BEFORE

THE PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of the Annual Energy Efficiency Portfolio Performance Report of Duke Energy Ohio, Inc.	)))	Case No. 20-612-EL-EEC

ANNUAL ENERGY EFFICIENCY PERFORMANCE REPORT

OF DUKE ENERGY OHIO, INC.

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COMPLIANCE STATUS REPORT

This portfolio performance report represents Duke Energy Ohio, Inc.'s, (Duke Energy Ohio) eleventh 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(A), O.A.C. This report is composed of the following two sections: (1) Compliance Demonstration, which provides 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 six appendices that fulfill the remaining requirements set forth in the Commission's regulations.

Compliance Benchmarks

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

Pursuant to Rule 4901:1-39-05 (A)(1)(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.

This benchmark update report provides information related to two topics. The first topic involves the baseline for 2019, 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 2019, 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 2018, the amount of the weather adjustment, and the weather normalized level of total energy.

Table 1 - Duke Energy Ohio Baseline and Benchmark for 2019[1]

Year	Total Energy (MWh)	Weather Normalization Adjustment (MWh)	Weather Normal Level of Total Energy (MWh) less opt out	Baseline: Three Year Average (MWh)	Cumulative Benchmark Percentage	Cumulative Benchmark Requirement (MWh)	Incremental Benchmark Percentage	Incremental Benchmark Requirement (MWh)
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	19,874,459	173,384	20,047,842	21,335,660	4.2%	902,633	1.0%	213,357
2015	19,552,288	(14,513)	19,537,775	21,341,352	5.2%	1,116,047	1.0%	213,414
2016	20,187,099	(211,689)	19,975,410	20,339,051	6.2%	1,319,437	1.0%	203,391
2017	19,473,540	279,769	19,753,309	19,853,676	7.2%	1,517,974	1.0%	198,537
2018	20,264,662	(676,360)	19,588,302	19,755,498	8.2%	1,715,529	1.0%	197,555
2019			**19,357,645**	**19,772,340**	**9.2%**	**1,913,252**	**1.0%**	**197,723**

Year	Peak Demand (MW)	Weather Normalization Adjustment (MW)	Weather Normal Level of Peak Demand (MW) less opt out	Baseline: Three Year Average (MW)	Cumulative Benchmark Percentage	Cumulative Benchmark Requirement (MW)	Incremental Benchmark Percentage	Incremental Benchmark Requirement (MW)
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	4,013	177	4,191	4,473	4.75%	211.5	0.75%	33.5
2015	4,001	204	4,205	4,413	5.50%	244.6	0.75%	33.1
2016	4,128	(6)	4,122	4,283	6.25%	276.8	0.75%	32.1
2017	3,916	371	4,287	4,172	7.00%	308.1	0.75%	31.3
2018	4,032	114	4,146	4,205	7.75%	339.6	0.75%	31.5
2019			**4,208**	**4,185**	**8.50%**	**371.0**	**0.75%**	**31.4**

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

[1] Calculated in accordance with Sec. 4928.66 A(2)(a)(i – iii)

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 2019 is the arithmetic mean of the historical values for the three years 2016 to 2018. The baseline values for energy and demand are provided above in Table 1.

4901:1-39-05(A)(1)Portfolio Performance Report and Compliance Demonstration

In accordance with 4901:1-39-05(A)(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), modified in Senate Bill 310 (S.B. 310), and further modified in House Bill 6, to the baseline. The computation of the benchmark achievement level for 2019 is provided above on Table 1. The baseline for energy is 197,723 MWH and the baseline for peak loads is 31.4 MW.

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)(1)(a), O.A.C., and requests that the Commission approve these baseline and benchmark calculations as submitted.

Pursuant to 4901:1-39-05(A)(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 2019 efforts to promote customer participation in its energy efficiency and demand response programs, the Company has achieved incremental energy and demand impacts in 2019 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®				71.5
Power Manager® for Business				3.9
PowerShare®				78.4
Total Demand Response Programs				**153.8**
Energy Efficiency Programs				
Residential Programs		2,555,716	232,256	39.9
Non-Residential Programs		10,859,382	82,493	15.0
Total EE Programs		**13,415,098**	**314,749**	**54.9**
Additional Impacts Under SB310				
T&D Infrastructure - 2019			93,261	
Total Additional Impacts			**93,261**	**0.0**
Prior Bank per SB-310			2,368,442	673.5
Total Load Impacts			**2,776,452**	**882.2**

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. 310 statutory benchmarks for the year 2019.

Table 3: Comparison of Achieved Impacts to the 2019 Benchmark			
	2019 Benchmark	Achievement	Variance Over / (Under)
MWH	197,723	2,776,452	2,578,729
MW	31.4	882.2	850.8

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 2020 and beyond.

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

In June 2016, Duke Energy Ohio filed a new three-year portfolio[2] plan for 2017 – 2019. This portfolio application was amended and resubmitted with updates on October 14, 2016 to incorporate the results of the market potential study conducted by Nexant. On September 27, 2017 the amended stipulation was approved by The Commission with modifications. On February 26, 2020, the Commission approved the continuation of this portfolio through December 31, 2020, with a budget of $46,895,800.[3]

In its September 27, 2017, Order approving the Company's portfolio, the Commission imposed a cap, stating that the combined total of program costs and shared savings for 2018 and 2019 could not exceed more than four percent of the Company's 2015 operating revenues. Because the Commission's Order was issued in September of 2017, the Commission recognized that the Company's spending for 2017 might exceed the cap imposed. Therefore, the Commission stated that it might permit the Company to exceed the cap to recover program costs, but would not permit shared savings in excess of the cap for 2017. The Commission also stated that the Company should not exceed the Portfolio Plan budget for programs for calendar year 2017 absent obtaining a waiver from the Commission. On October 12, 2017 Duke Energy Ohio requested a waiver and the waiver was approved on November 21, 2017.

Consistent with the amended stipulation that the Commission had approved, until the Company received approval of the 2017 – 2019 portfolio, it continued to operate under the 2016 portfolio guidelines. The Company operated under the imposed cap for program year 2018 and for a portion of 2019 until on October 15, 2019, the Ohio Supreme Court held that there was "no

[2] *In the Matter of the Application of Duke Energy Ohio, Inc. for Approval of Its 2017-2019 Energy Efficiency and Peak Demand Reduction Program Portfolio Plan*, Case No. 16-0576-EL-POR.
[3] *Id.*, Finding and Order, pp. 3, 17 (February 26, 2020).

express or implied authorization in the language of R.C. 4928.66 that would allow the commission to preemptively impose" a virtually identical cost cap on another utility.[4] Consequently, an amended application premised on the absence of the four-percent cost cap was filed on December 20, 2019 in Case No. 19-622-EL-RDR.

This report is consistent with the Company's ***amended*** application in Case No. 19-622-EL-RDR. In other words, it has been prepared as if there was no four-percent cost cap, in accordance with the October 15, 2019, Ohio Supreme Court decision described above.

Program Performance Assessment

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

4901:1-39-05 (A)(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

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

[4] *In re Application of Ohio Edison Co.*, 2019-Ohio-4196, ¶ 16, 158 Ohio St. 3d 27.

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 to a 60-watt incandescent. The maximum number of bulbs available for each customer is 15, but customers may choose to order less. Eligible customers also include those who maxed out on their free bulb limit and at least 5 years has passed since the original ship date of their order.

Customers have the flexibility to order and track their shipment through four 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) My Account:

   Once enrolled and authenticated in My Account, eligible customers will have the ability to order LEDs, check their order status and view frequently asked questions.

4) Duke Energy Mobile App:

   Once a customer downloads and authenticates their account on the mobile app, if eligible, the customer will see a “card” within the app offering the program. Like the other channels, customers can track order status and view FAQs.

The benefits of providing these 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 125,000 orders were placed in 2019; resulting in over 1.4M bulbs distributed.

Regarding marketing in 2019, the Free LED program relied heavily on intercepts (through our IVR and My Account ordering channels) to engage with customers. Overall, the My Account intercept accounted for 34% of the program's orders while the IVR intercept accounted for 29%.

The Duke Energy website contains pages explaining the program and portal through which the customer can check their eligibility and order free bulbs. In 2020, Duke Energy Ohio will continue to explore marketing the LED program through various channels including email and direct mail. Response of each channel will be 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.

The Free LED program is scheduled to discontinue in Duke Energy Ohio in Q2 2020 as a result of potential efficiency standards for general service bulbs that may be imposed as a part of the Energy Independence and Security Act (EISA). This standard-changing legislation will

diminish the impact of the program as well as its cost effectiveness, therefore, no longer making it a viable program for the company to continue to offer. Although, at this time, there is still uncertainty as to how and when this legislation will be imposed, Duke Energy still plans to move forward with its sunsetting strategy. The Company will work collaboratively with the implementation vendor to manage inventory and process pipeline orders efficiently during this time.

Online Savings Store

The Online Savings Store offers specialty bulbs such as recessed lights, candelabras, globe, three-way bulbs, capsules and dimmable bulbs. Purchase limits are at the account level (36 bulbs for the lifetime of the account). However, 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.

In 2018 the online savings store added smart thermostats (2 smart thermostats for the lifetime of the account), as a part of the Stipulation in Case No. 16-576-EL-POR, which was approved by the Commission on September 27, 2017. This agreement to offer smart thermostats, continued into 2019.

Utilizing the existing on-demand platform, customers may participate in the online Savings 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, Compact Fluorescent Lightbulb (CFL) recycling information, and old thermostat recycling information.

2) My Account

Customers who participate in the My Account program are encouraged to visit the Savings Store to order discounted energy efficient products, if they are eligible.

3) Order by Phone

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

4) Mail in Order

   On occasion, Duke Energy provides customers with a mail-in option for placing an order. Direct mail campaigns offer specially priced bulbs with the option to order these online, by phone or with a postage paid return mailer.

Customers who choose to shop at the Savings Store will see a wide variety of discounted LED bulbs for different fixtures around their home, as well as smart thermostats. Bulbs are available in single and multi-pack sizes (for special promotions) and various wattages. There are several smart thermostat brands for customers to select from. Educational Information is available to help customers to:

- 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.
- And compare several models of smart thermostats by price, features, and compatibility

The Online 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 15,185 orders were placed in 2019; resulting in over 132,176 bulbs and 3,030 smart thermostats being purchased. Less than 1% of orders were placed through My Account and 99% of orders were placed through the Duke Energy Ohio web site. The top five categories purchased on the Savings Store include; LED Reflectors, LED Globes, LED Decorative, LED A-line, and outdoor reflectors.

Duke Energy Ohio marketed the online Savings Store program through various channels including Email, Direct Mail, Printed Collateral, and other Duke Energy Program collaboration efforts. Response of each channel is tracked and monitored. Special shipping promotions occurred throughout 2019 to increase customers' participation such as $5 flat rate shipping and free shipping.

Savings Store Program Potential Changes

For 2020, the Savings Store is considering several enhancements that are centered around improving the overall customer experience and communication path. Additionally, the program is evaluating adding more incentivized products. Those product additions include:

- LED lighting fixtures (direct wire, portable, outdoor)
- Advance Power Strips
- Water Products (showerhead & TSVs)
- Dehumidifiers
- Air Purifiers

Retail Lighting Program

The Retail Lighting Program is an upstream, buy-down retail-based lighting program that works through lighting manufacturers and retailers to offer discounts to Duke Energy customers selecting incentivized LEDs and energy-efficient fixtures in the store for purchase at the register. Retailers, such as, but not limited to, Home Depot, Lowe's, Walmart and Habitat for Humanity Restores are evaluated at the store level for possible inclusion in this program. Eligible program participants include all Duke Energy Ohio residential customers.

This program encourages those customers not likely to shop at the on-line stores to adopt energy efficient lighting through incentives on a wide range of efficient lighting technologies including LED products, including Reflectors, Globes, Candelabra, 3 Way, Dimmable and A-Line type bulbs, as well as fixtures. Customer education is imperative to ensure customers are purchasing the correct bulb for the application to obtain high satisfaction with energy efficient lighting products, ensuring subsequent energy efficient purchases.

The incentive amount varies by product type and the customer pays the difference as well as any applicable taxes. Pack limits will be in place and enforced to the best of the retailers' ability.

The Retail Lighting program is managed / implemented by CLEAResult Consulting Inc. This vendor is an industry leader and leverages their existing relationships and systems established with the participating retailers and manufacturers. Additionally, the vendor has a field team in place to promote and monitor this program at the participating retail locations. A toll-free call center and website are hosted by the vendor to provide program information to Duke Energy Ohio customers. The website includes a retailer locator where customers can enter

their address and search for retailers in their area. Also available on the program website is an interactive savings calculator, which will explain the different types of lighting technologies to help guide customers to the appropriate bulb(s) for their application and provide an estimate of energy and monetary savings.

The primary goals for this program are to help customers lower their energy bills and to remove inefficient equipment from the electric grid. This program educates customers about energy consumption attributed to lighting and how to reduce their consumption by using high efficiency alternatives.

Duke Energy Ohio marketed the Retail Lighting program through various channels including Point of Purchase materials at participating retailer locations, Email, Direct Mail, Printed Collateral, other Duke Energy Program collaboration, and other retail and community events. These marketing efforts are designed to create customer awareness of this program, to educate customers on energy saving opportunities and to emphasize the convenience of Program participation. Additionally, marketing efforts related to advertised in-store events are designed to motivate customer participation.

In 2019, the program provided over $1.2M in incentives to Duke Energy Ohio customers who purchased 454,404 bulbs and 22,196 fixtures.

Multifamily Energy Efficiency Program

The Multifamily Energy Efficiency Program provides apartment complexes with free and installed lighting and water measures. Eligible units are Duke Energy Ohio served multifamily units on a residential rate. Traditionally, the properties targeted have four or more units. Franklin Energy is the program administrator. Franklin Energy oversees all aspects of the program which includes outreach, direct installations and customer care.

