfied nor dissatisfied
4. Somewhat dissatisfied
5. Very dissatisfied
98. (Don't know)
99. (Refused)

CADMUS

[ASK IF E1=1, 2, 3, 4 or 5]

E2. Why do you give it that rating?

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

E3. Using a scale of 0 to 10 where zero indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", what is your overall satisfaction with the Power Manager® program?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

[ASK IF E3=4 OR BELOW AND STATE=NC, SC or IN]

E4. Why do you say you are dissatisfied with Power Manager®?

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

F. Satisfaction with Duke Energy

F1. Using a scale of 0 to 10 where zero indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", what is your overall satisfaction with Duke Energy?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

[ASK IF F1 IS 4 OR BELOW]

F2. Why do you say you are dissatisfied with Duke Energy?

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

F3. Using a scale of 0 to 10, where zero means "Extremely Unlikely" and 10 means "Extremely Likely", how likely is it that you would recommend this program to a friend or colleague?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

CADMUS

G. Demographics and Closing

G1. Including you, how many people live in this home?

1. (1)
2. (2)
3. (3)
4. (4)
5. (5)
6. (6)
7. (7)
8. (8 or more)

99. (Refused)

Thank you for your time and feedback today!

CADMUS

Duke Energy
Power Manager Non-Event Survey 2015

Researchable Questions	Item
Introduction / screening	A1-5
Device activation awareness	B1-5
Response to activation	C1-9
AC usage	D1-4
Satisfaction with program	E1-4
Satisfaction with Duke Energy	F1-3
Demographics (number of occupants)	G1

General Instructions

- Interviewer instructions are in green **[LIKE THIS]** (the style is "Survey: Interviewer Instructions").
- CATI programming instructions are in red **[LIKE THIS]** (the style is "Survey: Programming").
- Items that should not be read by the interviewer are in parentheses like this ( ).
- Differences from Event Survey question text are highlighted yellow.

Variables defined in survey programming (update for each non-event high temperature day)

- [DATE OF HIGH TEMPERATURE]

Calling Instructions:

Only calls to homes, please. Businesses are not eligible for this survey.

Make one call attempt per contact within 28 hours beginning at 5 p.m. on the non-event high date of high temperature. Callbacks are OK as long as the survey is completed within the 28 hour timeframe. Call times are from 10:00 a.m. to 8:00 p.m. EST Monday through Saturday. No calls on Sunday. For example, if there is a high temperature day without an event on a Monday, calling hours for that particular non-event would be:

Monday 5 p.m.-8 p.m. Eastern

Tuesday 10 a.m.-8 p.m. Eastern

A. Introduction

A1. Hello, my name is _____, and I'm calling on behalf of Duke Energy with a short customer satisfaction survey. This survey will take about five minutes to complete; do you have five minutes to answer some questions for us today?

1. Yes
2. No or not a convenient time **[THANK AND TERMINATE]**

99. (Refused) **[THANK AND TERMINATE]**

CADMUS

A2. Thank you. The information you provide will be confidential and will help to improve service. This call may be monitored or recorded for quality assurance puposes. According to our information, you participate in the Power Manager® Program. This program allows Duke Energy to cycle your air conditioner on and off during periods of critical need for electricity. Are you aware of your participation in the Power Manager program?

1. Yes
2. No **[ASK IF THERE IS SOMEONE ELSE AVAILABLE WHO WOULD KNOW AND RESTART SURVEY WITH THAT PERSON; IF NO ONE ELSE IS AVAILABLE THANK AND TERMINATE]**
98. (Don't know) **[ASK IF THERE IS SOMEONE ELSE AVAILABLE WHO WOULD KNOW AND RESTART SURVEY WITH THAT PERSON; IF NO ONE ELSE IS AVAILABLE THANK AND TERMINATE]**

A3. Just to confirm, do you still live at **[ADDRESS FROM CALL SHEET]**?

1. Yes
2. No **[THANK AND TERMINATE]**
98. (Don't know) **[THANK AND TERMINATE]**

A4. **[CHECK STATE FROM CALL SHEET]**

1. North Carolina / South Carolina
2. Ohio
3. Indiana

A5. **[COPY RESPONDENT ID NUMBER FROM CALL SHEET]**

1. **[PASTE RESPONDENT ID NUMBER HERE]**

B. Device Activation Awareness

B1. 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 when there is high demand for electricity.*" THEN REPEAT THE QUESTION.]*

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

B2. How can you tell (how would you be able to tell) when the device has been activated? [RECORD ALL THAT APPLY; DO NOT READ LIST]

1. (A/C shuts down)
2. (Home temperature rises)
3. (The light on the meter is on)
4. (Light on AC unit flashes)
5. (Bill credits)
6. (Lower bill)
7. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

B3. Has your device been activated within the last two days? [IF NEEDED: Was your device activated yesterday or today?]

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

B4. At what temperature was your thermostat set to between 2:00 and 5:00 p.m. on [DAY OF HIGH TEMPERATURE]? [DO NOT READ LIST]

1. (Less than 65 degrees)
2. (65 to 68 degrees)
3. (69 to 72 degrees)
4. (73 to 75 degrees)
5. (76 to 78 degrees)
6. (79 to 81 degrees)
7. (82 to 84 degrees)
8. (85 to 87 degrees)
9. (88 to 90 degrees)
10. (91 to 94 degrees)
11. (95 to 97 degrees)
12. (98 to 100 degrees)
13. (Greater than 100 degrees)
14. (It's programmed into the thermostat)
15. (Thermostat was turned off)
16. (Air conditioner was turned off)
98. (Don't know)
99. (Refused)

CADMUS

B5. Were you or any members of your household home at that time?

1. (Yes)
2. (No) [SKIP TO D1]
98. (Don't know) [SKIP TO D1]
99. (Refused) [SKIP TO D1]

C. Response to Activation

[ASK IF B5=1]

C1. Using a scale of 0 to 10 where zero means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort before 2:00 pm on [DAY OF HIGH TEMPERATURE]?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

[ASK IF B5=1]

C2. Using the same scale of 0 to 10 where zero means very uncomfortable and 10 means very comfortable, how would you describe your level of comfort between 2:00 pm and 5:00 pm on [DAY OF HIGH TEMPERATURE]?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

[ASK IF C2<C1]

C3. What do you feel caused your decrease in comfort? [DO NOT READ LIST; RECORD ALL THAT APPLY] [IF CUSTOMER SAYS "rising temperature" or "rising humidity" ASK WHETHER THEY ARE REFERRING TO INDOOR OR OUTDOOR OR BOTH.]

1. (Power Manager device activation)
2. (Rising outdoor Temperature)
3. (Rising indoor temperature)
4. (Rising outdoor Humidity)
5. (Rising indoor humidity)
6. (Power Outage)
7. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

[ASK IF B5=1]

CADMUS

C4. Between 2:00 pm and 5:00 pm on [DAY OF HIGH TEMPERATURE] did you or any other members of your household adjust the settings on your thermostat?

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

[ASK IF C4=1]

C5. At what temperature was it originally set, and what temperature did you set it on [DAY OF HIGH TEMPERATURE]

C5c. (ORIGINAL TEMPERATURE SETTING) [RECORD DEGREES F]

C5d. [ADJUSTED TEMPERATURE SETTING) [RECORD DEGREES F]

[ASK IF B5=1]

C6. Between 2:00 pm and 5:00 pm on [DAY OF HIGH TEMPERATURE], were any electric fans being used in your home?

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

[ASK IF C6=1]

C7. Did you or any other members of your household turn any electric fans on between 2:00 pm and 5:00 pm, or were all of the fans already running before 2:00 pm?

1. (Yes, turned fan(s) on during time period)
2. (No, all fans were already running before time period)
98. (Don't know)
99. (Refused)

CADMUS

[ASK IF B5=1]

C8. What else, if anything, did you or other members of your household do to keep cool between 2:00 and 5:00 on [DAY OF HIGH TEMPERATURE]? [RECORD ALL THAT APPLY; DO NOT READ LIST]

1. (Continued normal activities/did not do anything else)
2. (Turned on room/window air conditioners)
3. (Closed blinds/shades)
4. (Moved to a cooler part of the house)
5. (Left the house and went somewhere cool)
6. (Wore less clothing)
7. (Drank more water/cool drinks)
8. (Cooled off with water (shower, bath, sprinkler, hose, pool))
9. (Opened windows)
10. (Other) [SPECIFY]
98. (Don't know)
99. (Refused)

C9. Did you experience any power outage issues on [DAY OF HIGH TEMPERATURE]?

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

D. AC Usage

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

D1. How often do you use your central air conditioner? Would you say you use it ... [READ LIST]

1. Not at all
2. Only on the hottest days
3. Frequently during the cooling season
4. Most days during the cooling season
5. Every day during the cooling season
98. (Don't know)
99. (Refused)

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D2. When you think of a typical hot and humid summer day, at what outside temperature do you tend to feel uncomfortably warm inside your home? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (Less than 65 degrees)
2. (65 to 68 degrees)
3. (69 to 72 degrees)
4. (73 to 75 degrees)
5. (76 to 78 degrees)
6. (79 to 81 degrees)
7. (82 to 84 degrees)
8. (85 to 87 degrees)
9. (88 to 90 degrees)
10. (91 to 94 degrees)
11. (95 to 97 degrees)
12. (98 to 100 degrees)
13. (Greater than 100 degrees)
98. (Don't know)
99. (Refused)

D3. At what <u>outside temperature</u> do you tend to turn on the central air conditioner? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (Less than 65 degrees)
2. (65 to 68 degrees)
3. (69 to 72 degrees)
4. (73 to 75 degrees)
5. (76 to 78 degrees)
6. (79 to 81 degrees)
7. (82 to 84 degrees)
8. (85 to 87 degrees)
9. (88 to 90 degrees)
10. (91 to 94 degrees)
11. (95 to 97 degrees)
12. (98 to 100 degrees)
13. (Greater than 100 degrees)
98. (Don't know)
99. (Refused)

D4. How old is your central air conditioner? [DO NOT READ LIST; RECORD ONE RESPONSE]

1. (0 to 4 years old)
2. (5 to 9 years old)
3. (10 to 14 years old)
4. (15 to 19 years old)
5. (20 years old or older)
98. (Don't know)
99. (Refused)

E. Satisfaction with Program

[ASK IF STATE=OHIO]

E1. How would you rate your overall satisfaction with the Power Manager Program, would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied, or Very Dissatisfied?

1. Very satisfied
2. Somewhat satisfied
3. Neither satisfied nor dissatisfied
4. Somewhat dissatisfied
5. Very dissatisfied
98. (Don't know)
99. (Refused)

[ASK IF E1=1, 2, 3, 4 or 5]

E2. Why do you give it that rating?

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

E3. Using a scale of 0 to 10 where zero indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", what is your overall satisfaction with the Power Manager® program?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

[ASK IF E3 IS 4 OR BELOW AND STATE IS NC, SC or IN]

E4. Why do you say you are dissatisfied with Power Manager®?

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

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F. Satisfaction with Duke Energy

F1. Using a scale of 0 to 10 where zero indicates "Very Dissatisfied" and 10 indicates "Very Satisfied", what is your overall satisfaction with Duke Energy?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

[ASK IF F1 IS 4 OR BELOW]

F2. Why do you say you are dissatisfied with Duke Energy?

1. [RECORD RESPONSE]
98. (Don't know)
99. (Refused)

F3. Using a scale of 0 to 10, where zero means "Extremely Unlikely" and 10 means "Extremely Likely", how likely is it that you would recommend this program to a friend or colleague?

1. [RECORD NUMBER] [RANGE 0 TO 10]
98. (Don't know)
99. (Refused)

G. Demographics and Closing

G1. Including you, how many people live in this home?

1. (1)
2. (2)
3. (3)
4. (4)
5. (5)
6. (6)
7. (7)
8. (8 or more)
99. (Refused)

Thank you for your time and feedback today!

CADMUS

Duke Energy
Power Manager Management Interview Guide 2015

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 Power Manager Program. 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. 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?

2. In your own words, please briefly describe the Power Manager 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 Power Manager states? Or for reporting to balancing authorities such as MISO or PJM?

3. What are the options for enrolling, what is the process?

4. What is the current enrollment in Power Manager? What is the dropout rate?

5. In your own words please describe how the Power Manager 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.

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

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

Objectives

8. Have the Power Manager's objectives changed in the last year or so, and if so how? Why?

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

10. 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 Power Manager program's operations?

11. 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?

12. 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

13. Do you think the incentives offered through the Power Manager Program are adequate enough to entice customers to enroll in the program? Why or why not?

14. Do you think the customers understand the incentive levels?

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 use Duke Energy Energy Efficiency programs to generate leads for Power Manager?

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

Overall Power Manager Management

18. 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?

19. Could you share with me when AC duty cycle and switch operability studies will be taking place?

20. Are there any other studies Duke Energy will be carrying out to better understand the response rate of the market?

21. Do you currently use any smart grid technologies in your DR programs? Do you have plans to do so?

Event calls

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

23. How do you coordinate events calls between your res and non-res DR programs?

24. Can residential customers opt out of an event?

25. How do you verify load shed? What is the quality control, tracking and accounting processes for determining how well control strategies worked?

26. Overall, what about the Power Manager Program works well and why?

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

28. In what ways can the Power Manager Program's operations be improved?

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

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

APPENDIX E

Impact and Process Evaluation of the 2015 PowerShare Program® Duke Energy Ohio

Final Report, March 8, 2016

Duke Energy
139 East 4th Street
Cincinnati, Ohio 45202

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CADMUS

Prepared by:

Cadmus and
Yinsight, Inc.

Table of Contents

Executive Summary

PowerShare® is a demand response program designed to reduce nonresidential customers' energy use (kW demand) during periods of high energy prices or when high energy usage would cause energy supplies across the transmission and distribution system be at, or near, critical levels. In both these situations, the PowerShare Program allows Duke Energy Ohio (DEO) to purchase capacity from their commercial and industrial (C&I) customers who reduce their energy demand, thus increasing the available energy supply.

DEO notifies customers that a demand response event is needed via a multi-approach communications system. Customers then reduce their electric usage to a level consistent with their program participation agreements. PowerShare emergency capacity reduction commitments are registered with PJM on a seasonal basis. Emergency events are dispatched by PJM to relieve capacity constraints.

DEO conducted the program year 2015 (PY2015) impact evaluation of PowerShare using a variety of commonly accepted, standard utility industry statistical practices and applications. These included calculating baseline proforma load calculations for each customer and monthly and hourly peak hour analysis. These approaches were then reviewed by an independent, third-party evaluator (Cadmus) commensurate with standard evaluation, measurement, and verification (EM&V) industry practice. Based on a critical review of the processes used for PowerShare, the findings for PY2015 are credible.

Program Year 2015 Highlights

An overview of the PY2015 PowerShare parameters and results include:

- The evaluation program year covers January 1, 2015 through December 31, 2015. To match the PJM Interconnection, LLC planning years, the period beginning January 1st through May 31st falls within the 2014 program year. Program year 2015 begins on June 1st. All customer participants in the 2014 program year had "summer only" agreements that expired on September 30, 2014. Therefore, this evaluation will be focused on customers who signed agreements that begin in June 2015.
- There were two PowerShare events during the 2015 calendar year. Both were 1 hour 'test' events scheduled for customers to demonstrate their ability to meet curtailment commitments as required by PJM:
  - September 1, 2015 (all participants)
  - September 23, 2015 (internal retest opportunity for select customers)
- During PY2015, the summer peak program capability[1] for the PowerShare program was calculated to be 63.3 MWs.

[1] Summer Peak Program Capability is defined as the Program Year, average load shed capability for active program participants, from June – September, between Hours Ending 15-18.