The program helps property managers upgrade lighting with energy efficient bulbs and save energy by offering energy efficient water measures such as bath and kitchen faucet aerators, water saving showerheads and insulating pipe wrap for installation on the hot water line that exits the water heater. Water measures are available to eligible customers with electric water heating. The Program filed in 2016 to adopt LED lighting technology now offers as of 2019, LED A-lines, Globes, and Candelabras with no limits on the number of lighting measures installed in apartments. These measures assist with reducing maintenance costs while improving tenant satisfaction by lowering energy bills.

The LEDs and water measures are installed during scheduled direct install visits by Franklin Energy crews. Installation crews carry tablets to keep track of the measures installed in each apartment. 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 each 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 to attract properties to participate in the program.

In addition to proactively marketing the program using the above methods, a Multifamily Energy Efficiency public webpage was developed for property managers to learn more about the program. On the page, a program brochure and a frequently asked question sheet are available for download. Also, on the page are an 800 number and a link to email for more information

about the program. Property managers may use either of these methods to learn more about the program and schedule an appointment for an Energy Assessment.

During the Energy Assessment, a Franklin Energy Energy Assessor surveys each unit type on the property (e.g. 1 bedroom, 2 bedroom, etc.) to determine the types and quantities of measures that can be replaced by the program. After the assessment, the property manager is provided with a report that shows the potential energy and water that can be saved by participating in the program. Property Management companies enroll in the Program by signing a Service Agreement.

Once enrolled, Franklin Energy provides property managers with a variety of communications tools to inform their tenants about the Program. This includes letters to each tenant informing them of the installation date and what will be installed in their apartment. In addition, tenants are provided an educational leave-behind brochure when the installation is complete. The brochure provides additional detail on the installed measures as well as access to a customer satisfaction survey to provide Duke Energy with valuable program feedback. To gauge property manager satisfaction with the program, property managers are provided with a separate survey to complete and provide feedback to Duke Energy.

In 2019, the Program installed 18,349 energy efficient measures installed in 17 properties. These measures comprised of:

- 8,799 LED A-lines
- 1,139 LED Candelabras
- 3,947 LED Globes
- 710 Bath Aerators
- 568 Kitchen Aerators
- 616 Showerheads
- 2,570 Ft of Pipe Wrap

Multifamily Energy Efficiency Program- Potential Changes

The Company continues to review new measures for inclusion in the program. Specifically, new LED measures such as track and recessed lighting are being considered for addition in 2020.

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 High Efficiency, Low Flow Water Fixtures and Insulated Pipe Tape to install in high-use fixtures within their homes. The energy saving devices are offered through both Direct Mail and Direct Email campaigns, enabling eligible customers to request to have these devices shipped directly to their homes, free of charge. To be eligible, customers must live in a resident owned single-family home and own an electric water heater. Customers must not have participated in past campaigns including this program and any other programs offering low flow water measures that Duke Energy has offered to Ohio customers. In 2019, the Online Platform was enhanced to allow customers to upgrade the showerhead in their kit. The goals of the upgrade option are to increase customer satisfaction and in-service rates for the showerheads. 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. Kit size eligibility is based on the total square footage of the customer's home. The kit also includes directions and items to help with installation.

There were 3,965 kits shipped to Ohio customers in 2019; resulting in over 11,500 aerators, over 6,300 shower heads and over 19,800 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 high efficiency, 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 Direct Email and the responses will continue to be tracked and monitored.

Save Energy and Water Kit Program Potential Changes

Targeted marketing campaigns and tactics will be utilized to improve awareness for hard to reach and late adopter[5] customers.

Heat Pump Water Heater Program

The Heat Pump Water Heater Program 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 Ohio 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 2019, program personnel focused on developing the contractor network, along with consumer awareness and education. A training workshop for plumbing contractors and distributors was conducted during the 2nd quarter to 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

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

inserts, product page on Duke Energy website, and in-store signage at home improvement retailers.

Heat pump water heaters are one of the most efficient technologies for domestic water heating, 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 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 Ohio 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 2019, program personnel focused on developing the contractor network, along with consumer awareness and education. Customer awareness campaigns included direct mail, targeted email, product page on Duke Energy website, and in-store signage at participating retailer locations. The Program processed 166 customer rebate applications for upgrading to a variable-speed pool pump during 2019. 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.

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. The HVAC equipment measures were modified beginning January 2018 to include a tiered incentive structure, based on the efficiency rating of the new unit installed, along with an add-on optional smart thermostat measure that customers can choose to combine with equipment replacement to further improve the efficiency of the HVAC system. Installation of a high efficiency heat pump or air conditioner will result in a $300 or $400 incentive, based on the efficiency rating of the new system. The optional add-on smart thermostat will result in an additional $125 incentive. Blackhawk Engagement Solutions serves as the back-office support for the program while Duke Energy Ohio 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 the additional complimentary measures offered through the HVAC program, eligible customers will receive $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 2019 over 3,700 HVAC incentives, and

326 complimentary measures were processed for Duke Energy Ohio customers through a network of 133 active trade ally companies.

A new marketing referral component of the Program, Find It Duke, was launched in March 2018 as a new delivery channel that provides a free home contractor referral service to customers to enhance program awareness and participation. The service simplifies the customer's decision-making around energy efficiency purchases and takes the guesswork out of finding reliable, qualified contractors with competitive offers. This delivery channel supports the Company's role as an energy efficiency program administrator while building trusted partnerships with customers and HVAC and home performance contractors. During 2019, awareness and marketing for Find It Duke was promoted through a variety of channels including TV, spot radio, digital, targeted email, branded website on Duke Energy, and direct mail campaigns.

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, pipe insulation and energy saving tips booklet.

The Duke Energy Ohio Residential Energy Assessment Program conducted 3,260 assessments in 2019 and installed 13,178 additional LEDs. The program also installed an additional 236 bathroom aerators outside of the one included in the energy efficiency kit and 1,327 feet of pipe insulation. The program continues to explore enhancements to the program as well as test and consider new marketing channels to increase participation.

HEHC Program Potential Changes

- Explore offering enhanced products and services at a discounted price to customers such as a blower door offering, specialty lighting, specialty water measures and smart thermostats.
- Continue to enhance post audit nurturing communication to increase adoption of recommendations made as well as cross program offers. Continue to evaluate referral data for

FindItDuke to facilitate customer journey from initial evaluation stage during the assessment to engaging with one of the contractors for any relevant recommendations.

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 who reside in households with electricity 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, middle and high school students. Teachers also receive 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 request 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 Duke Energy Ohio electric student households at participating schools.

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 2018-2019 school year, three new productions were launched. Elementary schools will learn how to measure the energy we use and how we can reduce the energy we waste while watching Lorraine Quiche realize her dream of opening her own restaurant *Kilowatt Kitchen*. In this 25-minute educational play, Lorraine learns how to use energy wisely and saves the day for her Kilowatt Kitchen! *The E-Team* is a 35-minute, live show for grades six through nine. The program consists of two actors with two goals. The first goal is to highlight how we measure energy, the uses of energy, how energy is wasted and renewable resources. The second goal is to make the middle school students laugh so hard that they forget they are learning. The show is a series of improvised comedy sketches between characters in all sorts of hilarious situations. Before each scene, actors interact with the audience and get ideas that will be used during the sketch, such as their favorite band or a household pet. The ideas are incorporated into the show and may change the course of a scene. New to the program, High School students enjoyed the 45-minute live performance titled “What’s your Goal”. The performance consists of segments including student volunteers to take part in a sketch called “Moving Bodies” where the volunteer has complete control over the movement of the two actors as they explore ways to save energy at home and discuss the impact that energy saving items can have. The second segment is a game show called “The Carbon Footrace”. Students are placed on teams and asked questions about what a carbon footprint is and ways they can reduce their own carbon footprint. The last segment takes the form of an interactive “TED Talk” style presentation where the actors explore topics relating to the effects of global climate change and how it relates

to industries and economies. The students are offered information on where they can go and what careers they can explore to help do their part for the future of the planet.

From January through December 2019, there were 179 participating schools hosting 275 performances to reach over 58,400 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 2018 indicated 94% of the teacher surveys had very high satisfaction ratings.
- Inclusion of the Kilowatt Krush mobile gaming application that will allow users to learn about smart energy use and conservation through an engaging arcade of action-packed, energy themed games. Students build and customize virtual houses in the neighborhood of their choice while learning about energy efficiency and safety education.

Now in its eighth year, the Program has effectively increased school participation by offering high school to the program and continued outreach focused on non-participating schools by making in person visits to the schools. 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 began offering the Kilowatt Krush with a promotional card announcing the app to any school scheduled to receive performances in March 2019. Full inclusion of the app during the performances began in September with the 2019-2020 program year.

The Program will remove the two (2) A-line bulbs from the kit and replace them with two (2) specialty Candelabra bulbs beginning January 2020.

Low Income Services Program

The Low-Income Services Program aids 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 Pay for Performance Pilot program was piloted with People Working Cooperatively (PWC) in Ohio from 2013-2017. The program was evaluated in 2017 and filed for commercialization and approved in 2018. Duke Energy Ohio is currently working with People

Working Cooperatively (PWC), Clermont County Community Services (CCCS) and Miami Valley Community Action Partnership (MVCAP) to provide incentives for installing energy efficiency measures in homes <200% of the poverty level. The participating agencies target low income customers who receive whole-house weatherization services, including installation of energy efficiency measures and education. Duke Energy Ohio will purchase and recognize the energy and demand savings achieved through the program that are currently funded by leveraged funds, funding from sources other than Duke Energy Ohio that are not explicitly tied to efficiency.

These programs are promoted through, but not limited to, Community Action Agencies, Non-Governmental Organizations (NGO's), and direct mail to customers. At this time, we do not foresee any changes to be made with the implementation of these programs.

My Home Energy Report

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 or multifamily residences with an active account and 12 months of usage history.

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 developed a report for customers living in multifamily dwellings that was ready for implementation in December 2016. This program was part of the new portfolio filed by the Company. Due to the regulatory situation in Ohio, the multifamily program was not rolled out until June 2018. 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 receive four printed reports and twelve electronic reports delivered throughout the year. Eligible customers without a registered email address on file with the Company receive six printed reports with a strong call to action to provide their email address to receive even more information on their home usage through the Interactive Portal.

The Company rolled out a new and improved design of the report including a view of disaggregated usage in the third quarter of 2017.

The Company also developed a dual fuel report for Ohio customers that receive both their electricity and gas from the Company. Fifty percent of eligible customers received their first dual fuel report in February 2018. The Company wants to ensure that providing this full energy perspective does not affect electric savings behaviors before rolling the report out to the full eligible population.

In 2019, the Company launched the My Home Energy Report in the Duke Energy Mobile App. Participants of the program are now able to view their usage comparison, and detailed usage breakdown on the Mobile App.

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.

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.

In 2019, a total of 1,341 homes were serviced through the program.

There are no program changes planned at this time.

Power Manager® Program

The Power Manager Program provides incentives to residential customers who allow the company to cycle their air conditioner's outdoor compressor 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 minimum credit amount of $12 or $18 depending on the option they enrolled in. The $12 minimum event season credit is paid out as $2.40 per month during event season (May – September) and the $18 minimum event season credit is paid out as $3.60 per month during event season (May – September).

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 2019 Duke Energy Ohio activated the Power Manager program on four separate occasions (1 time in July, 1 time in August, and 2 times in September) in addition there were two required one-hour PJM tests (August 1st and September 10th). The four events totaled eight 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 promoted in 2019 through outbound calling and targeted email offers along with the company website. Marketing efforts yielded approximately 1,133 new participants in 2019. Approximately 834 participants requested to have their switch removed. All device installations and removals on customers' air conditioning units were completed by a third- party vendor.

In addition, Duke Energy Ohio also uses the Move-out/Move-in communication process for customer premises with a Power Manager control device. When a participating customer moves out of a residence, the control device is deactivated. The new tenant receives a letter that informs them of their opportunity to participate in the program and is given 30 days to contact Duke Energy Ohio if they do not wish to participate. If the new tenant does not contact Duke Energy Ohio after 30 days, the Power Manager control device is reactivated.

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 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, and process equipment. Equipment and incentives are predefined based on current market assumptions and Duke Energy Ohio'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 Ohio 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 2019 this consisted of incentive payment applications, with paper and online options, and instant incentives offered through the Online Energy Savings Store. The 2019 results include:

- After the significant Program changes which occurred in 2018, customers continued to show interest in energy efficiency and the Smart $aver® Prescriptive Program, even though Program participation was down overall in 2019.
- More applicants are using the online application, an easier way to apply
- Outreach continued to support Trade Allies working with the program
- High levels of customer service were provided by a dedicated team of representatives answering customer questions via phone and email

Large account management continues to provide large businesses with personalized relationships to identify and support new EE projects. The following chart summarizes 2019 participating customers by Program channel:

Program Option	Participating Customers*	% 2019 Repeat Customer
Paper and Online Application Form	678	54%
Online Energy Savings Store	207	47%

*May include multiple facilities/sites for one customer.

Paper and Online Applications

During 2019, 910 applications, consisting of 2,138 measures, were paid for Duke Energy Ohio prescriptive incentives. Seventy-two percent of applications were submitted via the new online application portal, which is a five percent increase from 2018. The average payment per paid application was $3,653.47.

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.

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, and food service 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.

Considering the need to cap program expenditures in 2018, the Midstream channel was suspended, which carried through 2019. However, the Midstream channel is being reintroduced in 2020 along with improvements to better control the channel's incentive costs.