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Introduction

PowerShare is a demand response program designed to reduce nonresidential customers' energy use (kW demand) during periods of high energy prices or when high energy usage would cause energy supplies across the transmission and distribution system be at, or near, critical levels. In both these situations, the PowerShare program allows Duke Energy Ohio (DEO) to purchase capacity from their commercial and industrial (C&I) customers who reduce their energy demand, thus increasing the available energy supply.

PowerShare is the brand name given to DEO Peak Load Management Program (Rider PLM, Peak Load Management Program P.U.C.O. Electric No. 19, Sheet No. 87.3). A revised version of this Rider was accepted in PUCO Case No. 12-1682-EL-AIR. All information in this report refers to the Rider PLM. The PLM Program is voluntary and offers 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 this Rider, specifying the terms and conditions under which the customer agrees to reduce usage.

DEO notifies customers that a demand response event is needed via a multi-approach communications system. Customers then reduce their electric usage to a level consistent with their program participation agreements. PowerShare emergency capacity reduction commitments are registered with PJM on a seasonal basis. Emergency events are dispatched by PJM to relieve capacity constraints.

Program Year 2015 Options

In PY2015, DEO offered two product options within PowerShare, each of which is outlined below. For all program products the participant must be able to provide a minimum of 100 kW load reduction.

QuoteOption

Under the QuoteOption products, the DEO may notify the customer of a QuoteOption 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 DEO and provide an estimate of the customer's projected load reduction.

Each time the DEO exercises this option the customer who reduces load will receive an energy credit. There is no option premium for the QuoteOption® product since customer load reductions are voluntary.

Call Option

A customer enrolled in the PowerShare CallOption® product agrees, upon notification by DEO, to reduce its demand. Each time the DEO exercises its option under the agreement the customer will receive a credit for the energy reduced.

Duke Energy offered only emergency CallOption events and enrollment choices beginning in program year 2015. The enrollment choices mimic the rules for PJM's "Limited Demand Response" and "Extended Summer Demand Response" programs.

1. "CallOption 0/10":
    a. Customer agreements cover the time period from June 1, 2015 to September 30, 2015.
    b. Maximum number of interruptions during the agreement is 10.
    c. Emergency Events may be between 1 hour and 6 hours in duration.
    d. Emergency Events may be called only on non-holiday weekdays between noon and 8 pm.

2. "Extended Summer":
    a. Customer agreements cover the time period from June 1, 2015 to October 31, 2015 plus May 2016.
    b. There is no maximum number of interruptions during the agreement.
    c. Emergency Events may be between 1 hour and 10 hours in duration.
    d. Emergency Events may be called on any day during the agreement period between 10 am and 10 pm.

Emergency events are implemented due to reliability concerns. Participants are required to curtail during emergency events. During PJM Interconnection, LLC (PJM)-declared emergency events, customers are not provided the option to buy through. Participating customers receive a monthly capacity premium based on their curtailment capability during the term of the agreement. In addition, customer receive an energy credit for actual energy reduced during a curtailment event.

For the 2014 PowerShare program, DEO customers were only eligible for the Emergency-only option (CallOption 0/10) and were required to reach their contracted level of load reduction within 90 minutes

For 2015, PJM changed the advanced notification requirement for their DR programs to 30 minutes. Certain customers with safety or physical limitations are allowed to request a "waiver" and respond in either 60 or 120 minutes—depending on the situation. Duke Energy Ohio adopted this 30 minute notice requirement, and the exception process, for the 2015 program year.

Program Year 2015 Participation

The PowerShare program has an annual enrollment for participation. This report covers the participation year of 2015. However, customers may enroll for one year periods from June through May the following year. Under normal circumstances, DEO is a summer peaking utility and therefore, the most relevant participation period is the summer months of June through September and the impact analysis concentrates on those months.

Table 1 below compares account participation levels for summer 2014 and summer 2015, as well as megawatts (MWs) enrolled in the program. The MW values are DEO's estimate of the load reduction capability across the summer. Additional information is presented below on the different calculations performed for the program including summer load reduction capability (LRC), P&L revenue recovery values, Measurement & Verification (M&V) values, and day-ahead projected load reduction (PFLs).

Table 1. Program Participation and Capability[2]

PowerShare CallOption	2014	2015
Account Participation	44 (Average June-Sept)	38
MW Capability[3]	104.3	63.3

2 Average participation customer count during the summer months of June – September.

3 Values are reported at the point of generation grossed up using a line loss factor of 1.06842.

2015 PowerShare Program Evaluation Methodology

DEO calculates and reports a variety of internal and external values related to the PowerShare program, which are used for a variety of purposes. Three categories represent a large portion of the analytics effort and are relevant to this evaluation. This section outlines these categories and calculation areas, listed below then described in more detail.

Pro-Forma Load Estimates

Pro-forma load (PFL) are estimates of participants' hourly electric power consumption for the next day. These projections are used in the measurement and verification (M&V) analysis to determine the potential load reduction for a next day event. The baseline is the customers' load absent the event.

Measurement and Verification Load Reduction Estimates

In the M&V verification load reduction approach, the actual load reduction provided by individual program participants on a specific event day is calculated using the pro-forma, or baseline, as a proxy.

Peak Available Load Reduction Estimates

Also known as load reduction capability (LRC), these estimates of participant load reduction are calculated under peak normal weather conditions, if applicable, over a specified period of time (such as a month or the entire summer).

As the three calculation methodologies imply, analysis of the PowerShare program must meet a diverse set of goals. The specific methodology of how values are calculated for each approach are detailed below.

Pro-Forma Load Estimates

As the name implies, the process for PFL estimates is to create the day-ahead pro-forma (i.e., estimated assuming no control events) load shapes specific to each program participant in each PowerShare option.

Estimating the PFL involves using 12 weeks (84 days) of historical load and weather data (eliminating or accounting for North American Electric Reliability Corporation (NERC) holidays, event days, and any days identified as quiet periods from the analysis) to produce hourly predicted load shapes for the next 30 days based on the forecasted regional weather, if available. From that data, there are five ways to estimate the PFL, outlined below.

Hourly Regression Method

This method involves regression hourly energy on a set of Fourier, weather, and monthly dummy variables (if appropriate), and fitting an autoregressive process to the error terms. Then the same model is re-fit with weather variables excluded, and an F-test is performed to determine if weather is a significant explanatory factor. The appropriate model results are used for further calculations.

PJM Method
This method is based on the default method PJM uses to calculate a Customer Baseline CBL for settlement, using an average load shape based on the highest four of five days selected by the method from a 45-day window. Only NERC holiday weekdays are excluded as event days.

The initial set of days is the most recent five days in the 45-day window. If the average usage over the exposure hours on any of those days was less than 25% of the overall average usage over the exposure hours for all five days, that day is dropped and a replacement selected. This loop is repeated until there are five viable days, and the four days with the highest usage are selected from this group for calculating an average load shape.

MISO Method
The MISO method is similar to the PJM method, except it 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 on the most recent two non-NERC holiday and non-event day weekdays.

Hybrid Method
This method involves first performing 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 dummy variables (if appropriate), and interactions between the weather variables and binary variables.

As with the hourly regression, the model is re-fit without the weather variables and an F-test performed to determine the appropriate model. The predicted daily energy is spread over the hours of the day using the load shape from the PJM method, after normalizing that load shape by the total energy under the shape.

Measurement and Verification Load Reduction Estimates
The steps involved in calculating the monthly LRC, P&L, and M&V are similar. In addition, the LRC and P&L processes are not performed for PowerShare QuoteOption since they are not relevant to this program option. The M&V process for PowerShare requires collecting hourly load data from all enrolled customers for a particular month.

Data is treated similarly among the processes, with a few exceptions such as the modeling of quiet periods. In all the processes, event days are excluded. However, quiet periods, such as days when participants reduced load due to a maintenance period, are included and accounted for in the M&V process model. If an event occurs when the customer is on a maintenance shutdown, the information used in the analysis requires special handling to focus only during their shutdown period.

In this rare event, the typical procedure is to combine the data with actual weather data for that month. Then, the process is to develop regression models (with and without weather terms) using the combined data, similar to the hourly regression model used in the day-ahead PFL calculations discussed above. Specifically, the regression equation relates the customers' 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
- The temperature humidity index
- Binary variables for holidays and quiet periods, if appropriate
- Interactions between the Fourier transforms and 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 to not be weather sensitive). If weather is significant, 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 represent the actual load absent an event. These event-day baselines are then combined with actual load data from the event hours to calculate the load reduction.

All regression results are reviewed by DSM Analytics. If the results are clearly not representative of a specific participant 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. Note that the PFL event load reduction estimates are used for settlement with customers due to their quicker availability, and because the baselines are available for customers to review for load reduction decisions. However, M&V load reduction leads to DEO's best estimate of the load reduction impacts, which are used for regulatory reporting purposes.

Customer Settlement

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, a determination is made about whether they reduced load during the event period from a baseline. Another determination is made about whether the customer's actual load was at or below the firm service level during the event hours, regardless of the amount of load reduction.

For customers who are on a fixed reduction agreement, the difference between the baseline and the actual load during the control period is calculated to determine if the agreed amount of reduction was achieved. Credits or penalties for event participants are calculated using PFL baselines, within the Energy Profiler Online system for PowerShare, and are recorded on the customers' utility bills.

Peak Available Load Reduction Estimates

Similar to the M&V regression process described above, LRC is calculated on a monthly basis for PowerShare.

The LRC process requires collecting hourly load data from all enrolled customers for a particular month, eliminating event day information from the analysis and including quiet periods, such as due to a maintenance shutdown. The regression methodology is the same as for the M&V regression described above, with a few differences:

- While event day information is eliminated in both types of analysis, quiet periods, which are eliminated in the M&V process, are included and modeled in the LRC analysis.
- 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 represent the peak normalized load the customer would have consumed throughout the month.
- 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.

The monthly LRC by participant is typically not of interest for most reporting purposes, but the summer LRC is of primary interest since Duke Energy is a summer peaking utility. Therefore, an average of the summer monthly LRC values is calculated, by hour and by participant. Then, the hours ending Eastern Daylight Time (EDT) 15-18 are captured to determine the summer LRC of each participant. The sum across all participants provides the summer LRC for the program.

Specifically, the regression equation relates the customers' 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
- The 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 to not be weather sensitive). If weather is significant, 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 represent the peak normalized load that would have consumed throughout the month for all customers, even those who were not actually participating in one or more of the summer months.

For this next step, the processes for LRC and P&L differ. In LRC, the monthly June value 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.

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, and these values are averaged across the month. Then an average of the four monthly values is calculated, by hour and by participant.

Next, the hourly values for the hours ending EDT 15-18 are captured to determine the summer P&L of each participant. The LRC process terminates after summing across all participants. However, in the P&L process, monthly values are now calculated by summing the summer values described above for each month, only for participants in that particular month. These monthly values are then delivered to DSM Analytics for final calculations of the P&L results. Accounting adjustments are made as needed, including the application of a line loss factor.

Best-of-Breed

For each customer, the best calculation method is chosen to produce the final day-ahead baseline estimates. This is accomplished by comparing the predicted load from each method to the actual load for the five days outlined by the PJM method at an hourly, daily, and total level:

- 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 value, the difference in each hour for all five days is calculated, then summed to determine the absolute value

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

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2015 PowerShare Program Events and Impacts

PowerShare Events

During the 2015 PowerShare contract year (June 1, 2015 – May 31, 2016),[4] program participants were registered with PJM as either a DEO 'Limited' Emergency Resource or as an 'Extended Summer' Emergency Resource. Under PJM rules and DEO's contract for the limited emergency resource, customers are only obligated to respond to events called by PJM from June 2015 – September 2015. However, any response outside of the June-September commitment is considered a voluntary reduction and settled with the customer and PJM accordingly. Under PJM rules and DEO's contract for the extended summer emergency resource , customers are obligated to respond to events called by PJM only during June-Sept, October and May of the delivery year.

PJM called no emergency events within the DEO territory during the 2015 calendar year.

It is important to note that customers were under no obligation to respond to wintertime events and the impacts that would have been achieved would be due to the voluntary response of customers. No winter 2015 appeals for curtailment occurred.

Table 2. PY2015-16 Event Summary

Event Date	Event Time (Eastern Prevailing Time)	PJM Event Duration	Event Reason
None called by PJM			
Test Events			
9/1/2015	Hour ending 17 EPT (4-5 pm DST/3-4 pm EST)	1 hour	Test to fulfill PJM requirement
9/23/2015	Hour ending 17 EPT (4-5 pm DST/3-4 pm EST)	1 hour	Alternate internal retest date for customers electing to retest to demonstrate ablity to meet contractual reduction value

[4] The numbers provided in this report are current through March, though it is possible additional events can be called through May.

Table 3 outlines details of the MW savings for each event, by program option.

Table 3. Event Impacts[5]

Date	Hour Ending	Call Option (kW)	Quote Option	Extended Summer (kW)	Total Event Impact (MW)
None called by PJM					
Test Events					
9/1/2015	17 (EPT)	61,388	n/a	10,119	71.5
9/23/2015	17 (EPT)	209	n/a	n/a	0.21

[5] Values are reported at the point of generation.

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2015 PowerShare Program Process Evaluation

Process Evaluation Objectives

The process evaluation of the PY2015 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 members from multiple divisions and 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. Because no emergency events were called in PY2015, this report will document some of the activities that Duke Energy staff members have undertaken to prepare for current challenges and future events calls.

Methodology

Overview of the Evaluation Approach

The process evaluation for the PowerShare program was conducted by Cadmus and Yinsight (hereafter the evaluation team). The results presented in this report include management interviews and participant surveys.

Management Interviews

The evaluation team conducted hour-long management interviews with a Duke Energy product and services manager for PowerShare in the Midwest and an account manager serving Duke Energy customers.

The evaluation team developed the interview protocol for the PowerShare program management interview that was implemented in January of 2016. The full interview guide is in Appendix A.

Participant Survey

The evaluation team developed a customer survey for PowerShare Program participants, and administered questionnaires via short telephone interviews with the contact person identified to receive PowerShare alerts on behalf of the company. The evaluation team conducted the surveys between November 30 and December 16, 2015. The survey is in Appendix B.

Data collection methods, sample sizes, and sampling methodology

The evaluation team attempted a census of the 53 contactable companies that participated in PowerShare in PY2015. [6] The team completed 18 total phone interviews. [7]

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6 The evaluation team attempted to contact representatives from 53 businesses, which was the total number of unique contacts after removing records with duplicate or missing contact information.

7 For the purposes of the process evaluation, these findings include data from five Duke Energy Kentucky (DEK) participants and 13 DEO participants because the program is implemented using the same process in both states. There were no statistically significant differences in participants' responses between the two states.

These 18 companies comprise six manufacturers and seven schools, with the rest being sole representatives of nonmanufacturing sectors. Seven of these respondents also managed more than one site that participates in PowerShare. On average, these companies have participated in PowerShare for over four years, individually ranging from one to 10 years.

Survey Response Rates and Precision

Table 4 summarizes the response rates and achieved precision levels for the participant survey.

Table 4. Process Evaluation Data Collection and Analysis

Evaluation Component	Population	Attempted Contacts	Achieved Completes	Response Rate	Precision at 90% Confidence
Program Managment Staff	N/A	2	2	2	N/A
Participant Surveys	60	53	18	34%	±16.2%

Conclusions and Recommendations

In the absence of an emergency event, and in light of participants' high satisfaction with the PowerShare program, the evaluation team sees no need to change program operations, and thus has no major process recommendations for the PowerShare program. The evaluation team has two minor recommendations.