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. 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. 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
- Inspections of a sample of all projects to ensure quality control
- 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
- Trade Ally discussion group (20 trade allies that give input on program)
- Trade Ally training
- Sponsorship of trade ally events

The TA outreach team educates TAs on the program rules and the Smart $aver® program expectations for TA conduct. 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. Marketing activity in 2019 was more limited than in past years and included direct marketing such as email, online marketing (Hero banner), print marketing and supporting partnerships. The primary objective for marketing in 2019 was to deliver the message to customers and trade allies that Smart $aver® Prescriptive incentives were still being offered and that incentive funding is still available.

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.

Program Changes

Due to program funding limits created by the Commission-imposed portfolio cost cap in 2018, program operations were redesigned to stay within defined spending limitations. The following program changes were still applicable in 2019 and are being carried forward in 2020:

- Measure additions and removals: In order to identify a program offer that would help stay within capped program costs, and have the best chance of achieving kWh goals, the program team analyzed the list of measures offered by the program. The analysis results identified those measures that are highly cost effective, provide the greatest potential for

achieving kWh goals, and have lower costs. 142 measures remain in the program in 2020 based on this selection criteria.

- Reservation system: In order to ensure that program expenditures will not exceed the cap, a reservation system was implemented in 2018 and is still in use. Customers and trade allies seeking a prescriptive reservation can submit a Pre-Application in advance of starting an energy efficiency project. The Pre-Application will determine equipment qualification and reserve program funds, if available. Reserved projects receive an email communication from the Smart $aver program identifying what equipment is qualified, the amount of reserved funds, and the reservation expiration date.

- As explained further above, the Midstream channel is being reintroduced in 2020 along with vendor improvements to better monitor and control the channel's incentive costs.

Smart $aver® Custom Program

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.

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 using the provided "Smart $aver Tools". The Application documents 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 (For Your Business tab).

- Custom Application – Administrative Information
- Energy Savings Calculations & Basis
    - Classic Custom approach (> 700,000 kWh or no Applicable Smart $aver Tools calculator)
        - Variable Frequency Drives
        - Energy Management Systems
        - Compressed Air
        - Lighting
        - General
    - Smart $aver Tools (< 700,000 kWh and Applicable calculation tool)
        - HVAC (including Energy Management Systems)
        - Lighting (> 700,000 kWh is supported for lighting)
        - Compressed Air
        - Process VFDs

It should be noted the Smart $aver Lighting tool has specifically been designed to assist customers in determining whether their specific lighting project qualifies for Prescriptive or Custom Smart $aver Incentive program.

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 Changes

Beginning in 2018, the Custom program implemented a reservation system to manage program incentives and consequently program spend. Customers are required to maintain an approved reservation for their offer to ensure incentive payment. The reservation system is coordinated with the Prescriptive program.

Non-Residential Energy Assessment

Due to program funding limits created by the Commission imposed portfolio cost cap, the Non-Residential Energy Assessments program was not offered in 2019.

Mercantile Self-Direct Rebates Program

The Duke Energy Ohio Mercantile Self-Direct program was enacted in accordance with the Public Utilities Commission of Ohio (Commission) Rule 4901:1-39-05(G) O.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 the 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. The Self-Direct Prescriptive program has limited funding and utilizes a reservation system to manage program expenditures.

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. The Self-Direct Custom program has limited funding and utilizes a reservation system to manage program expenditures.

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 30 minutes (emergency) and there are penalties for non-compliance during an event.

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

- Duke Energy Ohio Account Executives
- Duke Energy Ohio Business Energy Advisors
- Email to customers
- Duke Energy Ohio website

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

PowerShare® Program Potential Changes

PJM rules required a shift to meet their "Capacity Performance" construct starting in the 2018-2019 planning year, which required a change in program parameters (such as removing the maximum number of interruption) and has had some impact on participation. PJM rules shifted again for 2020-2021 to include a "Summer Period Seasonal DR" offering to provide additional coverage of the "shoulder periods" in October and May. This change was incorporated into the 2020-2021 program structure to include a "Summer Period" offering. PJM discontinued its "Base Capacity" Summer Only offering in 2019-2020 and therefore Duke Energy Ohio has retired this offering as well. Duke Energy Ohio program management staff is working with customers to explore ways to navigate any 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[6], projected cost effective[7],

[6] "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.

[7] "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.

approved Program Portfolio resources[8] into the PJM Base Residual Auctions (BRA) occurring during the term of the 2014 – 2016 Program Portfolio. This agreement continued within the stipulated agreement for Case No. 16-0576-EL-POR for program years 2017 – 2019. All cost effective, PJM approved MW resources were bid into the 2021/2022 BRA. This resulted in 42.3 Capacity Performance MWs of energy efficiency, 21.8 MWs of Capacity Performance DR and 24.1 MW of Summer-Only DR) that was paired with wind resources elsewhere in PJM) clearing in the 2021/2022 auction.

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.

Due to the FERC ruling delaying the auctions, Duke Energy Ohio has not participated in an auction beyond the 2021/2022 Base Residual Auction.

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

Small Business Energy Saver Program

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

[8] "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.

a 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 180 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.

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

In 2019, there were over 200 Small Business Energy Saver projects completed for eligible Duke Energy Ohio customers. The program underperformed versus goals in 2019, largely because Duke Energy changed the Company-authorized vendor to Lime mid-year because the previous vendor scaled back program operations in Ohio, which negatively affected the program's staffing and project pipeline. The vendor switch added to the decline in active projects in the pipeline, but Lime was able to reverse the trend and finish out the year with November and December being above target.

Small Business Energy Saver Program Potential Changes

To increase the depth of project impacts, Lime is deploying a tiered incentive model in 2020 to drive more projects with measure beyond just lighting. The tiering model will lower the incentive on lighting only projects but provide additional incentives for HVAC and refrigeration measures. The tiering model also lowers the max incentive level of lighting measures and extends the level on HVAC and refrigeration but keeps the max incentive on the project to 80% of the project cost. These changes are to encourage and incentivize the customer to complete more in-depth projects.

As the program matures, 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.

Power Manager® for Business Program

Power Manager® for Business (the "Program") is an energy efficiency and demand response program for non-residential customers that will allow the Company to reduce the operation of participants air conditioning (AC) units to help manage the power grid. The Program provides customers with options on how they would like to participate in the Program.

For participation in the program, the Company provides participants with an annual reward applied directly to their bill.

Program participants can choose between a Wi-Fi thermostat or load control switch that will be professionally installed for free by the Program for each air conditioning or heat pump unit that they have. In addition to equipment choice, the participants also can choose at what cycling level they would like to participate. There are three levels of cycling, 30%, 50% or 75%. The levels are the percentage reduction of the normal on/off cycle of the unit. During a conservation period, the Company will send a signal to the thermostat or switch to reduce the on time of the unit by the percentage selected by the participant. For participating at the 30% level the customer will receive a $50 annual bill credit for each unit, $85 for 50% cycling or $135 for 75% cycling.

Participants choosing the thermostat will be given access to a portal that will allow them to control their units from anywhere they have internet access. They can set schedules, adjust the temperature set points and receive energy conservation tips and communications from the Company. In addition to the portal access, participants will also receive conservation period notifications. This will allow participants to adjust their schedules or notify their employees of the upcoming conservation period. Finally, the participants will be allowed to override two conservation periods per year. They can do this before the conservation period starts or during the conservation period.

The Program will be offered to business customers with qualifying air conditioning systems, weekday energy usage during the months of May to September and adequate communication signal can be received by device. Customers must agree to have the control device installed on their AC system, provide broadband/Wi-Fi internet to receive the thermostat

and to allow Duke Energy Ohio to control their AC system during Power Manager® for Business events.

The Power Manager® for Business 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 2019 Duke Energy Ohio activated the Program on two separate occasions (July and September). In all, the two events totaled four hours of reduced demand and helped Duke Energy Ohio meet peak summertime demand needs and contribute to the stability of the electric grid.

The Program was promoted in 2019 through customer visits and targeted email offers along with the company website. Marketing efforts yielded approximately 563 new participants in 2018 with 830 devices bringing the total devices on the program to 1310. All device installations and removals on customers' AC units were completed by a third-party vendor.

4901:1-39-05(A)(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 2019 as well as the forecasted impacts for 2020.

Table 4: Comparison of Achievement to Forecasted Impacts and Trend Projection Through 2020									
		Achieved Load Impacts		Forecasted Load Impacts					
		MWH 2019	MW 2019	MWH 2019	MWH 2020	MWH Total	MW 2019	MW 2020	MW Total
Other Programs									
Low Income Weatherization		372	0.1						
Residential Programs									
Energy Efficiency Education Program for Schools		3,743	1.0	3,210	3,636	6,846	0.9	1.0	1.8
Home Energy Comparison Report		93,717	23.9	93,638	95,854	189,492	23.9	24.9	48.8
Low Income Neighborhood Program		603	0.2	608	450	1,058	0.2	0.1	0.3
Low Income Weatherization - Pay for Performance		693	0.1	1,026	751	1,777	0.1	0.1	0.3
Residential Energy Assessments		4,170	0.4	3,392	3,688	7,080	0.3	0.3	0.7
Smart $aver® Residential		128,957	14.2	79,705	80,567	160,272	8.5	8.4	16.9
Power Manager®		0	71.5	0	0	0	72.9	60.5	133.4
Power Manager® for Apartments		0	0.0	0	0	0	0.0	0.0	0.0
Non Residential Programs									
Power Manager® for Business - EE		925	0.3	1,030	1,146	2,176	0.4	0.4	0.8
Small Business Energy Saver		11,337	2.0	15,992	18,248	34,240	3.1	3.3	6.3
Smart $aver® Non Residential Custom		22,293	4.1	25,966	16,725	42,691	3.0	1.9	4.9
Smart $aver® Non Residential Performance Incentive Program		0	0.0	536	1,806	2,342	0.1	0.2	0.3
Smart $aver® Non Residential Prescriptive		44,816	8.1	50,570	61,397	111,967	10.3	12.8	23.1
Power Manager® for Business - DR		0	3.9	0	0	0	4.1	9.4	13.6
PowerShare®		0	78.4	0	0	0	64.2	10.9	75.1
Mercantile Self-Direct		3,122	0.4	2,982	1,787	4,769	0.3	0.2	0.5
Total for All Programs		**314,749**	**209**	**278,654**	**286,055**	**564,709**	**192**	**135**	**327**

This table indicates that the achieved MWH impacts through 2019 are above the 2019 forecasted load impacts.

4901:1-39-05(A)(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 2019 as a result of energy efficiency improvements and implemented by mercantile customers and committed to the Company are 3,122 MWH.

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

The peak-demand reductions counted towards the benchmark for 2019 as a result of energy efficiency improvements and implemented by mercantile customers and committed to the Company are 0.4 MW.

4901:1-39-05(A)(2)(a)(iii) 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 reflects Duke Energy Ohio's impacts from transmission and distribution infrastructure improvements. 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(A)(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 when appropriate going forward into the 2019 program evaluation year. It should be noted however, that the TRM provides no specific methodologies for behavior programs or direct load control. An updated TRM was filed on November 29, 2019.

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 (May 2019)	**Appendix C**
PowerShare Impact and Process Evaluation Report (August 2019)	**Appendix D**
Multifamily Energy Efficiency Evaluation Report (December 2019)	**Appendix E**

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

TABLE 5:

SB310 - 2019
Cost Effectiveness Test Results

Program Name		UCT	TRC[1]	RIM	PCT
Residential Programs					
Energy Efficiency Education Program for Schools		4.15	3.92	1.76	17.40
Home Energy Comparison Report		3.43	3.43	1.56	
Low Income Neighborhood Program		0.75	0.67	0.62	2.11
Residential Energy Assessments		2.25	2.19	1.05	41.29
Smart $aver® Residential		5.94	4.32	1.64	8.86
Low Income Weatherization - Pay for Performance		1.20	4.35	0.76	
Power Manager®		9.14	15.38	9.14	
Total Residential		**5.34**	**4.48**	**1.82**	**9.74**
Non-Residential Programs					
Power Manager® for Business		1.67	1.89	1.45	
Small Business Energy Saver		3.32	2.00	1.81	3.04
Smart $aver® Non Residential Custom		5.84	1.72	2.47	2.07
Smart $aver® Non Residential Prescriptive		8.74	5.41	2.81	6.43
Smart $aver® Non Residential Performance Incentive		0.00	0.00	0.00	
PowerShare®	2	4.64	N/A	4.64	
Total Non-Residential		**5.64**	**3.61**	**2.75**	**3.84**
Other Programs					
Mercantile Self-Direct		9.89	0.47	2.63	0.60
Total Other		**9.89**	**0.47**	**2.63**	**0.60**
Portfolio Total		**5.50**	**3.67**	**2.14**	**5.85**

1 - TRC scores include Avoided Gas Production
2 - Due to applied credits from the PJM auctions, the TRC calculation for PowerShare® is not applicable

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, through the end of 2020. This proposal was approved by the Commission in the same case on February 26, 2020.

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 approved application of a new portfolio that does not allow it to earn an incentive in any year in which it does not meet its required benchmark savings and clarifies what net benefits should not be included in the calculation of shared savings in 2017 and beyond.[9]

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

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

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

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. *See* 4901:1-39-07(B).

4901:1-39-07 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 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.

4901:1-39-05(A)(1)(b), 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 federal standards, or an applicable building code.

4901:1-39-05 (A)(1)(d), 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 2019 compliance year.