Conclusion #1: **Respondents show some confusion about PY2015 PowerShare program features, and might not understand the requirements for the emergency-only offering.**

Recommendation #1: Duke Energy product and account managers should consider developing additional ways to reinforce customers' knowledge of current and upcoming PowerShare program features. If Duke Energy is not already doing so, staff members could develop additional marketing materials that can be distributed to customers, which clearly identify the program year, the current program options, and the programs' requirements. Alternatively, Duke Energy could schedule "talking points" for account managers to remind participants of upcoming program changes and test events. The evaluation team understands that account managers engage in regular communication about program changes, but believes that participants will have greater satisfaction with PowerShare if they do not have to rely on their memories when additional changes are made to PowerShare in the foreseeable future.

Recommendation #2: In addition, the evaluation team suggests that Duke Energy continue tracking participant satisfaction against the baseline data that have been gathered through PowerShare process evaluations since PY2011.

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Process Evaluation

PowerShare Program Objectives

In PY2015, Duke Energy's PowerShare program was offered as an emergency-only program in the PJM energy market. The PowerShare DEO demand response program provides a capacity premium for commercial and industrial participants that are willing to decrease their loads during an emergency event. PowerShare allows Duke Energy customers to earn a premium for helping to increase the reliability of the electricity transmission and distribution system and to mitigate the risk of blackouts.

PowerShare Background

For 2015, PJM revised its requirements, and curtailment service providers were required to be able to perform load shedding with 30 minutes of advance notice, down from two hours of advance notice in previous years. As a result of PJM requirements for demand response programs, Duke Energy applied for and received regulatory approval to change the PowerShare program from a year-round curtailment period to a summer-only curtailment period. In PY2015, PJM did not call any emergency events in DEO territory, and participants were only asked to perform load shedding during the annual test event.

PowerShare Operations

PowerShare program options

For the PY2015 summer-only program year, Duke Energy offered two program options: CallOption Emergency, with a curtailment period of June through September, and QuoteOption, with a year-round voluntary curtailment period. Both options had a contract term of one year. Duke Energy is moving toward offering year-round options for PowerShare: For the upcoming PY2016 summer season, Duke Energy has begun offering an extended summer option, with a curtailment period of June through October 2016 and May 2017. Duke Energy also reintroduced PowerShare with a year-round curtailment period. The premium credit levels for these longer curtailment periods are higher to provide appropriate incentive for customers to supply capacity beyond the summer months. The Midwest product manager reported that most 2016 PowerShare participants are signed up only for summer events in DEO territory. At the time of the interviews in January 2016, the PowerShare product manager reported that one customer is on the extended summer offering and all others are still on the four-month offering.

Program requirements

Participants must have at least 100 kW of curtailable load and are required to commit to reducing load during PJM emergency events. These events could last up to six hours, and would be called between noon and 8 p.m. on weekdays from June through September (excluding Independence Day and Labor Day). There could be up to 10 emergency event calls in any year. Participant must also participate in an annual emergency curtailment test.

Incentives

Duke Energy pays an annual capacity premium depending on the curtailment capacity to which a customer commits. This capacity premium is paid once a month during the curtailment period and is a line item labeled "PowerShare credit" on the customer's monthly bill. If customers respond to an event call by curtailing, they are paid an additional event incentive credited to their monthly bill after settlement. For PY2015, DEO paid customers $42/kW/year incentive to participate. For each event in which customers participate, they were also given 85% of real-time LMP credit based on their achieved curtailment. The incentive can fluctuate from year to year because it is determined by the prices of energy on the PJM market. The product manager reported that PowerShare incentives are designed to be competitive with other curtailment service providers. Despite fluctuations in incentives, PowerShare has historically enjoyed a high contract renewal rate, suggesting that customers are not very sensitive to these changes.

Penalties

Customers that do not curtail their loads are assessed a penalty and lose the monthly premium credit. These companies might also be removed from the program. There are no "buy-through" provisions for emergency events, in which participants can pay higher energy prices to avoid penalties for not curtailing to the level in their contracts.

Targeted Load Commitment

Customers can choose to reduce energy to a firm load-level or by a fixed amount against their *pro forma* baseline. A firm level-reduction commitment is a commitment to reduce down to a specific kW usage (e.g., customers commit to reduce energy usage to a firm level of 600 kW or below). A fixed level-reduction commitment is a commitment to reduce to a certain kW relative to the customer's load shape (e.g., customers commit to reducing energy usage by a fixed 400 kW against their *pro forma*). The *pro forma* baseline load shape is calculated based upon past energy usage.

Marketing

PowerShare is marketed mainly by Duke Energy account managers to their large commercial and industrial customers. Marketing collateral is available on the Duke Energy website. All but one respondent in the participant survey reported that they first became aware of PowerShare from a Duke Energy representative. The one exception learned about the program from the Duke Energy website and brochure.

Website and Brochure. Duke Energy has a website with a downloadable brochure about the PowerShare program. Interested customers are directed to contact their account representative or email Duke Energy's customer account services at the provided email address.

Marketing to Large Business Customers. Duke Energy account managers take the lead role in PowerShare marketing efforts. In the Midwest states, marketing for PowerShare starts with training of account managers in October and enrollment by mid-January.

The account managers help the customers determine whether or not PowerShare is appropriate for their company. Account managers help customers decide how they can participate without disrupting their business operations. If needed, the account managers discuss with the customers the specifics of what they will do at their facility to reduce the requisite load. An account manager reported that she

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regularly communicates with customers about the suitability of the program for their company's particular business. The account manager explained that this communication occurs year round because, "Things change from one year to the next, people change, they have different opinions and comfort levels with PowerShare, and finances change." The account manager also reported that prospective participants are interested in hearing about other customers that have had success with the PowerShare program.

In the participant surveys, respondents were asked to rate "how useful that source was in providing the information you needed to decide whether or not to participate," using a scale of 1 to 10, where 1 means "Almost nothing I needed" and 10 meaning "Everything I needed." The 16 respondents to this question gave a very high average rating of 9.6. Three respondents also reported that they asked other business colleagues about their PowerShare participation experiences before making their own decision. One respondent added, "They were pretty positive about the program."

Customer Motivation

Fourteen respondents reported that their primary reason for participating in PowerShare was financial; one other respondent reported that their primary reason was to "help the local community." When asked if there was a secondary reason, six said they wanted to help the community and help reduce their loads. Two others gave secondary reasons that were financial in nature, and one said it allowed the company to test its generation system control.

The Duke Energy account manager reported that many customers have corporate sustainability objectives that can influence their decision to participate in PowerShare to meet those objectives.

Enrollment and Renewal

DEO offered a bonus if customers signed their PY2015 PowerShare contracts by January 19.[8] By obtaining contracts early, Duke Energy can bid capacity resources into the PJM capacity market. Of the 18 respondents, 10 reported that their company signed early. The evaluation team asked the others why they didn't sign early. Of the four respondents, one said his company wasn't ready to make the decision and another respondent's company "had issues on target reduction quantities and the way [Duke Energy] was doing [calculations]." A third respondent said that they were initially told there was not going to be a PowerShare program. The last respondent was considering another curtailment service provider's offer. The product manager reported that in 2015, fewer than five participants have declined to renew their contracts; a couple of them have selected competing curtailment service providers.

Event Calls

Emergency events are determined entirely by PJM. After the emergency call, participating companies have 30 minutes to curtail loads. To achieve curtailment within this aggressive timeline, Duke Energy's system operator must relay the event notification to companies participating in PowerShare within five

8 DEO paid a bonus or $4/kW.

minutes or less, and those customers then have 25 minutes to complete load curtailment to their targeted loads.

DEO sends the notification by entering information into an automated notification system. This system contacts customers through a series of escalation rules that dictate which method of communication to use. Notifications are sent via phone, text, email, and fax to everyone on a contact list provided by the company. Notifications cease as soon as the customer responds. The product manager reported that the short timeline means it is likely that he will hear about an emergency event at the same time as PowerShare participants. However, the product manager reported that although the system operators have the task of notifying customers, the product managers have a communication role after the initial notification. The product manager reported that he follows up with customers and provides more details about each event, including estimates of the event duration. The product managers are usually assigned to notify customers that an event has ended. During the event season, the product managers and the account managers are vigilant about the possibility of event calls, and they strive to provide customers with as much advance notification as possible.

The evaluation team asked whether respondents would like to be notified by another method in addition to the current methods of communicating events. Most respondents did not have other preferences. Only three mentioned other methods: Two would prefer to be notified by Duke Energy representatives, and one suggested that a web service-based notification system might be faster. All respondents believed that the earlier the event notice was, the better. Only one respondent had some feedback on Duke Energy's event communication efforts, which was a preference for notification of any trend toward an event. Two respondents added that it was difficult for them to curtail their loads, and they wanted Duke Energy to be doubly sure that their participation was necessary. One of these respondents stated, "Determining a definite need would help. Do you *really* need *us* to drop?"

Respondents reported that they engage in a variety of tactics to curtail their loads during an event. Four of the respondents reported that they only need to turn on their generators; six conduct a full shutdown of their operations, five report they shut down or reduce their HVAC or chiller in addition to their lighting and plug load, three report they shut down or reduce their lighting and plug load only, and one reported they shut down or reduce their HVAC and chiller load only. Some respondents volunteered some of the challenges they faced in reducing load: One participant's company needed to ramp down its equipment over the course of an hour. Several respondents explained that equipment needs to be shut down manually, and an assistant might be responsible for shutting down equipment. Another respondent needed time to run materials through a process before a shutdown. Because the annual curtailment test is scheduled at the beginning of the calendar year, all respondents reported that they were successful in reducing their loads.

When asked whether respondents could curtail more load than their contracts mandated, 14 respondents considered their targeted level of load reduction to be "about right." Three said they might be able to curtail more load, but they wanted to be conservative to avoid risking penalties for not reaching their targets.

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Settlement

Settlement for each month's events are paid to the customer as a credit on their bill within one or two billing cycles, depending on the billing dates. There are separate line items for the capacity premium and the event credit. The Duke Energy product manager reported that a customer can review their usage the day after an event through Energy Profiler Online (EPO), a web-based application provided by a third party. In addition to displaying meter information, EPO is used to track PowerShare agreements. The product manager reported that customers do not have much interest in being able to see their real-time load. The evaluation team asked respondents about their awareness of EPO; 11 were aware of the product, although three had never used it. Only six respondents considered themselves able to rate EPO's ease of use. On a scale of 1 to 10, where 1 meant "very difficult" and 10 meant "very easy," respondents gave an average rating of 8.0. Only one respondent gave a rating below 8, and suggested that Duke Energy could improve EPO by making it more user friendly, with a larger and easier to read screen.

Participation Barriers

The Duke Energy account manager reported that one of the largest participation barriers for manufacturers is the need to shut down their plant during an event call. As more and more businesses move to a "just in time" model, the impact of interrupting plant processes could mean that the manufacturers are unable to meet their customers' needs. The Duke Energy product manager noted that most of the PowerShare participants in the PJM territory were urban and suburban customers and participation is robust.

Survey respondents did not show a strong trend toward any particular concern about participating in PowerShare. The most-frequently cited concern, from five respondents, was whether or not their company would be able to curtail the amount of load in their contract. The second most-frequent concern came from three schools concerned about being able to remain open when the buildings could not be cooled. Only two respondents cited concerns about the impact on business operations and production time. Another two respondents cited concerns about being able to reduce their loads within the 30-minute window required by PJM. Other individuals cited concerns over the frequency of alerts, the cost-to-benefit ratio of participating, and their need to verify the legitimacy of the offering because "it sounded too good to be true initially," considering the attractiveness of the premium credit.

The evaluation team asked respondents with concerns whether any experiences during the past event season allayed their concerns. Although there were no emergency event calls, five respondents said they became more efficient and experienced in their shutdown procedures. One respondent gained additional staff members to help with the shutdown, and another received a waiver from PJM to curtail within 60 minutes instead of 30. When asked whether Duke Energy could do anything to decrease their concerns with participating in PowerShare, two respondents requested more advance notice and one mentioned increasing the incentive.

Participant Satisfaction Ratings

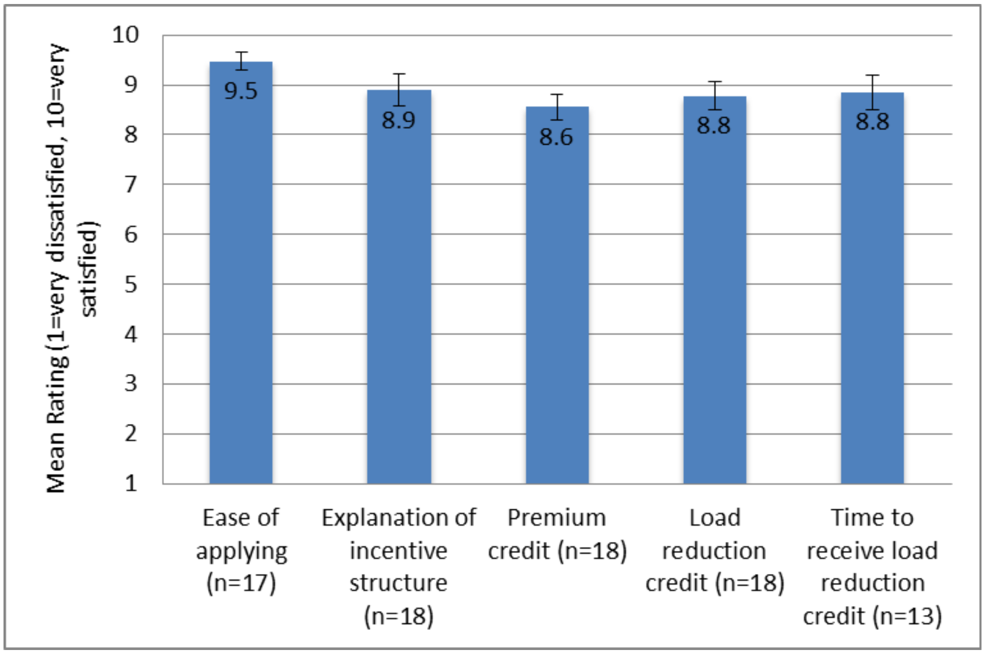
In general, respondents were highly satisfied with the PowerShare program. When asked about aspects of PowerShare that were working particularly well, six respondents stated that the program was working well in general. Five other respondents said that PowerShare communications were working exceptionally well, two cited the financial incentives, and two others were glad to help Duke Energy meet resource constraints. One respondent cited the timing of the test event as a program strength, another cited the EPO product, and another Duke Energy's representatives. When asked whether PowerShare could be improved in any areas, seven respondents could not identify any improvements. One respondent believed short events might not be worth curtailing, another said the 30-minute notification window was difficult to work with, and another said the test event should be scheduled when there was a larger load to reduce (rather than during "off-peak" days and hours). One respondent suggested that Duke Energy could allow aggregation of retailers with different owners, and another recommended that Duke Energy send periodic reminders of the annual test event.

Figure 1 shows that participant survey respondents have high satisfaction with PowerShare incentives and program enrollment operations. Respondents were highly satisfied with the enrollment process, rating it a 9.5 on a 10-point scale, where 1 indicates very dissatisfied and 10 indicates very satisfied. There were no ratings lower than 8 for the PowerShare enrollment process.

Respondents believed that they received a clear explanation of the incentive structure, rating it an 8. 9. One respondent explained that for PY2016, Duke Energy sent documentation that only stated the program would be the same as last year. However, this respondent did not remember the program details and suggested that Duke Energy could resend documentation on how the incentive was calculated.

Respondents were highly satisfied with the premium credit amount (mean rating of 8. 6), the load reduction credit amount (mean rating of 8. 8), and the time it took to receive the load reduction credit (mean rating of 8.8). One participant said it took almost two weeks to receive their test event results and suggested that Duke Energy could shorten this delay in the future.

Figure 1. Satisfaction with PowerShare Enrollment and Incentives



*Note: Error bars depict standard error of the mean.

Figure 2 shows respondents' moderately high satisfaction with PowerShare event calls. Respondents gave a mean satisfaction rating of 7. 9 for the amount of advance notice they received. Although there were no event calls in PY2015, respondents' comments indicate that they based their rating on their experience from previous years: three respondents wanted day-ahead notifications, one complained about a 4:00 a.m. winter event and suggested better forecasting, and another suggested that Duke Energy could provide periodic notifications for the mandatory test event.

Respondents gave a mean rating of 7.8 for the time they had to reduce their load, but again their responses reflected their experience from previous years: One respondent expressed frustration with receiving an event notification (for a winter event), only to learn that the event was cancelled after his company began shutdown procedures, and with another (winter) event that was cancelled after only one hour. Another suggested day-ahead notice, and a third wanted the response window increased from 30 minutes.

Respondents gave a mean rating of 7.8 for Duke Energy's method of confirming load reduction. Of the respondents who offered suggestions for improvement, four wanted to receive their test event results more quickly, and one complained that the test event occurred after his company had decreased its load, and he wanted Duke Energy to use the highest historical load as the baseline.

Figure 2. Satisfaction with PowerShare Event Calls

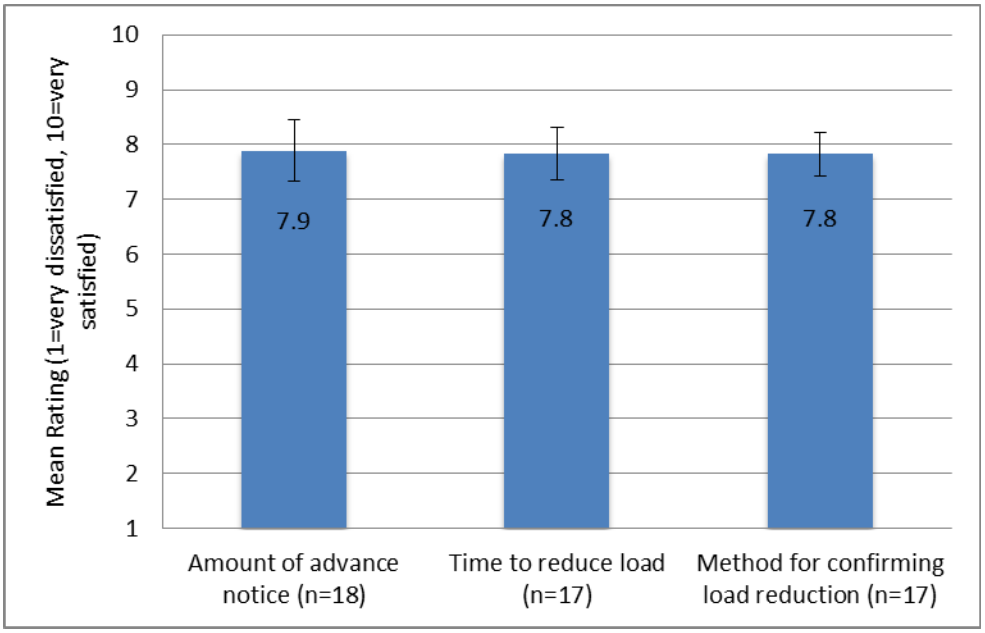


Figure **3** shows that respondents were very pleased with the technical expertise of Duke Energy staff, with a mean rating of 9.6, and they had no suggestions for improvement. Respondents gave moderately high satisfaction ratings for the time it took for Duke Energy staff to respond to issues or questions, with a mean rating of 8.8. One respondent said it was difficult to communicate with someone from Duke Energy during an emergency event, another wanted test event results within three to four days, and a third was currently waiting for someone from Duke Energy to return a call. There were no suggestions for improvement.

Overall, respondents have high satisfaction with the PowerShare program (mean rating of 8.8) and with Duke Energy (mean rating of 8.5). Only one respondent suggested an improvement for PowerShare, reiterating his suggestion of allowing small retailers to aggregate their accounts. Of the three comments from respondents who rated their overall satisfaction with Duke Energy an 8 or less, one repeated his earlier comment about a need to improve communication, and two others mentioned issues that were not related to Duke Energy's demand-side management programs.

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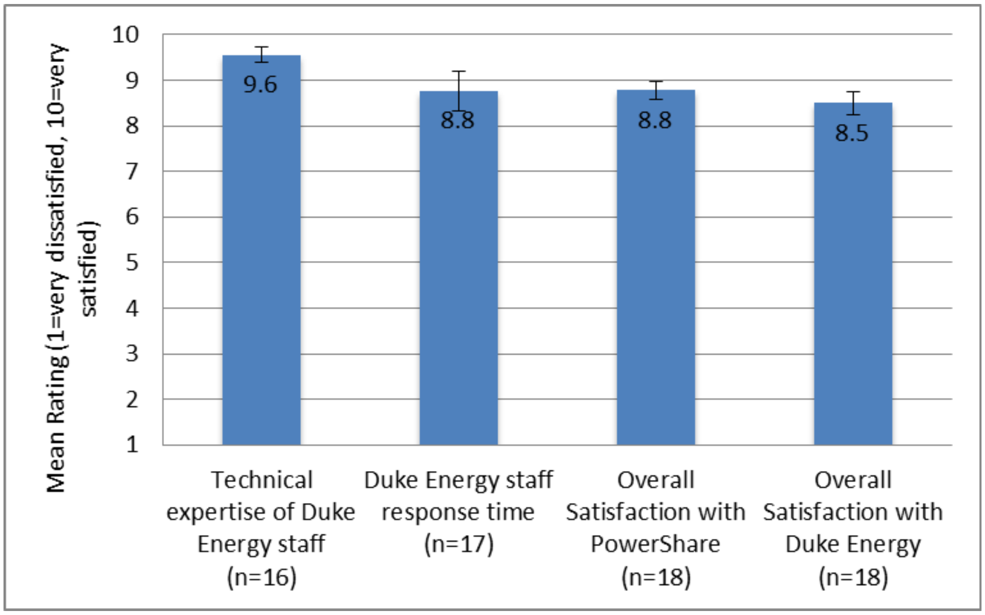
Figure 3. Overall Satisfaction Ratings

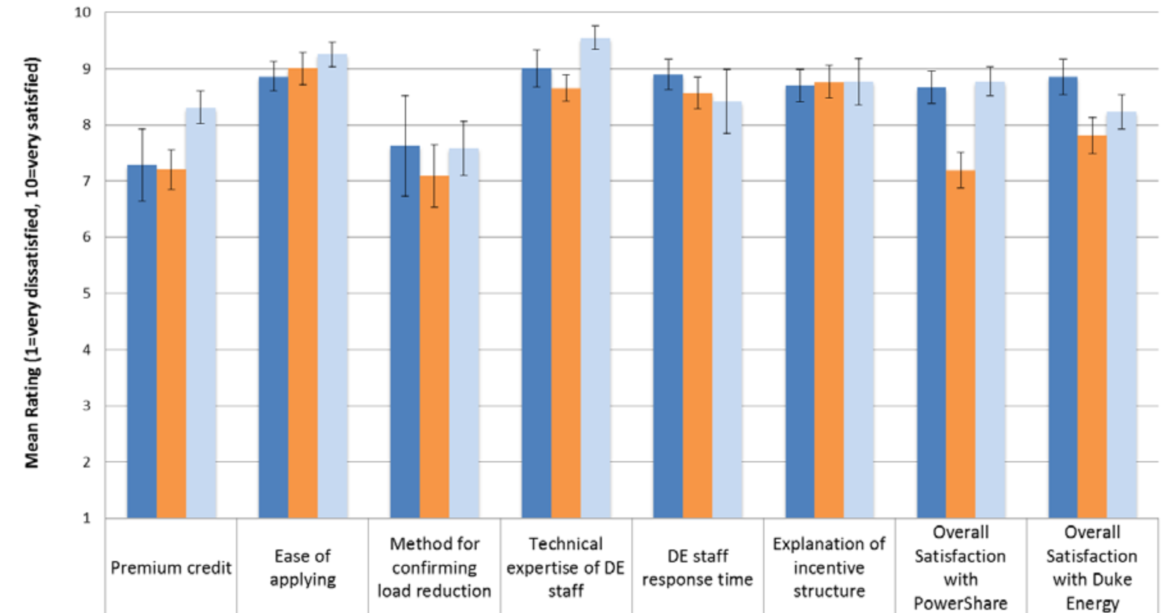


Change in Satisfaction Over Time

Figure 4 shows that participant satisfaction has remained high for many aspects of PowerShare since PY2011,[9] including satisfaction with the ease of applying to participate in PowerShare and the explanation of program rules and incentives. Since PY2011, participants have maintained moderate satisfaction with Duke Energy's method for confirming load reduction. In the areas where satisfaction ratings have fluctuated, there is an indication of lower satisfaction with the PY2013–PY2014 program, probably because of the unexpected winter events. These data form a baseline against which to track participant satisfaction.

9 These data show current and historical data from PowerShare participants in Ohio.

Figure 4. Satisfaction with PowerShare over Time (DEO Respondents)



	Premium credit	Ease of applying	Method for confirming load reduction	Technical expertise of DE staff	DE staff response time	Explanation of incentive structure	Overall Satisfaction with PowerShare	Overall Satisfaction with Duke Energy
2011 Mean (N=10)	7.3	8.9	7.6	9.0	8.9	8.7	8.7	8.9
2013 Mean (N=26)	7.2	9.0	7.1	8.7	8.6	8.8	7.2	7.8
2015 Mean (N=13)	8.3	9.3	7.6	9.5	8.4	8.8	8.8	8.2

Future Program Challenges

Legislative Uncertainty

The PowerShare program in the Midwest has undergone several changes in recent years because of changing regulations. In Ohio, SB221 impelled DEO to ramp up their load curtailment programs to meet new capacity goals. Recent legislation put SB211 on hiatus to study whether the goals were appropriate. The product manager reported that the two-year hiatus will end in PY2016, but it is uncertain what the outcome of the study will be and how PowerShare will be affected in PY2017. In anticipation of multiple outcomes, the product manager has identified some markets within PowerShare that can provide additional capacity and continues to try to identify ways to decrease the impact of events on business operations.

PJM 30-Minute Notification Window

At the time of this evaluation, PowerShare's new procedures to curtail loads within PJM's new 30-minute notification window had not been implemented yet. Although PJM has granted exceptions to this window, the product manager was concerned that many current PowerShare participants would not be able to curtail their loads within 30 minutes. He said, "We were concerned that schools and commercial customers might need real help to respond within 30 minutes because they are not eligible for a waiver from PJM." The product manager reported that, in anticipation of these difficulties, he had explored ways to offer automated demand response offerings to PowerShare participants. Duke Energy recently concluded a two-year pilot of an automated demand response offering with a few large

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customers[10] and was ready to apply lessons from the pilot with a larger pool of customers. To date, participants have not expressed much interest in automated demand response offerings, perhaps because PJM has not called any emergency events since instituting the 30-minute notification window. The product manager plans to continue to explore automated demand response offerings in anticipation of a changing energy market in which resources are managed through shorter, more frequent events, instead of longer and rare events.

Respondents have some awareness of and concerns about the 30-minute window. As one respondent explained about advance notice, “The earlier the better—the first year there was more time to respond. Last year I hesitated [to renew] because of the reduced 30-minute notification time. I have only 30 minutes to shut down [multiple] sites.” The product manager and the account manager independently expressed surprise that PJM’s change to a 30-minute notification window did not seem to deter participants from renewing their PowerShare contracts. One factor that makes the change more palatable may be the availability of exceptions to the 30-minute window. The product manager explained that manufacturers can apply for an exemption to curtail their loads within 60 or 120 minutes if there is risk that reducing loads within 30 minutes would cause damage to their equipment, raw materials, or finished products, or if it would take more than 30 minutes to safely evacuate a plant during shutdown. Likewise, customers with generators can receive an exemption if the transfer of loads to backup generators must be done manually and would take more than 30 minutes. The account manager reported that a customer must write a letter requesting an exemption, and Duke Energy sends the request to PJM. To date, PJM has generally granted all exemption requests.

Both the product manager and the account manager acknowledged that only a true emergency event call will allow them to find out how difficult it is to curtail loads with the 30-minute advance notification. To prepare for future events, the product manager reported that in spring 2016, Duke Energy will conduct another annual refresher of emergency event call procedures. This will allow Duke Energy to confirm the amount of time it takes for the system to notify customers of the start and end of an event.

The Duke Energy account manager said that despite the challenges posed by recent changes in the program, her longstanding relationship with customers means that they are willing to communicate their concerns to her. This allows her to explain the reasons and need for the program changes to her customers’ satisfaction. The account manager believed that the high renewal rate from program participants speaks to the program’s continued value to Duke Energy’s customers despite the recent changes.

[10] Those customers have since chosen another curtailment service provider.

Cadmus Review of Analytical Approach

Cadmus, as the third-party evaluator, reviewed the files for participation and impacts for the PowerShare program year 2015 provided by Duke Energy. A conservative approach was taken by the Duke Energy measurement and verification team to ensure accurate load reduction. The data reported here align with the information provided in the spreadsheets received. The methods reviewed are comparable with Cadmus' experience in other jurisdictions and confirmed as reliable estimates.

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 state of OH as it was implemented between the dates of January 1, 2015 and December 31, 2015. We'll talk about the Program and its objectives, your thoughts on improving the program and its participation rates. 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 Ohio Program's goals.

2. 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?

3. Would you please tell me the history of the PowerShare program in Ohio?

4. 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.

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

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

7. How does PowerShare fit into Duke Energy's demand response portfolio?

8. What other demand response programs does Duke offer to either residential or nonresidential customers?

9. How does Duke Energy prioritize use of the capacity provided by each of these demand response programs?

Objectives

10. Were there any quantitative targets in terms of participant enrollments? If yes, what were they?

11. Were there any quantitative targets in terms of demand response capacity? If yes, what were they?

12. Where there separate quantitative targets for each of the four participation options?

13. How do you set these objectives?

14. Please explain SB 221 and its influence on PowerShare program objectives.

15. How well has Duke Energy been meeting the capacity goals set by SB 221?

16. Did you meet those objectives? Exceed them?

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

18. Should the current objectives be revised in any way because of these changes that developed since the program objectives were devised?

19. What is Duke Energy's need for having an economic demand response program in OH?

20. Please tell me about the Auto Demand Response program in OH?

21. Can you please provide me with a list of the campanies that are participating in the pilot?

22. What information do you need that would help you with program design in the future?

Incentives

23. What were the incentives for the PowerShare program in 2015? Do you expect that these will change in the future?

24. How do customers receive the monthly premium credit?

25. How do customers receive the load reduction credit for the events in which they participated?

26. Are these two credits reported separately on their invoice?

27. 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?

28. 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?

29. Do you think customers have additional ability to shed load that could be tapped if the incentives were increased?

Marketing

30. 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?

31. 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 participatory benefits of the program? How might they be improved?

32. 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?

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

34. What are the key barriers to more efficient program operation?

35. What are the key barriers to achieving greater load reduction?

36. Are there any steps of the enrollment process that is more difficult for the customer? How does PowerShare plan to address these issues.

37. How many customers have unenrolled from the program in 2015, for each of the options? How many MW does this represent?

38. What are most common reasons for unenrolling?

39. 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?

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

Event calls

41. How many and what types of events were called in 2015?

42. What are the steps customers must go through to participate in the voluntary and economic events?

43. How do you track, manage, and monitor or evaluate customer response to the event calls? How do you know if they reached their load shifting objectives?