Respectfully submitted,

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SB 310 Appendix A

2019 Total Reported Achievement

Program	Customer	Product Code	Measure	Annual KWH Gross FR, @ Plant Total	Annual KW Gross FR, @ Plant Total	Participants
Grand Total				**314,748,988**	**208,687**	**13,415,098**

Other EE Programs and Impacts

Program	Customer	Product Code	Measure	Annual KWH Gross FR, @ Plant Total	Annual KW Gross FR, @ Plant Total	Participants
Low Income Weatherization	Res		Low Income Weatherization	372,249	100	353
Grand Total				**372,249**	**100**	**353**

Shared Savings and Mercantile Portfolios

Program	Customer	Product Code	Measure	Annual KWH Gross FR, @ Plant Total	Annual KW Gross FR, @ Plant Total	Participants
Energy Efficiency Education Program for Schools	Res	K12PRF	K-12 Education Program	3,743,426.14	1,005.25	6,998.00
		K12PRF Total		3,743,426	1,005	6,998
Energy Efficiency Education Program for Schools Total				3,743,426	1,005	**6,998**
Home Energy Comparison Report	Res	HECR	Home Energy Comparison Report	83,646,324.74	21,369.02	304,798.00
Home Energy Comparison Report	Res	HECR	My Home Energy Report	6,364,626.94	1,625.96	23,192.00
		HECR Total		90,010,952	22,995	327,990
Home Energy Comparison Report	Res	MFHECR	Multifamily MyHER	3,502,529.52	895.59	29,435.00
Home Energy Comparison Report	Res	MFHECR	Multifamily MyHER Interactive	203,512.77	52.04	1,531.00
		MFHECR Total		3,706,042	948	30,966
Home Energy Comparison Report Total				93,716,994	23,943	358,956
Low Income Neighborhood Program	Res	HWLI	Low Income Neighborhood	603,321.60	186.74	1,340.00
		HWLI Total		603,322	187	1,340
Low Income Neighborhood Program Total				603,322	187	**1,340**
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - CFL_EH	85,784.26	15.57	2,270.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - CFL_NonEH	354,704.63	44.20	6,443.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Energy Efficient Shower Head_EH	693.52	0.15	4.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Energy Efficient Shower Head_NonEH	866.90	0.19	5.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Faucet Aerator_EH	140.64	0.03	7.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Faucet Aerator_NonEH	160.74	0.04	8.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Refrigerator Replacement_EH	36,858.33	4.21	41.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Refrigerator Replacement_NonEH	177,910.46	20.31	130.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Water Heater Pipe Insulation_EH	2,526.34	0.56	10.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Water Heater Pipe Insulation_NonEH	4,800.04	1.07	19.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Water Heater Replacement Electric_EH	400.34	0.09	3.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Water Heater Replacement Electric_NonEH	800.67	0.18	6.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Water Heater Tank Wrap_EH	415.39	0.09	2.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Water Heater Tank Wrap_NonEH	415.39	0.09	2.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - ACR Insulation SC Only_EH per home	1,092.23	0.24	5.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - ACR Insulation SC Only_NonEH per home	1,529.12	0.34	7.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - ACR Insulation SH Only_EH per home	5,461.13	1.22	5.00

Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Air Sealing SC Only_EH per home	660.49	0.15	10.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Air Sealing SC Only_NonEH per home	1,188.87	0.27	18.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Air Sealing SH Only_EH per home	9,026.63	2.01	10.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Floor Insulation SH Only_EH per home	2,158.81	0.48	4.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Foundation Insulation SH Only_EH per home	1,856.34	0.41	1.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Wall Insulation SC Only_EH per home	479.73	0.11	2.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Wall Insulation SC Only_NonEH per home	479.73	0.11	2.00
Low Income Weatherization - Pay for Performance	Res	WTZKWH	WTZKWH - Wall Insulation SH Only_EH per home	2,573.09	0.57	2.00
		WTZKWH Total		692,984	93	9,016
Low Income Weatherization - Pay for Performance Total				692,984	93	**9,016**
Mercantile Self-Direct	NonRes	NRCSSD	SD Custom	3,122,201.81	414.81	1,219.00
		NRCSSD Total		3,122,202	415	1,219
Mercantile Self-Direct	NonRes	NRPRSD	SD Exterior HID replacement above 175W to 250W HID retrofit	-	-	-
Mercantile Self-Direct	NonRes	NRPRSD	SD VFD HVAC Fan	-	-	-
Mercantile Self-Direct	NonRes	NRPRSD	SD Window Film	-	-	-
Mercantile Self-Direct	NonRes	NRPRSD	SelfDirect LED Highbay replacing 251-400W HID	-	-	-
		NRPRSD Total		-	-	-
Mercantile Self-Direct Total				3,122,202	415	**1,219**
Power Manager®	Res	PWRMGR	PowerManager - 0.5 Low		28.84	
Power Manager®	Res	PWRMGR	PowerManager - 1.0 Med		59,473.49	
Power Manager®	Res	PWRMGR	PowerManager - 1.5 High		12,003.51	
		PWRMGR Total			71,506	
Power Manager® Total					71,506	
Power Manager® for Business - DR	NonRes	SBEEDR-DR	SBDR Switch 30% DR - Midwest		31.36	
Power Manager® for Business - DR	NonRes	SBEEDR-DR	SBDR Switch 50% DR - Midwest		-	
Power Manager® for Business - DR	NonRes	SBEEDR-DR	SBDR Switch 75% DR - Midwest		71.64	
Power Manager® for Business - DR	NonRes	SBEEDR-DR	SBDR Therm 30% DR - Midwest		2,065.71	
Power Manager® for Business - DR	NonRes	SBEEDR-DR	SBDR Therm 50% DR - Midwest		445.20	
Power Manager® for Business - DR	NonRes	SBEEDR-DR	SBDR Therm 75% DR - Midwest		1,306.23	
		SBEEDR-DR Total			3,920	
Power Manager® for Business - DR Total					3,920	
Power Manager® for Business - EE	NonRes	SBEEDR	SBDR Thermostat EE	924,501.38	340.74	989.00
		SBEEDR Total		924,501	341	989
Power Manager® for Business - EE Total				924,501	341	**989**
PowerShare®	NonRes	PWRSHR	PowerShare - Annual		56,734.85	
PowerShare®	NonRes	PWRSHR	PowerShare - Extended Summer		-	
PowerShare®	NonRes	PWRSHR	PowerShare - Summer Only		21,652.26	
		PWRSHR Total			78,387	
PowerShare® Total					78,387	
Residential Energy Assessments	Res	HEHC	Home Energy House Call - Kit w LEDs	3,363,318.53	302.29	3,260.00
Residential Energy Assessments	Res	HCBAER	Home Energy House Call - Bathroom Aerator	18,871.84	4.21	236.00
Residential Energy Assessments	Res	HCLED	Home Energy House Call - Additional LED	715,593.07	69.79	13,178.00
Residential Energy Assessments	Res	HCPWRP	Home Energy House Call - Pipe Wrap	72,707.80	8.41	1,327.00
		HEHC Total		4,170,491	385	18,001
Residential Energy Assessments Total				4,170,491	385	**18,001**

Small Business Energy Saver	NonRes	SSBDIR	SBES HVAC HP	14,621.01	3.12	13,639.00
Small Business Energy Saver	NonRes	SSBDIR	SBES Lighting 8760	1,354,474.18	114.48	1,214,931.00
Small Business Energy Saver	NonRes	SSBDIR	SBES Lighting Daylighting	8,449,829.54	1,686.45	7,670,361.00
Small Business Energy Saver	NonRes	SSBDIR	SBES Lighting DusktoDawn	1,142,081.88	192.93	1,023,719.00
Small Business Energy Saver	NonRes	SSBDIR	SBES OccSensors	41,333.92	8.25	37,521.00
Small Business Energy Saver	NonRes	SSBDIR	SBES Refrigeration	334,502.77	28.27	300,041.00
		SSBDIR Total		11,336,843	2,034	10,260,212
Small Business Energy Saver Total				11,336,843	2,034	**10,260,212**
Smart $aver® Non Residential Custom	NonRes	NRPRSC	Custom	22,293,075.95	4,051.07	9,208.00
		NRPRSC Total		22,293,076	4,051	9,208
Smart $aver® Non Residential Custom Total				22,293,076	4,051	**9,208**
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	Anti-sweat Heater Controls	771,634.35	2.54	430.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	Combination Oven_10 pan	125,544.43	23.20	18.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	Convection Oven Full-Sized	39,633.90	7.32	5.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	Fryer (Large Vat)	13,141.66	2.43	1.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	Fryer (Standard Vat)	5,224.30	0.97	1.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	HT ES Multi-Tank - CNV DW w-Boost Htr (Elec) New -repl on BO	32,623.32	4.02	1.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	HT ES Sngl Tank - CNV DW w-Boost Htr (Elec) New -repl on BO	32,191.01	3.97	3.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	HT ES Sngl Tank - Door DW New -repl on Burnout	14,124.40	1.74	1.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	HT ES Sngl Tank - Door DW w-Boost Htr (Elec) New -repl on BO	197,741.58	24.36	14.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	Steamer_6 pan	30,619.34	5.87	1.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	Zero Energy Doors_High-Temp Cooler	38,196.43	4.36	27.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	Zero Energy Doors_Med-Temp Cooler	445,735.74	50.88	297.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	ECM Refrigerated or Freezer Display Case Motors - ECM replacing PSC	7,979.96	0.91	1.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	ECM Walk-In Cooler and Freezer Motors - ECM replacing SP	41,933.96	5.07	2.00
Smart $aver® Non Residential Prescriptive	NonRes	NRFS	ECM Walk-In Cooler and Freezer Motors - ECM replacing PSC	6,971.74	0.84	0.93
		NRFS Total		1,803,296	138	803
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	0.5 Faucet Aerator (DI) - Commercial, public use	171,194.85	3.54	100.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	0.5 gpm Faucet Aerator (DI) - COMM, pvt use	1,440.74	0.21	6.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	1.0 Faucet Aerator (DI) - Commercial, public use	36,243.57	0.74	30.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	1.0 gpm Faucet Aerator (DI) - COMM, pvt use	3,387.45	0.49	20.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	1.5 gpm Low Flow Showerhead (DI) - COMM, pvt use	39,478.80	2.99	93.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	Air Cooled Chiller_Any greater than 150 tons	129,647.77	171.23	1,720.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	Air Cooled Chiller_Any less than 150 tons	5,950.06	7.70	77.39
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	DCV Retrofit School - per sq ft	6,840.90	41.59	29,550.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC DX AC 135-240kBtuh 11.7 EER (Tier 0_1)	52,449.93	41.25	608.34
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC DX AC 135-240kBtuh 12.2 EER (Tier 2)	3,686.26	2.90	28.66
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC DX AC 240-760kBtuh 10.8 EER (Tier 2)	9,877.08	7.77	86.36
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC DX AC 65-135kBtuh 11.7 EER (Tier 0_1)	17,759.49	13.97	269.74
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC DX AC 65-135kBtuh 12.2 EER (Tier 2)	10,264.56	8.07	94.83
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC DX AC less than 65kBtuh 14 SEER (Tier 0_1)	8,197.50	7.09	123.25
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC DX AC less than 65kBtuh 15 SEER (Tier 2)	4,072.25	3.52	32.80
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC DX mini split AC 15 SEER	372.46	0.32	3.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC DX mini split AC 18 SEER (eff 11.30.15)	1,707.12	1.34	6.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC DX mini split HP 18 SEER 9.6 HSPF	888.16	0.42	2.50

Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC DX PTAC 7600 Btuh 12.2 EER	2,596.53	2.04	70.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	Setback Programmable Thermostat	2,509,104.47	(0.47)	996.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	Water Cooled Chiller_Centrifugal at least 300 tons and less than 600 tons	35,238.57	51.48	1,100.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	Water Heater Pipe Insulation	45,068.09	4.16	546.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	High Volume Low Speed Fan	165,928.33	43.93	12.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC PTHP 12000 Btuh 11.4 EER 3.3 COP	1,291.37	0.64	8.00
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC DX AC 65-135kBtuh 11.7 EER (Tier 0_1) - EER only	6,975.40	3.87	106.42
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	HVAC DX AC less than 65kBtuh 16 SEER (Tier 2) - EER only	2,030.56	2.51	21.08
Smart $aver® Non Residential Prescriptive	NonRes	NRHVAC	Roof Insulation	1,258,456.49	81.82	254,412.00
		NRHVAC Total		4,530,149	505	290,123
Smart $aver® Non Residential Prescriptive	NonRes	NRIT				
		NRIT Total		-	-	-
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED 2ft Tube 1-LED, replacing or in lieu of T8 fluorescent	107,552.76	22.49	2,374.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED 4ft Tube 1-LED, replacing or in lieu of T8 fluorescent	13,199,966.56	2,760.53	215,099.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Display Case (rplcng or ILO INCD or FL display case Ltng)	2,462.89	0.54	31.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED FLD rplcng or ILO GRT 100W HAL, INCD, or HID	150,605.28		252.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Highbay replacing 251-400W HID	2,892,874.31	584.29	2,590.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Highbay replacing greater than 400W HID	1,235,339.32	249.51	602.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Lowbay replacing 176W-250W HID	104,506.60	21.28	125.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Lowbay replacing up to 175W HID	127,121.34	25.68	253.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Panel 1x4 replacing or in lieu of T8 FL	315,889.11	67.68	3,675.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Panel 2x2 replacing or in lieu of T8 FL	375,544.52	80.46	6,945.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Track Ltng (rplcng or ILO INCD, HAL, CFL, or HID track Ltng)	285,526.98	62.20	1,348.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Highbay replacing 251-400W HID Lamp Post EMV	309,492.84	64.78	261.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Lowbay replacing 176W-250W HID Lamp Post EMV	69,232.98	14.48	99.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Lowbay replacing up to 175W HID Lamp Post EMV	3,559.78	0.74	10.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Highbay replacing greater than 400W HID Lamp	126,434.91	26.46	42.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Highbay Fixture replacing 4-lamp 4ft T5HO fixture	973,097.18	203.51	2,065.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED FLD rplcng or ILO greater than 500W HAL, INCD, or HID	2,399,941.01		598.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED 4ft Tube 1-LED replacing or in lieu of T5SO fluorescent	54,115.79	11.32	842.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED 4ft Tube 1-LED, replacing or in lieu of T5HO fluorescent	931,164.07	194.74	7,151.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED A Lamps	1,278,391.07	267.35	7,994.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Decorative, Globe, 3-Way Lamps	535,548.01	112.00	3,096.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED PAR, BR, MR Lamps	1,376,880.47	287.95	8,485.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	Control sensor for lighting and exhaust fan in restrooms	1,023.99		2.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Linear Ambient Fixture	343,094.06	71.75	4,200.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Exit Signs Electronic Fixtures (Retrofit Only) Pre EMV	138,761.00	12.43	566.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED FLD rplcng or ILO up to 100W HAL, INCD, or HID Pre EMV	1,581.98		9.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Panel 2x4 replacing or in lieu of T8 FL Pre EMV	7,120,939.73	1,525.75	17,473.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Highbay Fixture replacing 6-lamp 4ft T8 fixture Pre EMV	996,535.48	208.41	3,352.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Highbay Fixture replacing 2-lamp 8ft T12 fixture Pre EMV	344,836.71	72.12	768.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Exit Signs Electronic Fixtures (Retrofit Only) Post EMV	91,690.00	18.81	374.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED FLD rplcng or ILO up to 100W HAL, INCD, or HID Post EMV	527.33		3.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Panel 2x4 replacing or in lieu of T8 FL Post EMV	1,906,877.87	408.57	4,679.00
Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Highbay Fixture replacing 6-lamp 4ft T8 fixture Post EMV	154,891.11	32.39	521.00