44. For customers who do not shed as much load as anticipated, how do you find out why customers did not shed enough load?

45. Can you describe for me your understanding of how customers react to a call? How quickly do they learn of a call, what determines what they can do, how quickly can they react?

46. 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?

47. 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?

48. Are there any market segments or customer types that the program is now serving that consistently 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?

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

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

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

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

Thank you for your time!

Appendix B: Participant Survey Protocol

Survey ID __________
Surveyor Name __________

State

( ) Ohio

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 Power Share 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 Power Share 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 Cadmus Works. I am calling on behalf of Duke Energy to conduct a customer satisfaction interview about the Power Share Program. Duke Energy has given us your name as someone who might be able to share some of your experiences with the Power Share 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 Rose Stoeckle, Manager of Measurement and Verification Ops, at Duke Energy. She can be reached at (513) 287-2264 or rose.stoeckle@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 Power Share?

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 Power Share for your company?

( ) Yes
( ) No
( ) DK

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

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

____

ES-5. How long has your company been participating in the Power Share Program?

____

INFORMATION-GATHERING PHASE

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

( ) Duke Energy sent me a brochure
( ) A Duke Energy representative told me about it
( ) Duke Energy website
( ) I saw an ad in: __________
( ) Other: __________
( ) Don't know

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

OHIO: AUTO DR PILOT

CODR-1. Are you, or were you, a participant in the Automated Demand Response pilot, which is also known as Auto DR?

( ) Yes
( ) No
( ) DK/NS

(If yes, ask CODR-2, CODR-3 and CODR-4)

CODR-2. What do you like most about Auto DR?

____

CODR-3. What do you like the least about Auto DR?

____

CODR-4. Please rate your overall satisfaction with the Auto DR pilot, on a scale of 1 to 10, where 1 means that you are very dissatisfied and 10 means that you are very satisfied.

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

If rating is less than 8:

CODR-5. What can be improved about the Auto DR program?

____

DECISION MAKING

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

____

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

____

DM-3a. Duke Energy offered an early enrollment period with a bonus if your company renewed their contract in January. Did your company renew under this early enrollment period?

( ) Yes
( ) No
( ) DK/NS

If "No"
DM-3b. What were some of the reasons why your company did not renew under the early enrollment period?

____

If "No"
DM-3c. Is there anything Duke Energy can do to help your company make a decision early?

____

EVENT PARTICIPATION

EV-4a. In addition to phone calls, texts, fax and emails, is there another way in which you would like to be notified of events?

____

EV-4b. 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 "Not at all useful" and 10 means "Useful".

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

EV-4c. Do you have any other feedback for Duke Energy on their event communication efforts?

____

EV-5d 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

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

____

EV-8. Please rate how easy is it for you to use the Energy Profiler Online, or 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

EV-11. For winter events that were called recently, were there any differences in your company's ability to respond compared to summer events?

____

IMPROVEMENTS

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

____

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-4. Is there anything about Power Share 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 Power Share 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 Power Share 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 Does your company intend to stay in the Power Share program in the coming year?

( ) **Yes**
( ) No
( ) DK

SAT-13. 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 Energy management about the Power Share Program that we have not discussed already?

____

Thank you for taking this time to share your thoughts! We appreciate it very much.

APPENDIX F

REPORT

Reimagine tomorrow.

Ohio Senate Bill 310 Energy Efficiency Savings Analysis 2006-2015

Submitted to Duke Energy Ohio
August 15, 2016

Principal authors:

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1 Executive Summary

In 2016, Duke Energy retained Nexant, Inc. (Nexant) to perform a market potential study for its operating company in Ohio. As an additional task, Nexant was retained to determine the energy and demand savings that are attributable to Duke Energy for customer energy efficiency activities within its Ohio service territory as allowed for in Ohio Senate Bill 310 (SB 310); the text of which is provided in Appendix A for reference.

The four secondary data analysis approaches that were considered by Nexant to make a determination of the additional energy savings are as follows:

- Residential Appliance Saturation Survey (RASS) data trend analysis;
- ENERGY STAR sales and shipment data analysis;
- Adjustment of prior evaluation and reported savings results; and
- Codes & Standards analysis.

In conducting each of these four analyses, Nexant carefully reviewed DEO program savings to ensure each analysis did not double count savings already being credited from DEO programs. A summary of each of these analysis approaches as well as the resulting energy savings from each analysis are outlined in detail in the following report.

The results of Nexant's analysis are presented below in Table 1-1 and Table 1-2.

Table 1-1: Summary of Analysis Energy Savings - kWh

Sector	RASS Incremental Savings (kWh)	ENERGY STAR Incremental Savings (kWh)	EM&V Incremental Savings (kWh)	Codes & Standards Incremental Savings (kWh)	Total Incremental Savings (kWh)
Residential	13,613,753	512,817,121	20,512,213	75,328,926	622,272,014
Non-residential	0	181,881,013	59,044,749	11,475,625	252,401,387
Total	**13,613,753**	**694,698,134**	**79,556,963**	**86,804,552**	**874,673,401**

Table 1-2: Summary of Analysis Energy Savings - kW

Sector	RASS Incremental Savings (kW)	ENERGY STAR Incremental Savings (kW)	EM&V Incremental Savings (kW)	Codes & Standards Incremental Savings (kW)	Total Incremental Savings (kW)
Residential	0	59,643	13,141	11,880	84,664
Non-residential	0	15,871	5,134	6,911	27,916

Sector	RASS Incremental Savings (kW)	ENERGY STAR Incremental Savings (kW)	EM&V Incremental Savings (kW)	Codes & Standards Incremental Savings (kW)	Total Incremental Savings (kW)
Total	**0**	**75,515**	**18,276**	**18,790**	**112,580**

These findings indicate that Duke Energy Ohio (DEO) should claim an additional 874.7 GWh of energy savings and 112.6 MW of demand savings for the period of 2006 through 2015 based on the provisions of SB 310.

2 Introduction

Duke Energy Ohio (DEO) retained Nexant to assess the effect of Ohio's Senate Bill (SB) 310[1] on the utility's historical estimated energy-efficiency savings. DEO's territory accounts for approximately 9.4%[2] of electricity sales in the state of Ohio and serves approximately 840,000 electric customers in the Cincinnati metro area. The company began offering these energy-efficiency programs to its residential and non-residential customers in 2006 and continues to provide a suite of program offerings. Like other investor-owned utilities in the state, DEO is subject to Ohio's energy-efficiency cumulative electricity savings target of 22% by 2027.

This report outlines the data collection and analysis that Nexant used to reliably characterize the company's historical energy-efficiency savings not already claimed though DEO's energy-efficiency programs. To understand and assess the effects of SB 310 on DEO's energy-efficiency savings estimates, we used multiple analysis approaches on independent but complementary data sources. This process increased the reliability of the final estimate because each approach and each supporting data source was not without limitation; using multiple approaches and data sources reduced the emphasis on any one input and strengthened the analytical process.

2.1 SB 310 Legislation

In the summer of 2014, the Ohio legislature passed SB 310, which was subsequently signed into law on June 13, 2014. SB 310 amended SB 221. SB 221 went into effect in 2008 and stipulated that electric distribution utilities (EDUs) had to achieve a cumulative annual energy savings of more than 22% by the end of 2025.[3] Under SB 310, EDUs are no longer required to secure energy-efficiency savings in 2015 or 2016; the bill also extends the timeframe for surpassing the 22% benchmark to 2027.[4] In addition to revising the schedule for complying with the savings target, SB 310 also introduced new mechanisms that adjust how EDUs estimate their energy savings. Specifically, the bill allows EDUs to retroactively adjust their achieved cumulative energy savings based on amended energy-efficiency accounting and through the inclusion of additional energy-efficiency resources.

SB 310 requires the Ohio Public Utilities Commission (PUC) to permit EDUs to account for energy-efficiency savings estimated on an "as-found" or a deemed basis. That is, an EDU may claim savings based on the baseline operating conditions found at the location where the energy-efficiency measure was installed, or the EDU may claim its own calculated deemed savings estimate. For example, if a DEO commercial customer installed an electronically

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[1] State of Ohio Substitute Senate Bill 310 Section 4928.662, sections (A) through (G), pages 30 and 31.

[2] Energy Information Administration, electricity data: http://www.eia.gov/electricity/data.cfm#sales

[3] Ohio Legislative Service Commission, Am. Sub. S.B. 221 127th General Assembly.

[4] Ibid.

commutated motor fan on a furnace, DEO can claim energy savings based on its own assumed deemed or calculated energy savings value associated with the fan upgrade irrespectively of third party evaluation, measurement, and verification which could show a higher or lower level of energy savings from observed conditions. Additionally, SB 310 requires that if a customer undertook an action that complied with federal standards, the resulting savings must also be accounted for, even if the actions occurred independent of an EDU energy-efficiency program. SB 310 permits EDUs to apply these accounting techniques retroactively to 2006. EDUs may carry forward any additional savings identified under SB 310's energy-efficiency accounting and apply those savings to future energy-efficiency targets.[5]

DEO benefits from quantifying the effect of these amended savings because it will help the company understand its progress toward its energy efficiency goals. Additionally, DEO may need to reassess its energy-efficiency program portfolio to successfully optimize energy-savings potential and resource management as the company pursues its 2027 compliance target.

[5] Ohio Legislative Service Commission, Am. Sub. S.B. 310 130th General Assembly.

3 Secondary Data Analysis

Nexant relied on secondary research and analysis to estimate the energy savings achieved within DEO's territory from 2006 through 2015 under the accounting guidelines of SB 310. We focused on four methods for analysis:

- Residential Appliance Saturation Survey (RASS) measure trend
- ENERGY STAR® shipment data and deemed savings
- Historic EM&V report review
- State and federal codes and standards

We conducted stand-alone analyses on each of the four sources; when appropriate, we also used each source to inform the others. We also identified data gaps and defined parameter assumptions to serve as proxies. We developed algorithms and calculations to make a final estimate of the energy savings achieved, according to the source in question. Finally, we completed a roll-up analysis, taking the four sources and their associated results and carefully combined them to guard against double-counting. This effort provided a robust overall assessment of energy savings impact resulting from SB 310 within DEO's territory.

3.1 Residential Appliance Saturation Survey (RASS) Measure Trend

Duke Energy periodically collects Residential Appliance Saturation Survey (RASS) data to better understand the current saturation of fuel sources and appliances in DEO customer homes, including heating, ventilation, and air conditioning (HVAC) systems; water heating; kitchen equipment; and lighting fixtures. The surveys do not specifically include research on specific efficiency levels or shares of these appliances by efficiency level; however, the surveys do collect data on measures that typically have a reliable deemed energy savings. Changes or trends detected for these measures across multiple iterations of a RASS would indicate uptake of specific energy savings measures, which can be quantified.

3.1.1 Methods

Nexant's approach to analyze the RASS centered on identifying energy-saving measures installed in DEO customers' homes and estimating the uptake of those measures and quantifying the associated energy savings.

3.1.1.1 Approach and Rationale

SB 310 requires any action that a utility's customers take that results in energy savings be included as part of the utility's compliance goal. Because of this, Nexant investigated: 1) how DEO's residential market characterization has changed with regard to saturation of energy-saving measures, and 2) the rate of measure uptake. Nexant's approach to assessing a change in the adoption trends of measures began by identifying the specific measures for which energy savings could be reliably estimated using energy-savings algorithms. This prerequisite limited our analysis to measures that were characteristically homogenous or that offered easily defined efficiencies. Based on these conditions, Nexant limited its investigation to three measures:

- Light-emitting diode (LED) lamps;
- Compact-fluorescent lamps (CFL); and
- Programmable thermostats.

For each of these measures, defined savings algorithms exist; these algorithms can be leveraged to estimate the energy-savings impact resulting from customer uptake. Although these measures' energy savings can be quantified, understanding the trend of customer uptake for any specific measure depends on consistent survey questions being asked for each RASS iteration. These data would enable Nexant to have comparable metrics through time.

3.1.1.2 Data Sources and Parameter Assumptions

To assess the trend changes in uptake for the above-mentioned measures, Nexant reviewed the survey data collected by Duke Energy for the DEO territory. DEO could provide data from the surveys conducted in 2010 and 2013. Therefore, Nexant could only quantify the impacts of any trends in measure uptake for this three-year period. After reviewing the data sources, Nexant concluded the following:

- LED lamps could not be analyzed for changes or trends in uptake because only the 2013 RASS included questions regarding LEDs. The 2010 RASS did not include any data on LEDs.
- CFLs were included in both the 2010 and 2013 RASS. However, each survey included different questions regarding CFLs, which made comparison difficult. That is, although the 2010 RASS provided the quantity of CFLs installed in a customer's home, the 2013 RASS only provided the percentage of CFLs among all lamps installed in a customer's home. Nexant did not have sufficient lighting inventory data to convert the 2013 responses to an actual quantity of lamps, so we did not quantify the potential uptake in CFLs by DEO residential customers.
- Programmable thermostats were included in both the 2010 and 2013 RASS. Among the questions asked in both survey iterations, DEO asked its customers whether their homes contained a programmable thermostat. This survey question allowed Nexant to estimate the saturation of installed programmable thermostats in 2013 compared to 2010. With these data points, Nexant could estimate the change in uptake of this measure and calculate the associated energy savings.

From 2010 to 2013, DEO did not offer a rebate or any other incentive type for programmable thermostats through its residential program portfolio. Therefore, Nexant needed to determine a per-unit savings value. Additionally, Nexant needed to calculate the total number of homes that installed programmable thermostats between 2010 and 2013. To estimate these values, we used parameter inputs sourced from the RASS data (Table 3-1), customer premise data provided by Duke Energy, and assumptions sourced primarily from the 2016 Pennsylvania Technical Reference Manual (PA TRM).[1] Nexant reviewed the Ohio TRM and identified effective full load hour assumptions; however, the TRM does not provide an algorithm nor a deemed savings estimate for programmable thermostats.

Table 3-1: Programmable Thermostat Parameter Inputs

Parameter	Value	Source
Population of homes with programmable thermostats		
Incremental percentage increase of homes with installed programmable thermostats	8.6%	Duke Energy 2010 and 2013 RASS
Incremental quantity of homes with installed programmable thermostats	57,264	DEO residential customer premise data
Programmable thermostat energy savings		
HVAC system efficiencies[1] SEER/ HSPF	13 seasonal energy efficiency ratio (SEER); 7.7 heating seasonal performance factor (HSPF)	Federal minimum code for 2010 to 2013
HVAC heating technology	Heat pump: 46.4% Resistance heating: 53.6%	2013 Ohio RASS
HVAC cooling technology	Heat pump: 42.4% Central air conditioner: 57.6%	2013 Ohio RASS
System capacity $(CAPY_{cool}/CAPY_{heat})$	32,000 BTU/h	2016 Pennsylvania Technical Reference Manual
Duct efficiency Eff_{duct}	80%	2016 Pennsylvania Technical Reference Manual
Effective full load hours (EFLH) $EFLH_{cool}/EFLH_{heat}$	Cooling: 941 Heating; 713	2010 Ohio Technical Reference Manual
Energy savings factor ESF_{cool}/ESF_{heat}	Cooling: 2.0% Heating: 3.6%	2016 Pennsylvania Technical Reference Manual

3.1.1.3 Algorithm and Calculations

Nexant calculated the estimated per-unit savings using Equation 3-1listed below.

Equation 3-1: Programmable Thermostat

$$\Delta kWh/yr = \Delta kWh_{cool} + \Delta kWh_{heat}$$

$$\Delta kWh_{cool} = \frac{CAPY_{cool}}{1000\,\frac{W}{kW}} \times \frac{1}{SEER \times Eff_{duct}} \times EFLH_{cool} \times ESF_{cool}$$

$$\Delta kWh_{heat} = \frac{CAPY_{heat}}{1000\,\frac{W}{kW}} \times \frac{1}{HSPF \times Eff_{duct}} \times EFLH_{heat} \times ESF_{heat}$$

[1] Technical Reference Manual, State of Pennsylvania. Act 129 Energy Efficiency and Conservation Program & Act 213 Alternative Energy Portfolio Standards, June 2016, Table 2-41.

This calculation yielded an estimated energy savings per programmable thermostat of 237.7 kWh. We used this per-unit savings value and applied it to the number of homes reported to have installed a programmable thermostat between 2010 and 2013, estimating the total impact of this customer action.

3.1.2 Results

Extrapolating the calculated per-unit savings by the incremental quantity of homes that installed programmable thermostats resulted in a total energy savings of 13,613,753 kWh. As noted above, DEO did not offer any residential program that included rebates or other incentives for programmable thermostats for the time period of 2010–2013. Therefore, we assumed that no double counting had occurred. The final energy savings attributable to the RASS analysis are illustrated in Table 3-2 below.

Table 3-2: RASS Energy Savings, 2010 – 2013 - kWh

Measure	Total RASS Savings (kWh)	DEO Program Savings (kWh)	Incremental Savings (kWh)
Programmable thermostat	13,613,753	0	13,613,753
Total	**13,613,753**	**0**	**13,613,753**

The Ohio TRM deems zero kW savings for programmable thermostats so no demand reductions were attributed to this end use.

3.2 ENERGY STAR® Shipment Data and Deemed Savings

Due to the provisions of SB 310 which allow an EDU to claim energy savings from actions that customers take outside of utility energy efficiency programs, Nexant focused on estimating the energy impact of ENERGY STAR equipment. Specifically, we investigated what the total shipments of ENERGY STAR equipment was into DEO's service territory from 2006 through 2015 and quantified the energy savings impacts of those measures.

3.2.1 Methods

Nexant's analysis on the effect of ENERGY STAR equipment focused on understanding the per unit savings of these measures as well as estimating the total shipments of these measures to DEO's service territory.

3.2.1.1 Approach and rationale

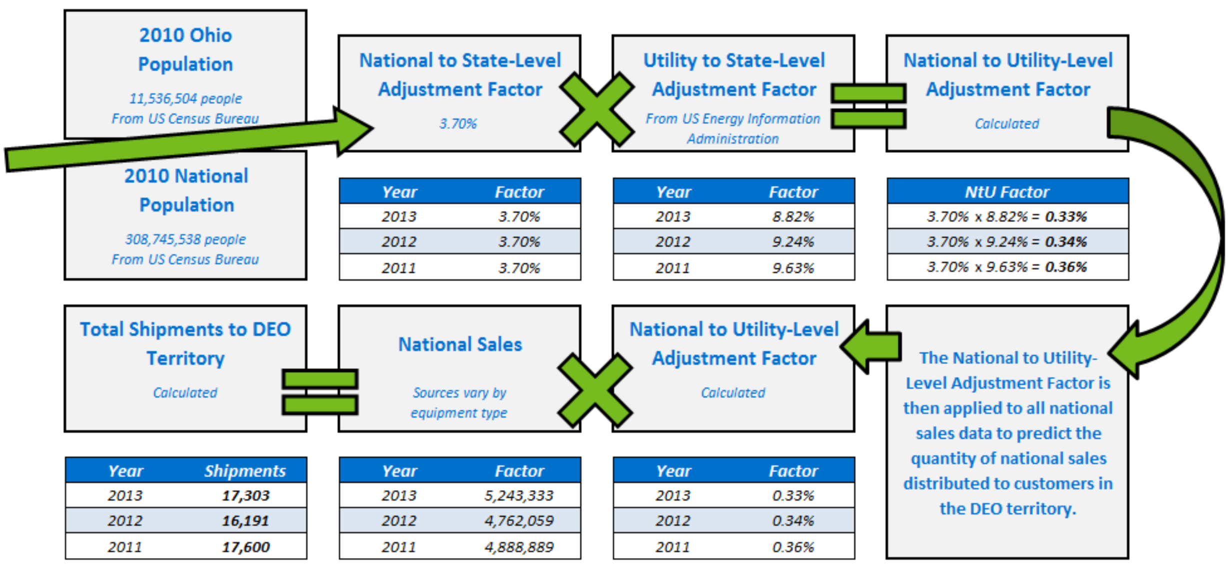
To estimate the effect of ENERGY STAR equipment energy savings achieved within DEO's territory, Nexant began by estimating total shipments at the state-wide level and ultimately within DEO's service territory for each year from 2006 through 2015. We modeled shipments by incorporating available national equipment sales data, regional equipment saturation data, commercial survey data, US Census data, and equipment estimated useful life (EUL). We then extrapolated savings based on per unit energy and demand savings calculated using ENERGY

STAR calculators and algorithms sourced from the 2010 Ohio TRM.

National equipment shipment data was readily available by year from 2006 through 2015 from ENERGY STAR. Shipment data is collected by ENERGY STAR from program partners and represents the certified product shipments for each year. ENERGY STAR does not adjust or attempt to extrapolate savings if it does not receive shipment data from all program partners. Therefore, ENERGY STAR considers the reported shipment totals for each product a conservative estimate[2]. The ENERGY STAR equipment included in our analysis includes appliances, lighting, HVAC, office equipment, and consumer electronics. Please see Appendix B for a complete list of included equipment and associated national shipments from 2006 – 2015.

To estimate total shipments within DEO's service territory, Nexant employed a top-down approach based on the national sales data, as depicted in Figure 3-1:

Figure 3-1: Methodology for Disaggregation of National Equipment Sales



For residential measures, Nexant used the utility to state-level adjustment factor provided by the US Energy Information Administration, which compares quantities of residential customers at the utility and state-levels.

We followed a similar disaggregation methodology for non-residential measures using 2012 commercial floorspace as provided by the US Energy Information Administration's Commercial Buildings Energy Consumption Survey (CBECS) in place of the US Census Bureau-supplied population values to determine the National to State-Level adjustment factor. CBECS presents total commercial floorspace in regions, with Ohio falling in the "East North Central" division.

[2] ENERGY STAR® Unit Shipment and Market Penetration Report.

Nexant used state population data from the 2010 census to disaggregate the floorspace reported in the East North Central Division in order to isolate the portion belonging to the state of Ohio. The utility to state-level adjustment factor provided by the US Energy Information Administration in the case of non-residential measures is based on documented electricity sales rather than customers.

Having established the annual estimated shipments within DEO's territory, Nexant calculated energy savings for each measure type based on the per unit energy savings. Our model multiplied the per-unit savings by the number of annual shipments to determine the total savings of all purchased equipment in each year. Following this step, Nexant reviewed DEO's program filings from 2006 through 2015 and identified any program that incentivized an ENERGY STAR measure. Our review found that DEO's programs during this time period offered its customers the following ENERGY STAR measures:

- Refrigerators and Freezers
- Fryers
- Oven (Combination or Convection)
- Room Air Conditioner
- Central Air Conditioner
- Heat Pump
- CFLs
- LEDs
- LED Exit Sign
- LED Display Case/Case Lighting
- LED Traffic Signal
- Pool Pump

Nexant summed the total savings associated with these program measures in order to avoid crediting DEO with savings it had previously claimed. Therefore DEO program savings were netted out of the total ENERGY STAR savings to estimate final incremental savings from shipments of ENERGY STAR measures to DEO's territory.

3.2.1.2 Parameter Assumptions and sources

To estimate shipments, Nexant began with national sales data provided by ENERGY STAR based on product reporting from program partners. On average, 89% of partners reported shipment data to ENERGY STAR[3]. To distill these shipment data to DEO's territory, Nexant relied on the following sources:

[3] Ibid.

- The US Census Bureau's 2010 Census
- The US Energy Information Administration's Commercial Buildings Energy Consumption Survey
- The US Energy Information Administration's Electricity Detailed Survey Data Files

Nexant relied on ENERGY STAR calculators and the 2010 Ohio and 2016 Pennsylvania TRMs to estimate per unit energy and demand savings. The vast majority of ENERGY STAR measures' energy savings were derived from the ENERGY STAR calculators. All calculators used to estimate per unit savings were based on the most recent version except in the case of measures that experienced a federal standard change such as refrigerators or dehumidifiers. For these measures, Nexant quantified pre- and post-standard per unit savings and applied each to the appropriate shipment years. In cases where an ENERGY STAR measure was not available for a specific measure, Nexant used deemed savings values provided in the 2010 Ohio TRM.

To estimate demand savings, Nexant relied on the Ohio and Pennsylvania TRMs as the ENERGY STAR calculators do not provide demand results. For most measures, Nexant applied the demand savings algorithm to the previously calculated energy savings to estimate the per unit demand reduction. We relied on the provided coincidence factor and hours of use listed in the TRM to complete our calculations.

3.2.1.3 Algorithm and calculations

As discussed above, Nexant calculated energy savings primarily based on the ENERGY STAR calculator algorithms and utilized the Ohio and Pennsylvania TRM algorithms to estimate demand savings. These savings were extrapolated based on the total shipments of a given measure within DEO's territory.

An example of Nexant's savings calculation for residential refrigerators is shown below (Table 3-3). Based on 2014 national shipment data and the 2013 ENERGY STAR appliance calculator, we determine the total energy savings for the 2014 calendar year.

Table 3-3: Refrigerator Algorithm and Parameters

Configuration	∆kWh	Source
Manual Defrost and Partial Automatic Defrost	80	2013 ENERGY STAR Appliance calculator via 2014 PA TRM
Top mount freezer without door ice	111	
Side mount freezer without door ice	156	
Bottom mount freezer without door ice	154	
Side mount freezer with door ice	139	
Bottom mount freezer with door ice	122	
Refrigerator only - single door without ice	89	
Refrigerator/Freezer – single door	102	
Average per unit energy savings	**119**	

Nexant extrapolated the per unit savings for refrigerators to DEO's territory based on the estimated total shipments to the territory. We then subtracted energy savings from DEO program rebated refrigerators to ensure savings are not double counted.

Table 3-4 illustrates this process and shows that DEO may claim over 2.4 million kWh from ENERGY STAR refrigerators in the 2014 compliance year.

Table 3-4: ENERGY STAR Refrigerator Energy Savings (kWh)

Year	Total ENERGY STAR Units Shipped (U.S.)	% Shipped to DEO Territory	ENERGY STAR Units Shipped (DEO)	ENERGY STAR Per Unit Savings (kWh)	ENERGY STAR Total Savings (kWh)	DEO Program Annual Savings (kWh)	Incremental ENERGY STAR Savings (kWh)
2014	7,347,000	0.32%	23,790	119	2,833,934	395,319	2,438,615

3.2.2 Results

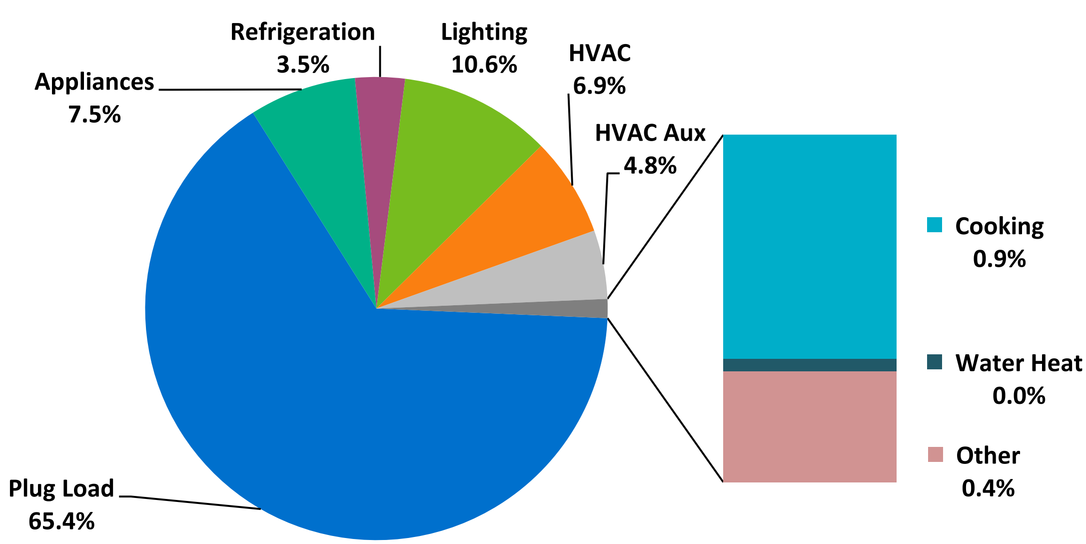
Nexant completed its analysis for each ENERGY STAR measure and totaled the incremental savings. We found ENERGY STAR measures contribute nearly 695 million kWh of achieved savings over the 10 year period from 2006 to through 2015. Total incremental savings by year are presented in Table 3-5.

Table 3-5: ENERGY STAR incremental savings by year

Year	Total ENERGY STAR Units Shipped (U.S.)	% Shipped to DEO Territory	ENERGY STAR Units Shipped (DEO)	ENERGY STAR Annual Savings (kWh)	DEO Program Annual Savings (kWh)	Incremental ENERGY STAR Savings (kWh)
2006	2,098,438,867	0.53%	11,142,051	23,005,707	304,640	22,701,067
2007	2,340,831,173	0.54%	12,647,714	26,674,358	15,322,927	11,351,431
2008	2,783,363,815	0.54%	15,093,619	48,112,234	18,036,525	30,075,709
2009	3,024,867,480	0.53%	15,899,363	112,486,252	23,373,048	89,113,204
2010	35,156,103,617	0.45%	158,286,524	149,527,288	26,234,586	123,292,702
2011	8,622,102,000	0.38%	33,116,121	145,688,760	12,673,618	133,015,142
2012	6,912,941,000	0.36%	24,846,879	143,139,397	83,023,007	60,116,391
2013	7,937,827,000	0.34%	27,149,917	144,549,155	41,274,232	103,274,922
2014	8,370,050,000	0.34%	28,335,700	133,209,277	63,660,982	69,548,294
2015	11,635,594,000	0.42%	49,146,487	100,751,872	48,542,601	52,209,271
Total	**88,882,118,952**	**0.42%**	**375,664,373**	**1,027,144,299**	**332,446,165**	**694,698,134**

Figure 3-2 illustrates how the ENERGY STAR energy savings are distributed by end use. Plug load captured nearly two thirds of the incremental savings followed by lighting at just over 10%. This distribution of shares is a result of the program portfolio design offered by DEO which does not prioritize plug load measures but does focus on lighting as well as HVAC and refrigeration measures.

Figure 3-2: Incremental ENERGY STAR Savings by End Use



The final energy and demand savings attributable to the ENERGY STAR analysis are presented by sector in Table 3-6 and Table 3-7.

Table 3-6: ENERGY STAR Energy Savings - kWh

Sector	ENERGY STAR Savings (kWh)	DEO Program Savings (kWh)	Incremental Savings (kWh)
Residential	800,013,916	287,196,795	512,817,121
Non-residential	227,130,383	45,249,370	181,881,013
Total	**1,027,144,299**	**332,446,165**	**694,698,134**

Table 3-7: ENERGY STAR Demand Savings - kW

Sector	ENERGY STAR Savings (kW)	DEO Program Savings (kW)	Incremental Savings (kW)
Residential	96,408	36,764	59,643
Non-residential	24,682	8,811	15,871
Total	**121,090**	**45,575**	**75,515**

3.3 Historic EM&V Report Review

DEO's program portfolio energy savings, which the utility files for regulatory compliance, are informed by evaluation, measurement, and verification (EM&V) reports conducted by third-party contractors on a periodic basis. Evaluation activities typically included the assessment of the impact savings estimates. Third-party contractors often complete these assessments by assuming the baseline equipment is equivalent to the prevailing code or standard. DEO program EM&V reports provided an estimated energy savings value independent from what DEO's program initially reported. After receiving an EM&V report, DEO updates its assumed energy savings per the findings of the report and revises subsequent filings to be aligned with the EM&V reported savings values. DEO uses the EM&V report savings values until another updated EM&V report is delivered to DEO, at which time filed energy savings are again updated.