Smart $aver® Non Residential Prescriptive	NonRes	NRLTG	LED Highbay Fixture replacing 2-lamp 8ft T12 fixture Post EMV	62,411.85	13.05	139.00
		NRLTG Total		38,018,419	7,421	296,023
Smart $aver® Non Residential Prescriptive	NonRes	NRP&M	VFD on Hot Water Pump	211,051.58		190.00
		NRP&M Total		211,052	-	190
Smart $aver® Non Residential Prescriptive	NonRes	NRPROC	VSD Air COMP replacing load no load COMP	206,768.43	49.94	385.00
Smart $aver® Non Residential Prescriptive	NonRes	NRPROC	VSD Air COMP replacing variable displacement COMP	46,352.32	11.10	230.00
		NRPROC Total		253,121	61	615
Smart $aver® Non Residential Prescriptive Total				44,816,036	8,126	**587,754**
Smart $aver® Residential	Res	CRSMTS	Smart Saver - CRES Smart Thermostat	120,653.98		166.00
		CRSMTS Total		120,654	-	166
Smart $aver® Residential	Res	HPWH	Heat Pump Water Heater	137,708.09	10.54	49.00
		HPWH Total		137,708	11	49
Smart $aver® Residential	Res	MFEEAR	Faucet Aerators MF Direct 1.0 GPM - bath	44,712.32	5.88	710.00
Smart $aver® Residential	Res	MFEEAR	Faucet Aerators MF Direct 1.0 GPM - kitchen	71,124.00	9.35	568.00
		MFEEAR Total		115,836	15	1,278
Smart $aver® Residential	Res	MFEEPW	Pipe Wrap MF Direct	141,829	16	2,570
		MFEEPW Total		141,829	16	2,570
Smart $aver® Residential	Res	MFEESH	LF Showerhead MF Direct 1.5 GPM	223,891	18	616
		MFEESH Total		223,891	18	616
Smart $aver® Residential	Res	MPSMTS	Marketplace Smart Thermostats	1,602,101		3,030
		MPSMTS Total		1,602,101	-	3,030
Smart $aver® Residential	Res	PEEPVS	Pool Pump	279,470	104	165
		PEEPVS Total		279,470	104	165
Smart $aver® Residential	Res	RCFLSP	RCFLSP - Specialty Bulbs 3 Way LED	107,571	13	2,274
Smart $aver® Residential	Res	RCFLSP	RCFLSP - Specialty Bulbs Candelabra LED	813,286	118	28,147
Smart $aver® Residential	Res	RCFLSP	RCFLSP - Specialty Bulbs Globe LED	904,772	131	30,054
Smart $aver® Residential	Res	RCFLSP	RCFLSP - Specialty Bulbs Recessed Outdoor LED	919,517	44	7,224
Smart $aver® Residential	Res	RCFLSP	Specialty Bulbs A Line LED	876,149	86	16,149
Smart $aver® Residential	Res	RCFLSP	Specialty Bulbs Recessed LED	2,331,490	314	48,328
		RCFLSP Total		5,952,785	706	132,176
Smart $aver® Residential	Res	RLED	RLED - Free LED Phase 1	43,106,582	4,204	793,829
Smart $aver® Residential	Res	RLED	RLED - Free LED Phase 2	37,719,325	3,679	694,620
		RLED Total		80,825,906	7,883	1,488,449
Smart $aver® Residential	Res	RLEDPM	RLEDPM-ALINE	477,478	47	8,793
Smart $aver® Residential	Res	RLEDPM	RLEDPM-CANDELABRA	106,710	10	3,943
Smart $aver® Residential	Res	RLEDPM	RLEDPM-GLOBE	31,700	3	1,139
		RLEDPM Total		615,889	59	13,875
Smart $aver® Residential	Res	RTLLED	LED - Retail A Line LED - 2016	6,599,443	644	121,532
Smart $aver® Residential	Res	RTLLED	LED - Retail Fixture LED	863,225	78	21,859
Smart $aver® Residential	Res	RTLLED	LED - Retail Reflector Recessed LED	5,973,582	543	127,976
Smart $aver® Residential	Res	RTLLED	LED - Retail Reflector Track LED	71,362	6	2,913
Smart $aver® Residential	Res	RTLLED	LED - Retail Reflector Outdoor LED	7,253,970	659	57,015
Smart $aver® Residential	Res	RTLLED	LED - Retail Specialty Decorative LED	1,475,238	134	75,950
Smart $aver® Residential	Res	RTLLED	LED - Retail Specialty Globe LED	1,099,981	100	58,064
Smart $aver® Residential	Res	RTLLED	LED - Retail Specialty 3 Way	404,508	37	8,555

		RTLLED Total		23,741,309	2,202	473,864
Smart $aver® Residential	Res	SFEEAR	Faucet Aerators SF DIY 1.0 GPM - bath	942,544	74	7,930
Smart $aver® Residential	Res	SFEEAR	Faucet Aerators SF DIY 1.0 GPM - kitchen	1,918,560	153	3,965
		SFEEAR Total		2,861,104	227	11,895
Smart $aver® Residential	Res	SFEEPW	Pipe Wrap SF DIY	977,610	79	19,825
		SFEEPW Total		977,610	79	19,825
Smart $aver® Residential	Res	SFEESH	LF Showerhead SF DIY 1.5 GPM	2,961,364	236	6,307
Smart $aver® Residential	Res	SFEESH	LF Wand Showerhead SF DIY 1.5 GPM	939	0	2
		SFEESH Total		2,962,303	236	6,309
Smart $aver® Residential	Res	SSAC	Smart Saver - Central Air Conditioner	-	-	-
		SSAC Total		-	-	-
Smart $aver® Residential	Res	SSAC2N	Smart Saver - Central Air Conditioner Tier 2 - Non-Referred	2,349,624	1,363	2,184
		SSAC2N Total		2,349,624	1,363	2,184
Smart $aver® Residential	Res	SSAC2R	Smart Saver - Central Air Conditioner Tier 2 - Referred	27,815	16	28
		SSAC2R Total		27,815	16	28
Smart $aver® Residential	Res	SSAC3N	Smart Saver - Central Air Conditioner Tier 3 - Non-Referred	706,362	408	521
		SSAC3N Total		706,362	408	521
Smart $aver® Residential	Res	SSAC3R	Smart Saver - Central Air Conditioner Tier 3 - Referred	13,771	8	11
		SSAC3R Total		13,771	8	11
Smart $aver® Residential	Res	SSAISN	Smart Saver - Attic Insul & Air Sealing - Non-Referred	190,587	59	153
		SSAISN Total		190,587	59	153
Smart $aver® Residential	Res	SSAISR	Smart Saver - Attic Insul & Air Sealing - Referred	148,234	46	119
		SSAISR Total		148,234	46	119
Smart $aver® Residential	Res	SSDINN	Smart Saver - Duct Insulation - Non-Referred	5,634	4	6
		SSDINN Total		5,634	4	6
Smart $aver® Residential	Res	SSDINR	Smart Saver - Duct Insulation - Referred	1,878	1	2
		SSDINR Total		1,878	1	2
Smart $aver® Residential	Res	SSDSEN	Smart Saver - Duct Sealing - Non-Referred	15,916	12	23
		SSDSEN Total		15,916	12	23
Smart $aver® Residential	Res	SSDSER	Smart Saver - Duct Sealing - Referred	11,693	9	18
		SSDSER Total		11,693	9	18
Smart $aver® Residential	Res	SSHP	Smart Saver - Heat Pump	-	-	-
		SSHP Total		-	-	-
Smart $aver® Residential	Res	SSHP2N	Smart Saver - Heat Pump Tier 2 - Non-Referred	2,219,248	359	667
		SSHP2N Total		2,219,248	359	667
Smart $aver® Residential	Res	SSHP2R	Smart Saver - Heat Pump Tier 2 - Referred	15,361	2	5
		SSHP2R Total		15,361	2	5
Smart $aver® Residential	Res	SSHP3N	Smart Saver - Heat Pump Tier 3 - Non-Referred	1,137,608	317	256
		SSHP3N Total		1,137,608	317	256
Smart $aver® Residential	Res	SSHP3R	Smart Saver - Heat Pump Tier 3 - Referred	24,620	7	6
		SSHP3R Total		24,620	7	6
Smart $aver® Residential	Res	SSSTN	Smart Thermostat - Non-Referred	1,427,086		2,699
		SSSTN Total		1,427,086	-	2,699
Smart $aver® Residential	Res	SSSTR	Smart Thermostat - Referred	22,736		43
		SSSTR Total		22,736	-	43

Smart $aver® Residential	Res	VFMSHP	Smart Saver - VRF Mini-split heat pumps	80,295	26	44
		VFMSHP Total		80,295	26	44
Smart $aver® Residential Total				128,956,863	14,196	**2,161,052**
Grand Total				**314,376,738.34**	**208,587.10**	**13,414,745.30**

[1] **My Home Energy Report impacts are annualized.**

[2] **NRLTG pre-M&V impacts are included for information only and not included in total impacts.**

Schedule of Planned[1] Evaluation Activities and Reports

Residential Customer Programs	Program/ Measure	Q1 2020	Q2 2020	Q3 2020	Q4 2020
Low Income Neighborhood		M&V	Report		
Smart $aver Residential	Lighting (Retail)	M&V	Report		
	Save Energy & Water	Report			
Power Manager		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 2019 and 2020 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

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 because 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.

A completed evaluation is scheduled for the second quarter of 2020.

Residential Smart $aver®: Retail 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 or other relevant TRMs.

The process evaluation is planned to include program staff interviews. In addition, interviews with retailers/manufacturers and sales data modeling will estimate net-to-gross and the state of the lighting market.

A completed evaluation is tentatively planned for the second quarter of 2020.

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 or other relevant TRMs, 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.

The final evaluation report is scheduled for completion in the first quarter of 2020.

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.

There will not be a process component in the PY 2019 evaluation. The final impact report is scheduled for completion in the second quarter of 2020.

Duke Ohio 2018 Power Manager Evaluation

May 23, 2019

Eric Bell, Principal
Greg Sidorov, Consultant

Figures

Tables

1 Executive Summary

This report presents the results of the 2018 Power Manager impact evaluation for the Duke Energy Ohio territory. Power Manager is a voluntary demand response program that offers incentives to residential customers who allow Duke Energy to reduce the use of their central air conditioner's outdoor compressor and fan during summer days with high energy usage. Through the program, events are called at times when extreme temperatures are expected and household cooling needs are highest. During normal events, a remote signal is sent to participating load control devices that reduce customers' air conditioner use. During emergency operations, all devices are initiated to instantaneously shed loads and deliver larger demand reductions.

1.1 Impact Evaluation Key Findings

The impact evaluation is based on a randomized control trial. All Power Manager program participants who had a load control device installed by the start of the summer were randomly assigned to one of six groups – a primary group made up of 75% of the population, and five research groups, each made up of 5% of the population. During each event, one or more of the smaller research groups (each comprising approximately 2,100 customers) is withheld as a control group in order to provide an estimate of energy load profiles absent a Power Manager event. During the summer of 2018, approximately 43,000 households were actively participating in Power Manager and had load control devices. Of those enrolled in the program, Nexant received useable AMI data for approximately 38,000 customers.

Table 1-1 summarizes the demand reductions attained during each event in 2018 (excluding the PJM test event called on September 6), as estimated using the randomized control trial.[1] Events shown in red and green text indicate emergency shed operations. The events called on August 28 and September 5 included side-by-side tests of emergency and normal operations in order to estimate the incremental demand reductions due to emergency operations. Moreover, both of these events included simultaneous dispatch of two different levels of emergency shed, allowing for a three-way comparison of normal operations, Emergency 1 shed and Emergency 2 shed.

A few key findings are worth highlighting:

- Demand reductions were 0.81 kW per household for the average general population event.
- Emergency shed test events produced load impacts that varied depending on shed percentages and weather factors, ranging from 0.81 kW to 1.21 kW with an average of 0.98 kW.
- In general, the magnitude of demand reductions grows larger when temperatures are higher and resources are needed most.
- The difference in impacts between customers who signed up for the moderate and high load control options was minimal and within the range of uncertainty.

[1] By design, the PJM test event did not involve withholding a control group and therefore, a RCT design could not be applied. Impacts for the PJM test event were estimated using a within-subjects approach and are summarized in Section 5.

- Average customer load shapes during event days indicate that Power Manager events were called prior to the residential system peak.[2]

Table 1-1: Randomized Control Trial Demand Reductions for Individual Events[3]

Event Date	Event Type	Start Time	End Time	Load without DR	Impact	Std. error	90% Confidence Interval		% Impact	90% Confidence interval		Daily Max
							Lower bound	Upper bound		Lower Bound	Upper Bound	
6/18/2018	Emergency 2	4:00 PM	5:00 PM	3.67	-1.21	0.07	-1.32	-1.09	-33.0%	-36.1%	-29.8%	94
6/18/2018	Regular	5:00 PM	6:00 PM	3.81	-0.98	0.07	-1.10	-0.87	-25.9%	-29.0%	-22.8%	94
6/19/2018	Regular	3:00 PM	5:00 PM	3.39	-0.91	0.07	-1.02	-0.80	-26.9%	-30.1%	-23.6%	93
6/29/2018	Regular	3:00 PM	5:00 PM	3.32	-0.75	0.08	-0.87	-0.62	-22.6%	-26.4%	-18.9%	91
7/2/2018	Regular	3:00 PM	5:00 PM	2.82	-0.46	0.07	-0.58	-0.35	-16.5%	-20.5%	-12.5%	92
7/5/2018	Regular	4:00 PM	6:00 PM	3.53	-0.79	0.07	-0.90	-0.68	-22.5%	-25.6%	-19.3%	93
8/28/2018	Emergency 1	4:00 PM	5:00 PM	3.44	-0.95	0.09	-1.10	-0.81	-27.5%	-31.9%	-23.1%	91
8/28/2018	Emergency 2	4:00 PM	5:00 PM	3.44	-1.10	0.08	-1.24	-0.96	-32.1%	-36.3%	-28.0%	91
8/28/2018	Regular	4:00 PM	6:00 PM	3.53	-0.95	0.07	-1.06	-0.84	-27.1%	-30.2%	-24.0%	91
9/5/2018	Emergency 1	5:00 PM	6:00 PM	3.06	-0.83	0.09	-0.97	-0.69	-27.1%	-31.7%	-22.5%	91
9/5/2018	Emergency 2	5:00 PM	6:00 PM	3.06	-0.81	0.09	-0.95	-0.67	-26.4%	-31.1%	-21.8%	91
9/5/2018	Regular	4:00 PM	6:00 PM	3.08	-0.72	0.07	-0.83	-0.61	-23.4%	-27.0%	-19.9%	91
9/20/2018	Regular	4:00 PM	6:00 PM	3.35	-0.88	0.07	-0.99	-0.77	-26.4%	-29.7%	-23.2%	90
Average General Population Event				**3.33**	**-0.81**	**0.07**	**-0.92**	**-0.69**	**-23.9%**	**-27.3%**	**-20.5%**	91.9

1.2 Time-Temperature Matrix and Demand Reduction Capability

A key objective of the 2018 impact evaluation was to quantify the relationship between demand reductions, temperature, hour of day, and cycling strategy. This was accomplished by estimating loads under historical weather conditions and applying observed percent load reductions from the 2018 events. The resulting tool, referred to as the time-temperature matrix, allows users to predict the program's load reduction capability under a wide range of temperature and event conditions.

In an ideal program year, a large number of events would be called under a variety of different weather conditions, dispatch windows and cycling strategies so that demand reduction capability could be estimated for a wide range of operating and planning scenarios. In actuality, opportunities for program events can be sporadic, and based on uncertain weather projections, such that they occur infrequently and under fairly similar conditions. In 2018, a total of eight events were called, all of which occurred between 3:00 p.m. and 6:00 p.m. and covered either a 1-hour or 2-hour period. Moreover, all events occurred under similar weather conditions, with daily maximum temperatures ranging from 90°F to 94°F.

[2] Leveraging data from the 2018 DEO Market Potential Study, Nexant determined that events were, in fact, called during the full DEO system peak (including both residential and commercial classes).

[3] Emergency 1 operations noted with red text; Emergency 2 operations noted with green text.

Figure 1-1: Demand Reduction Capability – Emergency 1 Dispatch with 94°F Maximum Temperature

Inputs	
Dispatch Type	Emergency 1 Dispatch
Option	Overall
Event Start	4 PM
Event Duration (Hours)	1
Daily Max Temp (°F)	94
# Customers	42,872

Event Window Average Impacts		
Load without DR	3.64	kW per customer
Load with DR	2.38	kW per customer
Impact per customer	-1.27	kW per customer
Impact (MW)	-54.38	MW
% Impact	-34.8	%

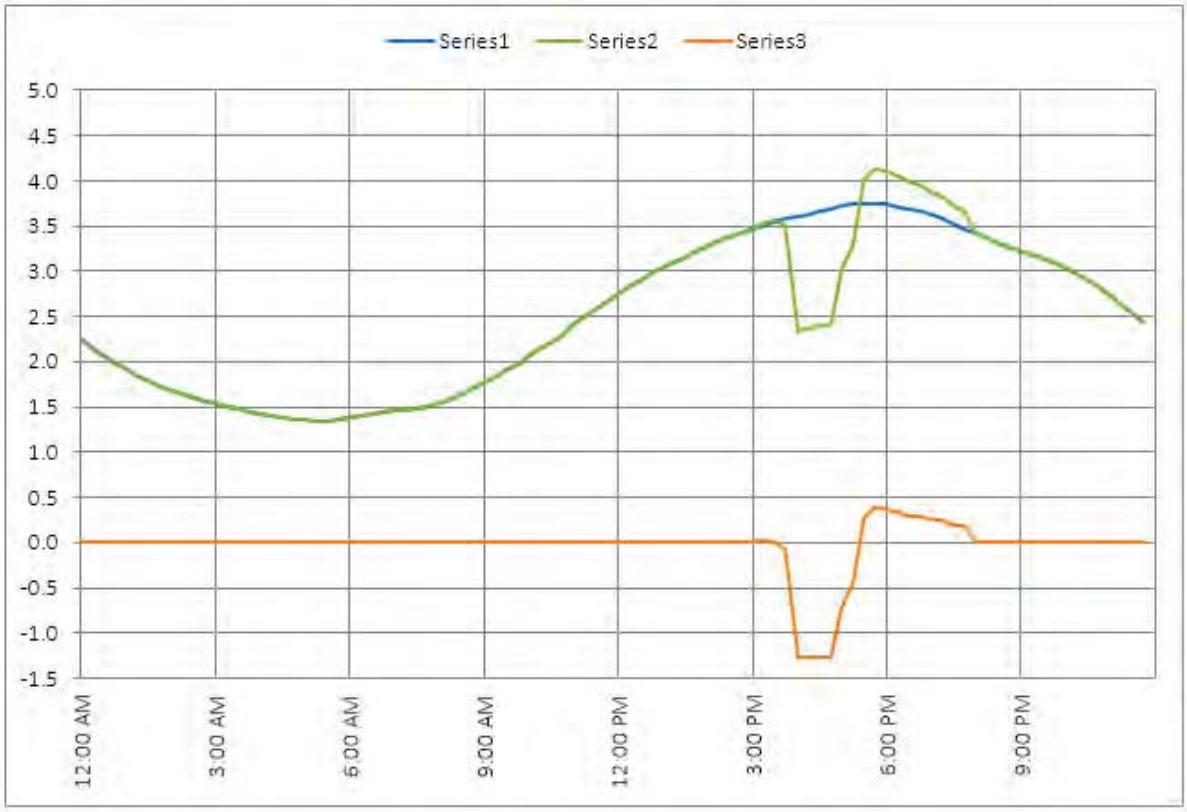


Figure 1-1 shows the demand reduction capability of the program if emergency shed becomes necessary on a day with a maximum temperature of 94°F for a 1-hour event duration. Individual customers are expected to deliver 1.27 kW of demand reduction. Because there are approximately 43,000 devices, the expected aggregate system load reduction is 54.4 MW.

2 Introduction

This report presents the results the 2018 Power Manager impact evaluation for the Duke Energy Ohio (DEO) territory. Power Manager is a voluntary demand response program that provides incentives to residential customers who allow Duke Energy to reduce the use of their central air conditioner's outdoor compressor and fan on summer days with high energy usage.

Because Duke Energy has full deployment of smart meters in DEO territory, and has access to Power Manager customers' interval data, the impact evaluation is based on a randomized control trial that randomly assigned customers to six different groups. During each event, at least one of the groups is withheld to serve as a control group and provide an estimate of customer's energy profiles absent a Power Manager event. The randomized control trial approach was applied during normal Power Manager operations, as well as during specific test events designed to address key research questions.

In addition to estimating load impacts during 2018 events, this study enables the estimation of the program's demand reduction capability under a range of weather and dispatch conditions. Average customer load reductions were calculated as a function of event type, control option, event start time, event duration, and maximum daily temperature.

2.1 Key Research Questions

The study data collection and analysis activities were designed to address the following impact evaluation research questions:

- What demand reductions were achieved during each event called in 2018?
- Did impacts vary for customers who enrolled in the moderate vs. high load control options?
- Do impacts vary based on the hour(s) of dispatch and/or weather conditions?
- What is the magnitude of the program's aggregate load reduction capability during extreme conditions?
- In general, were events called during the optimal time-of-day, i.e. during the system's peak demand period?

2.2 Program Description

Power Manager is a voluntary demand response program that provides incentives to residential customers who allow Duke Energy to reduce their central air conditioner's outdoor compressor and fans on summer days with high energy usage. All Power Manager participants have a load cycling switch device installed on at least one outdoor unit of qualifying air conditioners. The device enables the customer's air conditioner to be cycled off and on to reduce load when a Power Manager event is called. Duke Energy initiates events by sending a signal to participating devices through a corporate paging network, which instructs the switch devices to cycle the air conditioning system on and off, reducing the run time of the unit during events.

The program participates in the energy and capacity markets of the PJM market, but Duke Energy generally limits participation in the energy markets to days when the wholesale price exceeds $65/MWh.

Duke Energy regularly bids Power Manager into the capacity market, which means that the program must be available for PJM emergency events. Absent a PJM emergency, Duke Energy's operations team schedules and calls events for local emergency, economic, or testing reasons.

Power Manager events typically occur between May and September in DEO territory, but are not limited to these months. Participants receive financial incentives for their participation based on the amount of load control they experience during an event. Upon program enrollment, Power Manager customers select either moderate or high load control. Approximately 84% of Power Manager devices in DEO are enrolled in the moderate load control option and the remaining 16% are enrolled in the high load control option.[4] The payments received by participants include a one-time installation credit – $25 for moderate load control and $35 for high load control – plus bill credits for cycling events. The minimum bill credit for 2018 participation was $12 for customers enrolled in the moderate option and $18 for customers enrolled in the high option.

In DEO territory, Duke Energy uses a cycling algorithm known as *true cycle*. The algorithm uses learning days to estimate air conditioners' run time (or duty cycle) as a function of hour of day and temperature at each specific site, and aims to curtail load demand by a specified amount. In general, Power Manager events fall into three categories: economic events during which customers are cycled at 60% and 75% for moderate and high control customers, respectively; Emergency 1 events during which both moderate and high customers are cycled at 75%; and Emergency 2 events during which moderate and high customers are cycled at 66% and 75%, respectively. For purposes of program capability reporting, Emergency 1 shed is used. Table 2-1 shows the device cycling levels for each event type and control option.

Table 2-1: DEO Regular and Emergency Level Shed Options

Event Type	Low Option	Moderate Option	High Option
Regular Shed	25%	60%	75%
Emergency 1 Shed	66%	75%	75%
Emergency 2 Shed	66%	66%	75%
PJM Test Event	100%	100%	100%

In 2018, Duke Energy introduced two separate levels of emergency dispatch, each with different load control intensities. Emergency 1 dispatch involves 75% cycling for both high and moderate control customers, while Emergency 2 dispatch involves 75% and 66% cycling for high and moderate customers, respectively.

[4] Customers who ask to be removed from the program are offered a low load control option to minimize attrition. Approximately 0.1% of devices are enrolled in the low load control option.

2.3 Participant Characteristics

Duke Energy serves approximately 660,000 residential customers in DEO service territory, located in the southern portion of Ohio and centered in the Cincinnati area. By the start of summer 2018, over 45,000 devices were part of Power Manager.[5] Of those units, 16% enrolled in the high load control option. On average, participating customers enrolled 1.06 air conditioner units per account.

Table 2-2: Customer Count by Control Option

Control Option	Customer Count	Percent
Low	54	0.1%
Moderate	35,858	83.7%
High	6,952	16.2%
Total	**42,864**	**100%**

To enroll in Power Manager, customers must own a single-family home located in DEO service territory and have a functional central air conditioning unit with an outdoor compressor. According to a residential appliance saturation survey implemented by Duke Energy in 2016, approximately 54.7% of customers meet the eligibility criteria.[6] As of summer 2017, DEO has enrolled approximately 10.9% of eligible customers. Figure 2-1 depicts program enrollment over time.

[5] Slightly more than 43,000 accounts were enrolled in the program, totaling approximately 45,000 air conditioner units.

[6] 77.3% of residential customer in the territory own single family homes and, of those, 82.7% have central air conditioners. The estimate does not include heat pumps.