However, under the direction of SB 310, DEO may align program savings based on either a deemed savings assumption or on an "as-found" baseline assumption. For example, DEO may establish its filed energy savings based on its own reported savings value for a measure, or it may recalculate the energy savings for a measure based on the pre-existing equipment efficiency. Therefore, DEO may opt to record its own reported savings value, irrespective of the EM&V report. DEO may also retrospectively amend its filed savings values to align with its reported or deemed savings values rather than the value stipulated by the EM&V report.

3.3.1 Methods

Nexant focused its investigation on historic program energy savings filings that could be amended to reflect: 1) a deemed per-unit energy savings value, or 2) a per-unit energy savings value based on an "as-found" condition efficiency level. When we amended historic filings based on either a reset baseline or on a revised deemed savings value, we recalculated the measure and program savings to the higher value, as allowed by SB 310.

3.3.1.1 Approach and rationale

Nexant extracted multiple savings metrics from DEO-provided program EM&V reports, including participation data, gross annual ex-ante savings (kW and kWh), realization rates, gross annual ex-post savings (kW and kWh), net annual savings, net-to-gross ratios, "as-found" data describing the baseline equipment efficiency (if provided), and code baseline data. When "as-found" data appeared in an EM&V report, Nexant determined whether the evaluator used this baseline to calculate savings. We either ensured that the evaluator used the "as-found" baseline when computing savings or, if the "as-found" baseline was not used, we re-calculated the savings using the respective algorithm detailed in the 2010 Ohio Technical Reference Manual (Ohio TRM). If the "as-found" baseline did not appear in the evaluation report, Nexant reviewed the report for the code baseline that the evaluator assumed, using it to estimate the energy savings for each evaluated measure. If we could not identify the code baseline, we reviewed federal codes and the International Energy Conservation Code (IECC) to determine their effects on the measure energy savings. For affected measures, we re-calculated savings using the respective Ohio TRM algorithm and the appropriate code baseline. Finally, Nexant recorded and included in its comparative analysis deemed savings values provided by the Ohio TRM.

After reviewing the energy savings values for the ex-ante value, ex-post value, realization rate, "as-found" value, code baseline value, Ohio TRM value, and the net savings value, Nexant used the highest per-unit savings value among these to compare with the per-unit values listed in the DEO program energy savings filings. For residential programs, if we found a higher value from our review of the EM&V report, we calculated an adjusted program savings to reflect the participation listed in DEO's filings and the identified, higher per-unit energy savings value. For non-residential programs, Nexant relied on the EM&V realization rate to make any program savings adjustments. It was necessary to apply the realization rate to non-residential programs, as the EM&V reports often did not consistently provided measure-level data but rather provided end use realization rates. In these cases we could not amend individual measures; however, we were able to adjust end uses presented in the DEO filing based on the end use realization rates provided in the EM&V reports. The incremental increase between DEO's initial filed program savings and the amended program savings based on our analysis represented the additional savings credited to DEO under SB 310.

3.3.1.2 Data Sources and Parameter Assumptions

Nexant used the historical program EM&V reports provided by DEO to extract the various savings metrics discussed above. We evaluated the fourteen DEO program categories and a total of 34 individual evaluation reports outlined in Table 3-8 below.

Table 3-8: Summary of DEO Program Evaluations from 2006 to 2015

Duke Energy Ohio Program	Evaluations reviewed from 2006 to 2015
Appliance Recycling	1
Home Energy House Call	4
Energy Efficiency Education Program for Schools	4
Low Income	5
Multi-Family Energy Efficiency	1
Non-Residential Smart $aver Prescriptive Program	5
Non-Residential Smart $aver Custom Program	2
Non-Residential Energy Assessments	1
Personalized Energy Reports	1
Residential Smart $Saver CFL Program	5
Residential Smart $aver HVAC Program	3
Specialty Bulbs	1
Energy Star Energy Efficiency Washer Program	1

DEO provided EM&V reports spanning from 2006 through 2015; however, the majority of reports covered program years 2009 through 2015. Additionally, the EM&V activities were not conducted for all programs for all years. In such cases, Nexant used the most recent report as the source to make any amendments to the filed program or measure savings values. For example, if one EM&V report reviewed program year 2010, and the next available report reviewed program year 2013, we amended the filed program or measure savings values for years 2010 through 2012 based on the parameters and findings from the 2010 report. We amended the filed program or measure savings values for years 2013 through 2015 based on the 2013 evaluation report.

In addition to using the provided EM&V reports, Nexant also used the Ohio TRM to inform any required calculations to estimate the "as-found" and code baseline energy savings. Nexant used the input parameters provided in the EM&V reports, when available, as our default values; otherwise, we relied on the Ohio TRM parameter assumptions and algorithms when calculating measure energy savings.

3.3.1.3 Algorithm and calculations

Nexant's process to calculate savings used the following steps, as illustrated in the example in Table 3-9.

- Determine the filed savings values for the reviewed program;
- Adjust the filed savings values using the per-unit savings provided from the evaluation

report, multiplied by the filed program participation; and

- Calculate the incremental increase in savings between the initial and amended filed savings.

Table 3-9: Sample Amended EM&V Report Calculation

Program Year	Duke Energy Ohio Program	Measure	Participation	DEO Filed Per-Unit Savings (kWh)	Amended Per-Unit Savings		Incremental Per-Unit Savings (kWh)	Total Incremental Savings (kWh)
					kWh	Source		
2011	Residential Smart $aver HVAC	Central Air Conditioner	2,597	1,062.5	1,184.0	Evaluation report ex-ante value	121.5	315,536

3.3.2 Results

Nexant's final savings from the EM&V report analysis reflected the incremental savings between the adjusted program savings and the DEO filed program savings. In total, we estimated an incremental savings achieved almost 79.6 million kWh for program activity between 2006 and 2015 (see Table 3-10). Nexant found over half of the incremental savings occurred within the non-residential Smart $aver Prescriptive Incentive program.

Table 3-10: EM&V savings by program

Program Name	Sector	Total Incremental Savings (kWh)	Total Incremental Savings (kW)
“Get Energy Smart” Program in Ohio	Residential	0	0
Energy Efficiency for Schools	Residential	3,707,413	83
NEED Program in Ohio	Residential	170,445	0
Energy Star Energy Efficiency Washer Program	Residential	0	7
Personalized Energy Report (PER) Program in Ohio	Residential	0	0
Home Energy House Call (HEHC)	Residential	11,553,416	1,047
Multifamily Energy Efficiency	Residential	286,460	49
Non-Residential Energy Assessment	Non-Residential	0	0
Ohio Smart $aver Prescriptive Incentive Program	Non-residential	42,626,398	2,647
People Working Cooperatively Low Income Pilot Program	Residential	434,698	0
Low Income Refrigerator replacement program in Ohio	Residential	0	3
Residential Appliance Recycling Program (ARP) in Ohio	Residential	0	0
Residential CFL Program	Residential	800,304	10,419
Residential Energy Efficient Appliance and Devices: Lighting - Specialty Bulbs Program	Residential	1,148,003	0
Residential Neighborhood Program in Ohio	Residential	0	0
Residential Smart $aver HVAC	Residential	2,291,445	1,526
Residential Smart $aver: Property Manager CFLs in Ohio	Residential	120,030	7
Smart $aver Nonresidential Custom Incentive	Non-residential	16,418,352	2,488
Total:		**79,566,963**	**18,276**

The final energy and demand savings attributable to the EM&V report review analysis appear by sector in Table 3-11 and Table 3-12.

Table 3-11: EM&V Report Review Savings - kWh

Sector	Total EM&V Report Adjusted Savings (kWh)	DEO Program Savings (kWh)	Incremental Savings (kWh)
Residential	211,329,070	190,816,857	20,512,213
Non-residential	282,368,148	223,323,399	59,044,749
Total	**493,697,219**	**414,140,256**	**79,566,963**

Table 3-12: EM&V Report Review Savings - kW

Sector	Total EM&V Report Adjusted Savings (kW)	DEO Program Savings (kW)	Incremental Savings (kW)
Residential	25,234	12,093	13,141
Non-residential	40,327	35,193	5,134
Total	**65,561**	**47,286**	**18,276**

3.4 State and Federal Codes and Standards

SB 310 allows actions taken by customers that comply with specified codes and standards to count towards the EDU energy-efficiency compliance mandate. Thus, Nexant analyzed the impacts of measures that were subject to a code or standard change between 2006 and 2015, quantifying those impacts within DEO's territory.

3.4.1 Methods

Similar to the ENERGY STAR® analysis, Nexant's analysis on the effect of codes and standards on savings focused on understanding the per unit savings of measures affected by federal- or state-mandated changes in efficiency as well as estimating the total shipments of these measures to DEO's service territory.

3.4.1.1 Approach and rationale

To estimate the effect of codes and standards on energy savings achieved within DEO's territory, Nexant began by looking at state-wide, achieved energy savings. We created a model based on the methodology used by the Bonneville Power Authority in their Energy Efficiency Momentum Savings analysis[4] and calculated energy savings in Ohio and ultimately within DEO's service territory over the code-mandated baseline in effect for each year from 2006 through 2015. Our model incorporated available national equipment sales data, regional equipment saturation data, commercial survey data, equipment estimated useful life (EUL), and minimum code baseline values.

National equipment shipment data was readily available by year from 2006 through 2015 for most measures from one of the following sources:

- U.S Department of Energy,
- Association of Home Appliance Manufacturers,
- Air-Conditioning, Heating, and Refrigeration Institute,
- American Architectural Manufacturer's Association
- U.S. Census Bureau
- Northeast Energy Efficiency Partnerships
- National Electrical Manufacturers Association

In some cases only partial data was available with shipment information missing from one or two specific years. In these instances, a polynomial trendline was created from the known information, and shipment data for years with missing data was either interpolated or extrapolated as needed as a function of the trendline.

For one measure (Residential Dehumidifiers) where equipment shipment data was not available at all, Nexant's model used equipment saturation as a proxy to calculate the estimated equipment shipments for each year. Equipment saturation is the quantity of specific equipment that exists within a specified region for all of the square footage sampled. For example, if a study included 1,000,000 square feet of commercial buildings within a utility's territory, and found only 18 ice makers present, the saturation of ice makers for this subset of data would be 18 units/1,000,000 square feet. Nexant obtained residential dehumidifier equipment saturation from Duke Energy's RASS data. The model calculated a stock growth rate for the equipment from known data points and applied it linearly to years in which we had no available data. The model output detailed the estimated stock saturation of each equipment type by year. Nexant obtained floor space data from the DEO forecasting models and broke it down into "existing"

[4] Momentum savings are defined as achieved energy savings that occur outside of utility demand management program.

Bonneville Power Authority. Energy Efficiency Momentum Savings. https://www.bpa.gov/EE/Utility/research-archive/Pages/Momentum%20Savings.aspx and “additional” floorspace for each sector by year. With no equipment shipment data readily available, Nexant’s residential dehumidifier model estimated annual shipments of equipment as a function of the equipment saturation and floorspace data as follows:

$$Shipments_{YEAR} = Shipments_{NEW} + Shipments_{REPLACEMENT}$$

$$Shipments_{NEW} = Area_{NEW} \times Saturation$$

$$Shipments_{REPLACEMENT} = Shipments_{YEAR-EUL}$$

We calibrated the model by overwriting the estimated annual shipments with actual values for years in which Nexant had actual data available.

In order to estimate the savings achieved in the DEO territory specifically for all measures effected by a code or standard change, we had to estimate what portion of the national shipments were distributed within the DEO territory. Following the same method described in Section 3.2, the model used multiple sources to generate national- to state-level and state- to utility-level adjustment factors (ADJ) for application to the national sales data. For residential measures, national- to state-level adjustment factors were determined as the ratio between the US and Ohio populations according to the 2010 census data. State- to utility-level adjustments factors were provided by the US Energy Information Administration as a function of Ohio and DEO residential electric account customer quantities. For non-residential measures, the model predicts national- to state-level adjustment factors by comparing the 2012 total commercial floorspace to that of the “East North Central” division as observed in CBECS. The East North Central division included Indiana, Illinois, Ohio, Wisconsin, and Michigan. Using the 2010 census data for the included states, Nexant obtained a ratio of Ohio’s population to that of the entire division, and used that to adjust the floorspace accordingly. The US Energy Information Administration provided the non-residential state- to utility-level adjustment factors, which they determined as a function of Ohio and DEO commercial electric sales. In both iterations, the model translated national sales data to DEO sales data as follows:

$$Shipments_{DEO} = Shipments_{National} \times ADJ_{National-State} \times ADJ_{State-Utility}$$

Nexant input historical baseline code values into the model for each affected measure. The model used algorithms and assumptions found in the Ohio TRM to analyze the maximum allowable energy consumption for each piece of equipment for each year from 2006 through 2015. For equipment types not described in the Ohio TRM, Nexant obtained algorithms and assumptions from the Pennsylvania 2016 TRM and from the ASHRAE Fundamentals Handbook. Because the relevant code changed throughout the years, we calculated the consumption associated with the efficient case using the updated code values and the baseline consumption calculated using the previous code value. The delta in each consumption value represented the total energy savings. Figure 3-3 illustrates the savings calculations associated with a 65,000 British thermal unit (BTU) central air conditioner assumed to run 854 hours per year. Note that savings only occurred after the code change in the 2009 International Energy

Conservation Code (IECC), which the State of Ohio adopted in 2012.

Figure 3-3: Central Air Conditioner Savings Calculation Example

Year:	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Code Minimum SEER:	10	10	10	10	10	10	13	13	13	13	13
Baseline:	10	10	10	10	10	10	10	10	10	10	10
Efficient Case:	10	10	10	10	10	10	13	13	13	13	13
Base Consumption:	410	410	410	410	410	410	410	410	410	410	410
Efficient Consumption:	410	410	410	410	410	410	315	315	315	315	315
Savings Above Code:	0	0	0	0	0	0	95	95	95	95	95

The savings we calculated represented the savings per unit of equipment replaced. Our model multiplied the per-unit savings by the number of shipments made in each year to ascertain the total savings of all purchased equipment in each year. A review of DEO's historical programs confirmed that no incentives were offered to customers for the code minimum measures included in this analysis. Therefore, Nexant affirmed that this analysis did not include any double-counting of measure savings.

3.4.1.2 Data sources and Parameters

To populate the model, Nexant used the data outlined Table 3-13:

Table 3-13: Codes and Standards data and sources

Data Point	Source
Equipment saturation for at least two non-consecutive years	Duke Energy RASS
Historical floor space data for at least two non-consecutive years	Duke Energy Forecasting Models
Equipment shipment data	Association of Home Appliance Manufacturers; Department of Energy; American Architectural Manufacturers Association; Window & Door Manufacturers Association; Air-Conditioning, Heating, and Refrigeration Institute; Northeast Energy Efficiency Partnerships; US Census Bureau
Estimated useful life per measure	Ohio 2010 TRM
Measure-specific assumptions (such as hours of use)	Ohio 2010 TRM; Pennsylvania TRM; National Fenestration Rating Council testing standards
Relevant code minimum values per measure	International Energy Conservation Code; Code of Federal Regulations; and Energy Policy Act; Energy Independence and Security Act

In cases in which Nexant was able to obtain actual shipment data for measures, we defaulted to these values; this approach helped us calibrate the model's extrapolated shipment estimates.