Figure 2-1: Power Manager Participation Over Time

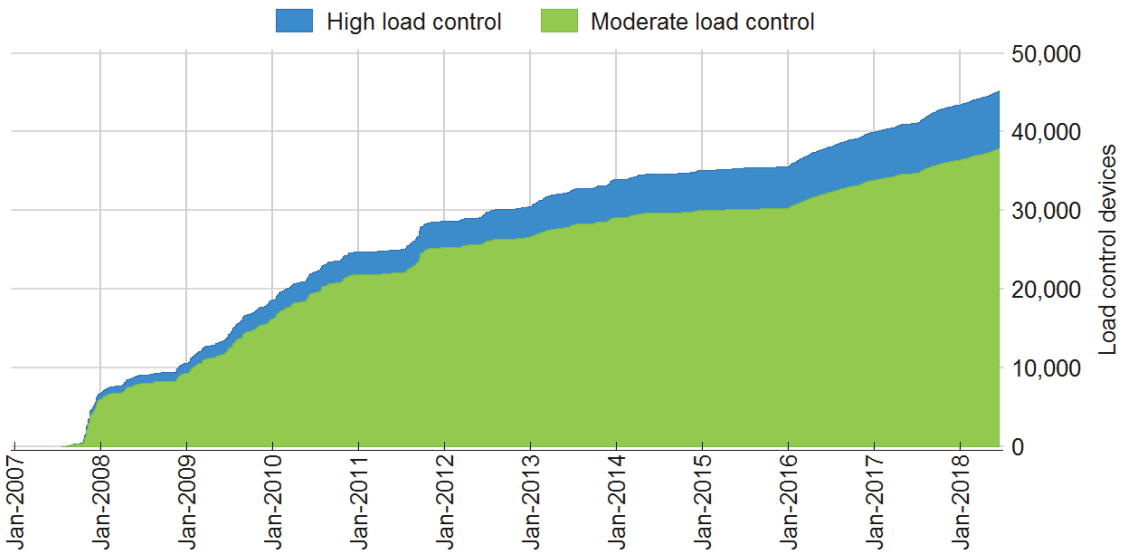


Figure 2-2 shows the distribution of peak household demand during the 4pm to 6pm period on hot, non-event days. Household loads varied substantially, reflecting different occupancy schedules, comfort preferences, and thermostat settings.[7] Roughly 50% of loads exceeded 3.5 kW. As with any program, some enrollees use little or no air conditioning during late afternoon hours on hotter days. These customers are, in essence, free riders. The bulk of the costs for recruitment, equipment, and installation have already been sunk for these customers and, as a result, removing these customers may not improve cost effectiveness substantially. However, given the availability of smart meter data, we recommend assessing nonparticipant afternoon loads on hotter days prior to marketing in order to target customers who are cost effective to enroll.

[7] It is assumed that household-level demand on these days is predominantly due to AC use; however, other factors could contribute to the varying customer loads.

Figure 2-2: Distribution of Peak Period Loads

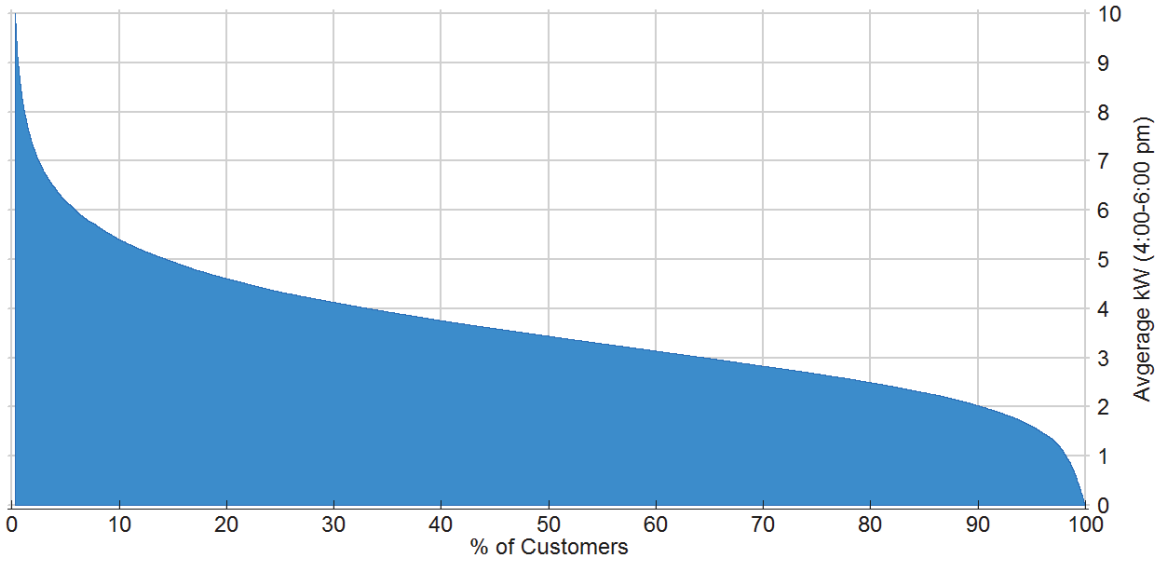
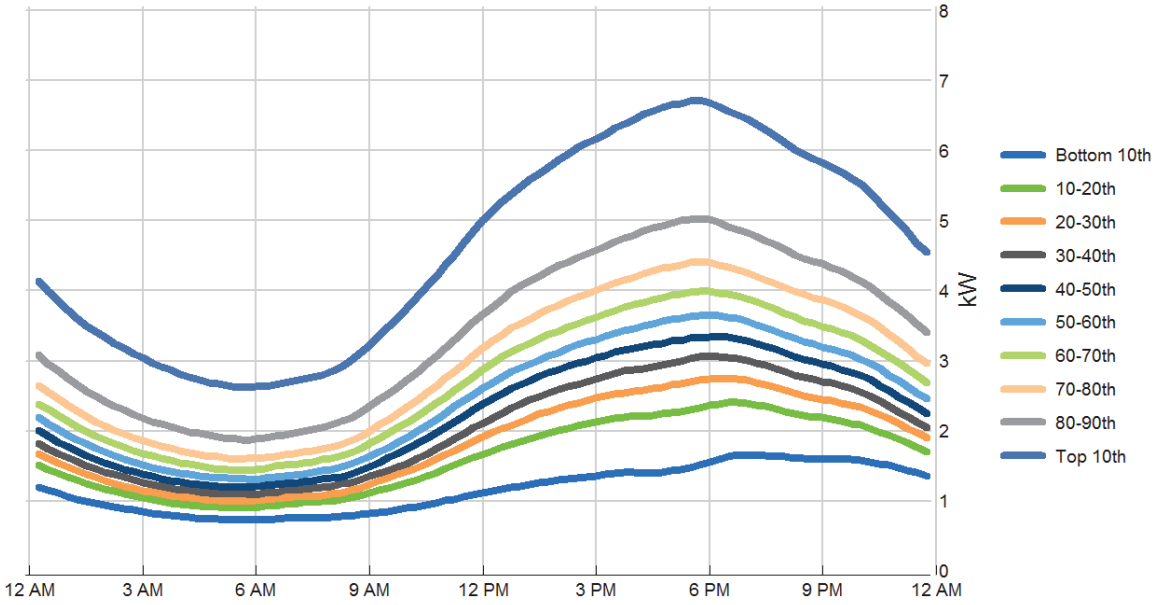


Figure 2-3 provides additional detail and shows the hourly household loads for different customer groups. The customers were classified into ten equally sized groups, known as deciles, based on their household consumption during hot, non-event days. Each line represents the hourly loads for the average customer in each decile.

Figure 2-3: Household Loads by Size Decile



2.4 2018 Event Characteristics

Duke Energy dispatched Power Manager events nine times in 2018. All general population events occurred either between 4:00 and 6:00pm or 3:00 and 5:00pm. Emergency events were dispatched three times, each occurring during a general population event window. This side-by-side dispatch framework allowed for direct comparison of emergency event performance compared to general dispatch. Table 2-3 summarizes 2018 event conditions.

Table 2-3: 2018 Event Operations and Characteristics

Event Date	Start Time	End Time	Type of Event	Customers Dispatched	Control Group	Daily Max Temp	Notes
6/18/2018	4:00 PM	5:00 PM	Research	34,485	1,840	94°F	Group 1 held back
	5:00 PM	6:00 PM	GP Event	34,485	1,840		
6/19/2018	3:00 PM	5:00 PM	GP Event	34,530	1,822	93°F	Group 4 held back
6/29/2018	3:00 PM	5:00 PM	GP Event	34,702	1,837	91°F	Group 2 held back
7/2/2018	3:00 PM	5:00 PM	GP Event	34,797	1,768	92°F	Group 3 held back
7/5/2018	4:00 PM	6:00 PM	GP Event	34,798	1,809	93°F	Group 5 held back
8/28/2018	4:00 PM	6:00 PM	GP Event	32,156	1,874	91°F	Groups 2, 3, and 4 held back
	4:00 PM	5:00 PM	Research	3,728	1,874		Groups 2 and 3 dispatched
9/5/2018	4:00 PM	6:00 PM	GP Event	32,216	1,876	91°F	Groups 1, 4, and 5 held back
	5:00 PM	6:00 PM	Research	3,791	1,876		Groups 1 and 4 dispatched
9/6/2018	4:00 PM	5:00 PM	PJM Test	37,892	-	91°F	No control group
9/20/2018	4:00 PM	6:00 PM	GP Event	36,121	1,917	90°F	Group 1 held back

Duke Energy overlaid three research experiments alongside general population events on June 18, August 28, and September 5. On June 18, Duke Energy implemented a two-stage event, where emergency dispatch was called during the first hour of the event and normal dispatch was called during the second hour of the event. On August 28 and September 5, research groups were dispatched using emergency shed operations side-by-side with a control group and a group that experienced normal operations in order to assess how the magnitude of the emergency shed compares to traditional operations. Both the August 28 and September 5 events included simultaneous Emergency 1 and Emergency 2 level dispatches, in addition to normal dispatch, allowing for a three-way comparison of event strategies.

3 Methodology and Data Sources

This section details the study design, data sources, sample sizes, and analysis protocols for the impact evaluation.

3.1 Randomized Control Trial Design and Analysis

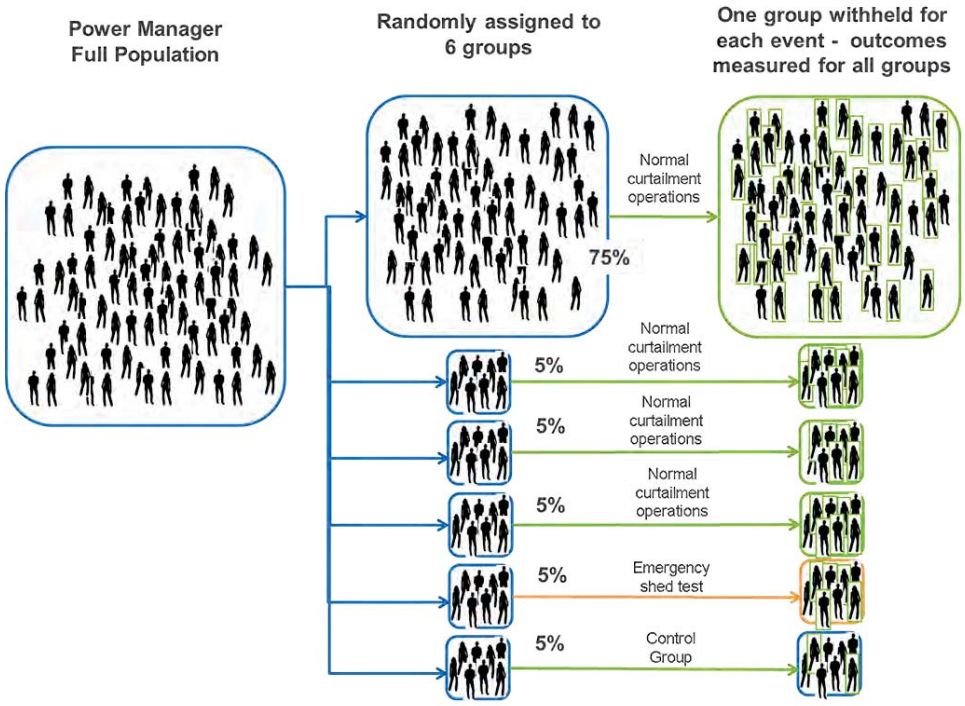
Randomized control trials are well-recognized as the gold standard for obtaining accurate impact estimates and have several advantages over other methods:

- They require fewer assumptions than engineering-based calculations;
- They allow for simpler modeling procedures that are effectively immune to model specification error; and
- They are guaranteed to produce accurate and precise impact estimates, provided proper randomization and large sample sizes.

The RCT design randomly assigns the Power Manager population into six groups – a primary group consisting of 75% of the population and five research groups, each consisting of 5% of the population. For each event, groups are assigned as either treatment or control according to Duke Energy's operational plan.[8] All devices assigned to the treatment group are controlled during the event window, whereas devices assigned to the control group are withheld and continue to operate normally. As a result of random group assignment, the only systematic difference between the treatment and control groups is that one set of customers is curtailed while the other group was not. Figure 3-1 shows the conceptual framework of the random assignment.

[8] The PJM test event called on September 6 dispatched all program participants and therefore, no control group was withheld.

Figure 3-1: Randomized Control Trial Design



All customers who were enrolled in the program and had addressable load control devices installed by the start of the 2018 summer were randomly assigned into six distinct groups using the last two digits of the device serial number.[9] Table 3-1 summarizes the feeder assignment and number of accounts in each group. By design, the primary general population group includes 75% of participants, approximately 32,000 participants. The remaining five research groups each include 5% of participants, or roughly 2,100 customers each.