Nexant estimated energy savings for the 16 measures that are described Table 3-14.

Table 3-14: Measures Reviewed Under Codes and Standards Analysis

Measure	Sector	End Use
Air-cooled chillers	Non-residential	HVAC
Air source heat pump	Non-residential	HVAC
Unitary air conditioners	Non-residential	HVAC
Centrifugal water-cooled chillers	Non-residential	HVAC
Water-cooled positive-displacement chillers	Non-residential	HVAC
Water heating	Non-residential	Water heat
Windows	Non-residential	HVAC Auxiliary
Lamps	Residential	Lighting
Air source heat pump	Residential	HVAC
Clothes washers – front loader	Residential	Appliances
Clothes washers – top loader	Residential	Appliances
Dehumidifiers	Residential	Plug load
Freezers	Residential	Refrigeration
Refrigerators	Residential	Refrigeration
Room air conditioners	Residential	Plug load
Windows	Residential	HVAC auxiliary

3.4.1.3 Algorithms and calculations

As discussed above in section 3.4.1.1, Nexant relied primarily on the Ohio TRM and secondarily on the Pennsylvania TRM to estimate the difference in energy usage between the pre- and post-code measure. This difference represents the per unit energy savings associated with the measure which we subsequently extrapolated across the DEO territory based on total shipments.

Below we describe this process using dehumidifiers as an example.

Dehumidifier Calculations

Nexant used the Ohio TRM algorithm to estimate the energy consumption of dehumidifiers. Table 3-15 presents an example of the algorithm and associated parameters that we used to estimate the impacts associated with the efficiency change for dehumidifiers.

Table 3-15: Dehumidifier Algorithm and Parameters

Savings Algorithms:		Source
ΔkWh = (Capacity * 0.473) / 24 * Hours / Energy Factory (EF)		2010 Ohio TRM
Assumptions:		
Capacity	30 pints/day	2010 Ohio TRM
Hours	1620 hours/year	2010 Ohio TRM
EF	1.20; 1.35	Federal minimum standard
EUL	12 years	2010 Ohio TRM

Using the Ohio TRM as our source for the savings algorithm, Nexant calculated the pre- and post-energy consumption, given the increase in the unit's energy factor. Dehumidifiers underwent a standard energy-efficiency change in 2012; Table 3-16 demonstrates the effect of that change on the energy consumption of dehumidifiers.

Table 3-16: Dehumidifier Energy Consumption Pre- and Post-Energy Efficiency Standard

Effective Date	Required EF (L/kWh)	Baseline EF (L/kWh)	Efficient EF (L/kWh)	Baseline Consumption	Efficient Consumption
January 1, 2001	1.20	1.20	1.20	557	557
October 1, 2006	1.20	1.20	1.20	557	557
October 1, 2012	1.35	1.20	1.35	557	412

Finally, Nexant extrapolated the difference in energy consumption before and after the change in efficiency standards based on estimated shipments within DEO's territory, as illustrated in Table 3-17. The difference in the energy consumption represents the incremental energy savings credited toward DEO's compliance goal. In this example, DEO would achieve 3.2 million kWh of incremental savings toward the utility's goal.

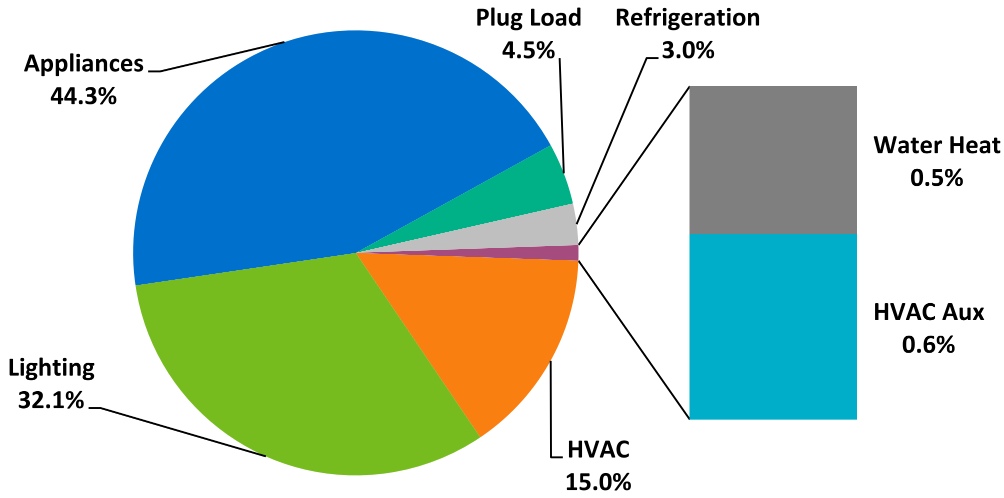
Table 3-17: Dehumidifier Incremental Energy Savings

Year	Shipments (Units)	Baseline		Efficient		Incremental Savings (kWh)
		Per Unit Consumption (kWh)	Total Consumption (kWh)	Per Unit Consumption (kWh)	Total Consumption (kWh)	
1999	1,890	557	1,052,409	557	1,052,409	0
2000	2,529	557	1,408,063	557	1,408,063	0
2001	3,293	557	1,833,841	557	1,833,841	0
2002	4,178	557	2,326,537	557	2,326,537	0
2003	5,167	557	2,877,122	557	2,877,122	0
2004	8,229	557	4,582,169	557	4,582,169	0
2005	7,152	557	3,982,574	557	3,982,574	0
2006	6,328	557	3,523,938	557	3,523,938	0
2007	5,703	557	3,175,455	557	3,175,455	0
2008	5,235	557	2,915,035	557	2,915,035	0
2009	5,845	557	3,254,529	557	3,254,529	0
2010	8,880	557	4,944,735	557	4,944,735	0
2011	7,129	557	3,969,853	557	3,969,853	0
2012	6,350	557	3,536,253	557	3,536,253	0
2013	7,619	557	4,242,452	412	3,142,557	1,099,895
2014	6,549	557	3,646,924	412	2,701,425	945,499
2015	8,121	557	4,522,404	412	3,349,929	1,172,475
Total	**103,937**	**-**	**55,794,292**	**-**	**52,576,424**	**3,217,869**

3.4.2 Results

Nexant summed the incremental savings for each measure we analyzed, estimating a total achieved savings of approximately 87 million kWh resulting from codes and standards changes within DEO's territory between 2006 and 2015. Figure 3-4 illustrates how these savings were distributed by end use. Appliances dominated the savings resulting from changes in codes and standards. Lighting was the next-highest savings end use; the federal Energy Independence and Security Act mandated higher lumen output per watt which effectively phased out incandescent lighting technology.

Figure 3-4: Incremental Codes and Standards Savings by End Use



The final energy and demand savings attributable to the codes and standards analysis appear by sector in Table 3-18 and Table 3-19.

Table 3-18: Codes and Standards Energy Savings - kWh

Sector	Total Codes and Standards Savings (kWh)	DEO Program Savings (kWh)	Incremental Savings (kWh)
Residential	75,328,926	0	75,328,926
Non-residential	11,475,625	0	11,475,625
Total	**86,804,552**	**0**	**86,804,552**

Table 3-19: Codes and Standards Demand Savings - kW

Sector	Total Codes and Standards Savings (kW)	DEO Program Savings (kW)	Incremental Savings (kW)
Residential	11,880	0	11,880
Non-residential	6,911	0	6,911
Total	**18,790**	**0**	**18,790**

3.5 Overall findings

The summation of each analysis represents the total incremental energy savings achieved as a result of SB 310. As discussed in each analysis section, Nexant carefully reviewed DEO program savings to ensure each analysis did not double count savings already being credited from DEO programs. Additionally, when aggregating total savings across all four analyses, we reviewed measures to again ensure no double counting of saving occurred. Table 3-20 and Table 3-21 present the summary energy and demand savings from each analysis and the overall achieved savings.

Table 3-20: Summary of Analysis Energy Savings - kWh

Sector	RASS Incremental Savings (kWh)	ENERGY STAR Incremental Savings (kWh)	EM&V Incremental Savings (kWh)	Codes & Standards Incremental Savings (kWh)	Total Incremental Savings (kWh)
Residential	13,613,753	512,817,121	20,512,213	75,328,926	622,272,014
Non-residential	0	181,881,013	59,044,749	11,475,625	252,401,387
Total	**13,613,753**	**694,698,134**	**79,556,963**	**86,804,552**	**874,673,401**

Table 3-21: Summary of Analysis Energy Savings - kW

Sector	RASS Incremental Savings (kW)	ENERGY STAR Incremental Savings (kW)	EM&V Incremental Savings (kW)	Codes & Standards Incremental Savings (kW)	Total Incremental Savings (kW)
Residential	0	59,643	13,141	11,880	84,664
Non-residential	0	15,871	5,134	6,911	27,916
Total	**0**	**75,515**	**18,276**	**18,790**	**112,580**

To understand the impact of SB 310 on DEO's program performance, Nexant compared the total incremental savings over the reviewed period (i.e., 2006-2015) to DEO's 2015 program portfolio annual energy savings.

Table 3-22 and Table 3-23 present the results of this comparison.

Table 3-22: Incremental Energy Savings as Percentage of DEO Program Portfolio (2006 – 2015)

Sector	RASS Incremental Savings (kWh)	ENERGY STAR Incremental Savings (kWh)	EM&V Incremental Savings (kWh)	Codes & Standards Incremental Savings (kWh)	Total Incremental Savings (kWh)
Total Incremental Savings	13,613,753	694,698,134	79,556,963	86,804,552	874,673,401
Total DEO Portfolio Savings	1,541,762,215				
Percent of Program Savings	**0.9%**	**45.1%**	**5.2%**	**5.6%**	**56.7%**

Table 3-23: Incremental Demand Savings as Percentage of DEO Program Portfolio (2006 – 2015)

Sector	RASS Incremental Savings (kW)	ENERGY STAR Incremental Savings (kW)	EM&V Incremental Savings (kW)	Codes & Standards Incremental Savings (kW)	Total Incremental Savings (kW)
Total Incremental Savings	0	75,515	18,276	18,790	112,580
Total DEO Portfolio Savings	315,057				
Percent of Program Savings	**0.0%**	**24.0%**	**5.8%**	**6.0%**	**35.7%**

We found the incremental energy savings amounted to 56.7% of DEO's program portfolio while the demand savings amounted to 35.7% of portfolio. Hence, the impact of SB 310 significantly increases DEO's historical portfolio performance.

Appendix A Senate Bill 310 Legislation on Energy Efficiency Accounting

130th General Assembly Senate Bill Number 310

Sec. 4928.662. For the purpose of measuring and determining compliance with the energy efficiency and peak demand reduction requirements under section 4928.66 of the Revised Code, the public utilities commission shall count and recognize compliance as follows:

(A) Energy efficiency savings and peak demand reduction achieved through actions taken by customers or through electric distribution utility programs that comply with federal standards for either or both energy efficiency and peak demand reduction requirements, including resources associated with such savings or reduction that are recognized as capacity resources by the regional transmission organization operating in Ohio in compliance with section 4928.12 of the Revised Code, shall count toward compliance with the energy efficiency and peak demand reduction requirements.

(B) Energy efficiency savings and peak demand reduction achieved on and after the effective date of S.B. 310 of the 130th general assembly shall be measured on the higher of an as found or deemed basis, except that, solely at the option of the electric distribution utility, such savings and reduction achieved since 2006 may also be measured using this method. For new construction, the energy efficiency savings and peak demand reduction shall be counted based on 2008 federal standards, provided that when new construction replaces an existing facility, the difference in energy consumed, energy intensity, and peak demand between the new and replaced facility shall be counted toward meeting the energy efficiency and peak demand reduction requirements.

(C) The commission shall count both the energy efficiency savings and peak demand reduction on an annualized basis.

(D) The commission shall count both the energy efficiency savings and peak demand reduction on a gross savings basis.

(E) The commission shall count energy efficiency savings and peak demand reductions associated with transmission and distribution infrastructure improvements that reduce line losses. No energy efficiency or peak demand reduction achieved under division (E) of this section shall qualify for shared savings.

(F) Energy efficiency savings and peak demand reduction amounts approved by the commission shall continue to be counted toward achieving the energy efficiency and peak demand reduction requirements as long as the requirements remain in effect.

(G) Any energy efficiency savings or peak demand reduction amount achieved in excess of the requirements may, at the discretion of the electric distribution utility, be banked and applied toward achieving the energy efficiency or peak demand reduction requirements in future years.

Appendix B ENERGY STAR® Equipment and National Shipment Data

Measure	Total ENERGY STAR Units Shipped (U.S.) – 2006 - 2015
Audio/Video Products - Consumer - Blu-ray Players	25,223,000
Audio/Video Products - Consumer - CD Players	305,387
Audio/Video Products - Consumer - DVD Players	83,517,380
CAC/ASHP - ASHP	6,091,300
CAC/ASHP - CAC	8,670,444
Ceiling Fans - Ceiling Fan Only	18,028,295
Ceiling Fans - Ceiling Fan with Light Kit	3,591,158
Ceiling Fans - Light Kit Only	742,508
Clothes Washers - Commercial Use	416,000
Clothes Washers - Residential Use	31,177,000
Commercial Dishwashers	284,540
Commercial Fryers	142,716
Commercial Griddles	16,000
Commercial Hot Food Holding Cabinets	155,202
Commercial Ice Machines	661,274
Commercial Ovens	183,000
Commercial Refrigerators & Freezers	2,816,467
Commercial Steam Cookers	55,609
Computers - Desktops	59,348,571
Computers - Notebooks	280,366,739
Decorative Light Strings	243,508,221
Dehumidifiers - pre code	8,989,489
Dehumidifiers - post code	5,692,000
Dishwashers - Residential	34,191,000
Displays - LCD Monitors	225,398,236
Displays - Professional Displays PDP	656,000
Exit Signs	2,254,122
Freezers	3,508,000
Imaging Equipment - Copiers	758,948
Imaging Equipment - Fax Machines	1,302,892
Imaging Equipment - Multi-Function Devices	161,782,959
Imaging Equipment - Printers	15,993,571

Measure	Total ENERGY STAR Units Shipped (U.S.) – 2006 - 2015
Imaging Equipment - Scanners	7,341,421
Luminaires - Solid State Retrofit Kits	44,300,000
Pool Pumps	429,000
Refrigerators	35,287,000
Residential Light Fixtures - Indoor	107,194,458
Residential Light Fixtures - Outdoor	35,215,260
Room Air Cleaners	6,931,748
Room Air Conditioners	22,603,000
Set-top Boxes	83,596,000
Set-top Boxes - Cable	35,776,000
Set-top Boxes - IP	22,513,000
Set-top Boxes - Satellite	16,037,000
Set-top Boxes - Thin Client/Remote	23,676,000
Small Network Equipment	2,394,000
Telephony	115,162,632
Televisions	280,456,313
Traffic Signals	605,210
Transformers	173,390
TV Combination Units	1,409,000
TV/VCR/DVD	62,051,320
TV/VCR/DVD - TV-VCR-DVD Combination Units	1,930,040
TV-VCRs	2,882,000
Uninterruptible Power Supplies	11,644,000
Vending Machines	655,894
Ventilating Fans	17,050,635
Water Coolers	9,998,249
Water Heaters - Electric	43,000
Water Heaters - Heat Pump	217,000
Water Heaters - Solar	38,000
Windows, Doors and Skylights	127,283,000
Windows, Doors and Skylights - Doors	13,264,000
Windows, Doors and Skylights - Skylights	1,135,000
Windows, Doors and Skylights - Windows	63,463,000