Table 3-1: Feeder Group Assignment

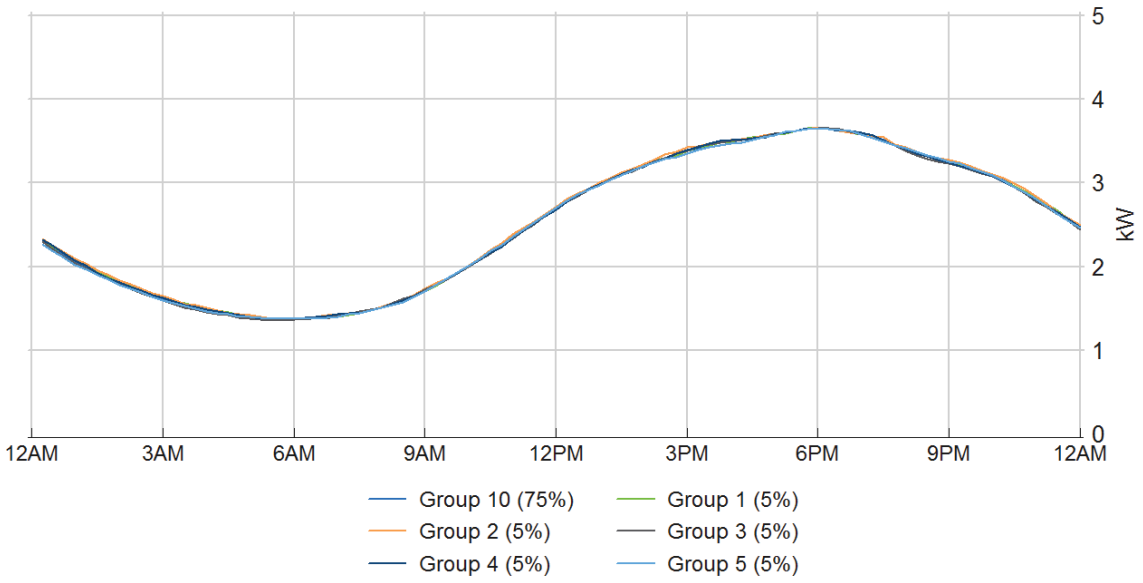
Feeder Group	Last Two Digits of Device Serial Number	Number of Accounts
10	01-75	32,243
1	76-80	2,158
2	81-85	2,144
3	86-90	2,089
4	91-95	2,103
5	96-00	2,135

[9] Some households have multiple load control devices. In these instances the homes were randomly assigned such that all devices in a given home were in the same group.

The purpose of creating six distinctive, randomly assigned groups was twofold. First, it allowed for side-by-side testing of cycling strategies, event start times, or other operational aspects to help optimize the program. Second, it allowed Duke Energy to alternate the group being withheld as control for each event, increasing fairness and helping to avoid exhausting individual customers by dispatching them too often solely for research purposes.

To ensure that random group assignment was properly implemented, average loads for each of the six groups were compared to each other for all non-event days with temperatures reaching 90°F or higher.[10] Figure 3-2 shows average loads for each feeder group on these hottest, non-event days. Feeder loads are nearly identical, which provides strong evidence that the random group assignment effective. It also emphasizes the high degree of precision provided by an effective RCT design for estimating the counterfactual.

Figure 3-2: Average Customer Loads on the Hottest Non-Event Days by Feeder Group



For each event, one of the five smaller research groups was withheld to serve as a control group and establish the electricity load patterns in the absence of curtailment, i.e. the baseline. Within the experimental framework of a RCT, the average usage for control group customers provides an unbiased estimate of what the average usage for treatment customers would have been if an event had not been called. Therefore, estimating event day load impacts requires simply calculating the difference in loads between the treatment and control groups during each interval of the event window, as well as for the hours immediately following the event when snapback can occur. Demand reductions calculated in this way reflect the net impacts and inherently account for offsetting factors, such as device failures, paging

[10] A total of four non-event weekdays reached at least 90°F.

network communication issues, and customers' use of fans to compensate for curtailment of air conditioners.

The standard error, used to calculate the confidence bands, is calculated using the formula shown in Equation 1.

Equation 1: Standard Error Calculation for Randomized Control Trial

$$Std.Error\ of\ Difference\ between\ Means_i = \sqrt{\frac{sd_c^2}{n_c} + \frac{sd_t^2}{n_c}}$$

Where:

- sd = standard deviation
- n = sample size
- t = indicator for treatment group
- c = indicator for control group
- i = individual time intervals

4 Randomized Control Trial Results

One of the primary goals of the impact evaluation is to understand the load impacts associated with the Power Manager program under a variety of temperature and event conditions. General population events were targeted to understand the available load reduction capacity under a variety of temperature conditions during normal operations, while emergency shed events were used to demonstrate the program's capacity for short-duration events under more extreme conditions. In addition, two of the event days were used to dispatch groups of customers under normal operations and emergency shed operations simultaneously, allowing for a side-by-side comparison of impacts under the two scenarios. Section 4.1 presents overall program results for all event days, including general population and emergency shed events. Section 4.2 details the results of the side-by-side comparison of normal operations vs. emergency shed on two event days. Section 4.3 presents impacts by control option (moderate vs. high) for 2018 events.

4.1 Overall Program Results

The load impact estimates resulting from the RCT analysis for the general population events, as well as the research events that occurred side-by-side with normal operation, are presented in Table 4-1. Results for the August 28 and September 5 emergency events are presented separately from the general population events occurring on the same days. Moreover, both of these events included simultaneous dispatch of two different levels of emergency shed, allowing for a three-way comparison of normal operations, Emergency 1 shed and Emergency 2 shed. The load impacts presented for each event, along with their confidence intervals, are the average changes in load during the indicated dispatch windows. Results for the PJM test event, called on September 6, are presented separately in Section 5.

Table 4-1: Randomized Control Trial per Customer Impacts[11]

Event Date	Event Type	Start Time	End Time	Load without DR	Impact	Std. error	90% Confidence Interval		% Impact	90% Confidence interval		Daily Max
							Lower bound	Upper bound		Lower Bound	Upper Bound	
6/18/2018	Emergency 2	4:00 PM	5:00 PM	3.67	-1.21	0.07	-1.32	-1.09	-33.0%	-36.1%	-29.8%	94
6/18/2018	Regular	5:00 PM	6:00 PM	3.81	-0.98	0.07	-1.10	-0.87	-25.9%	-29.0%	-22.8%	94
6/19/2018	Regular	3:00 PM	5:00 PM	3.39	-0.91	0.07	-1.02	-0.80	-26.9%	-30.1%	-23.6%	93
6/29/2018	Regular	3:00 PM	5:00 PM	3.32	-0.75	0.08	-0.87	-0.62	-22.6%	-26.4%	-18.9%	91
7/2/2018	Regular	3:00 PM	5:00 PM	2.82	-0.46	0.07	-0.58	-0.35	-16.5%	-20.5%	-12.5%	92
7/5/2018	Regular	4:00 PM	6:00 PM	3.53	-0.79	0.07	-0.90	-0.68	-22.5%	-25.6%	-19.3%	93
8/28/2018	Emergency 1	4:00 PM	5:00 PM	3.44	-0.95	0.09	-1.10	-0.81	-27.5%	-31.9%	-23.1%	91
8/28/2018	Emergency 2	4:00 PM	5:00 PM	3.44	-1.10	0.08	-1.24	-0.96	-32.1%	-36.3%	-28.0%	91
8/28/2018	Regular	4:00 PM	6:00 PM	3.53	-0.95	0.07	-1.06	-0.84	-27.1%	-30.2%	-24.0%	91
9/5/2018	Emergency 1	5:00 PM	6:00 PM	3.06	-0.83	0.09	-0.97	-0.69	-27.1%	-31.7%	-22.5%	91
9/5/2018	Emergency 2	5:00 PM	6:00 PM	3.06	-0.81	0.09	-0.95	-0.67	-26.4%	-31.1%	-21.8%	91
9/5/2018	Regular	4:00 PM	6:00 PM	3.08	-0.72	0.07	-0.83	-0.61	-23.4%	-27.0%	-19.9%	91
9/20/2018	Regular	4:00 PM	6:00 PM	3.35	-0.88	0.07	-0.99	-0.77	-26.4%	-29.7%	-23.2%	90
Average General Population Event				**3.33**	**-0.81**	**0.07**	**-0.92**	**-0.69**	**-23.9%**	**-27.3%**	**-20.5%**	91.9

[11] Emergency 1 operations noted with red text; Emergency 2 operations noted with green text.

Overall load impacts for the average customer ranged between 0.46 kW and 0.98 kW during normal operations. These impacts are considerably higher than those observed in 2017, which were subject to cooler weather conditions and ranged from 0.24 kW to 0.78 kW. Although the intention was to call events under a range of temperature conditions, the general population event days in 2018 all experienced similar maximum daily temperatures, ranging from 90°F to 94°F.

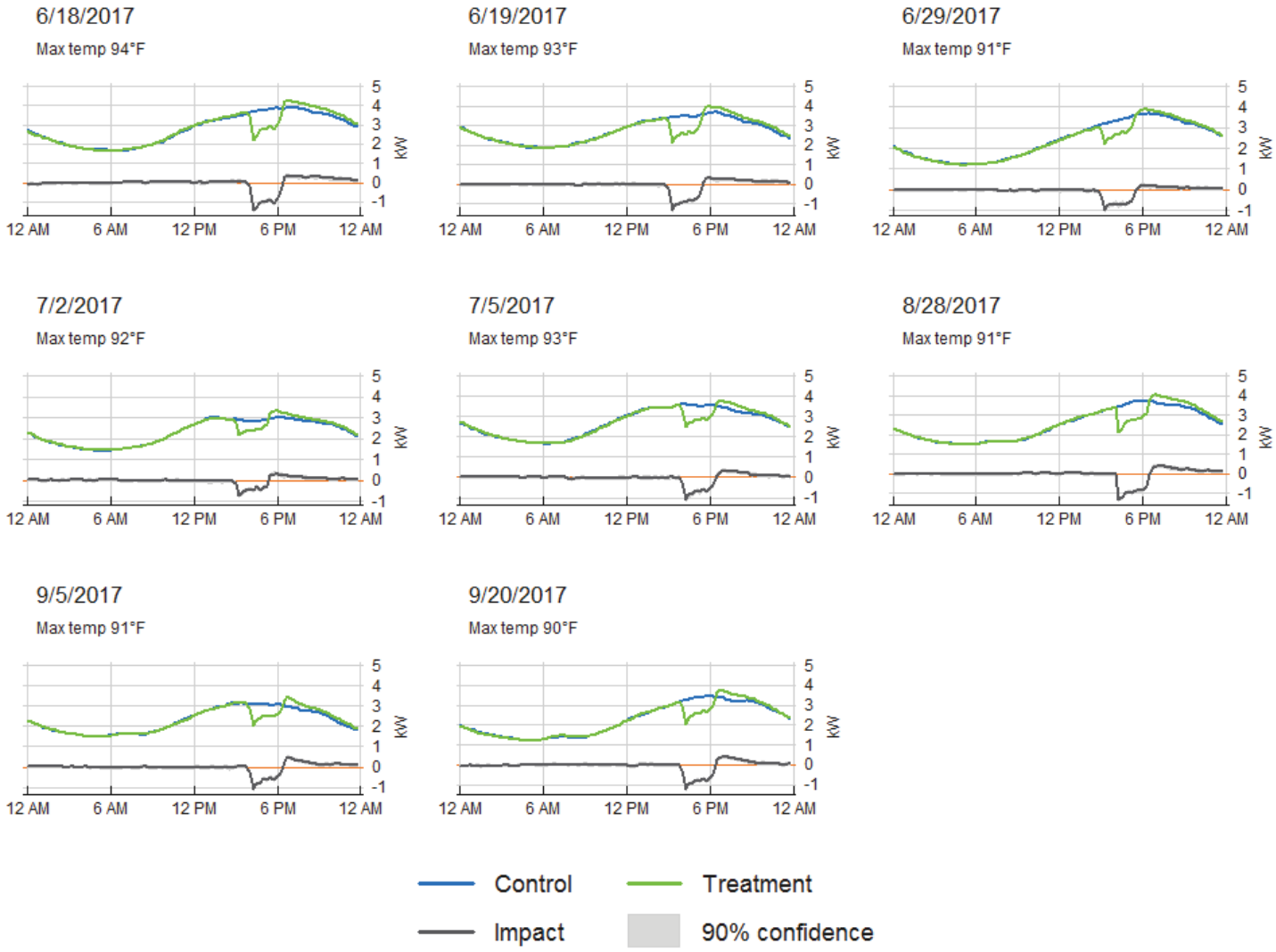
As expected, emergency shed events, on average, produced higher load impacts compared to general population events in 2018. The average load reduction under emergency conditions was 0.98 kW. Emergency 2 impacts were slightly larger than Emergency 1 impacts, on average. The June 18 emergency event – which was called on the hottest event day – produced the highest per customer load impacts of 1.21 kW.

At least 5% of the population was held back as a control group during each event (excluding the PJM test event) in order to establish the baseline. While withholding a control group is an essential component of the RCT research design, it adversely affects the aggregate performance of the program, since customers being withheld do not contribute load reduction to the total impact. Had all program customers been dispatched under normal operation on June 18, the hottest emergency event day, the program would have delivered approximately 38.9 MW. If instead, all customers had been dispatched using emergency operations, reduction would have been 41.5 MW.

The results presented implicitly take device inoperability (and other offsetting factors) into account. Because randomized group assignment was utilized effectively, each of the individual test groups accurately represents the overall percentage of customers with inoperable devices from among the entire population. As such, the estimated load impacts are appropriately de-rated by the non-working devices included in the test groups.

Event impacts are displayed graphically in Figure 4-1, with the average customer load profiles shown for the treatment and control groups. All of the events show a clear drop in treatment group loads during the event dispatch period, as well as a small snapback in energy usage during the hours immediately following the events. Furthermore, most events show an instantaneous and prominent load drop during the first 15-minute interval of the dispatch period, underpinning the immediate, collective response of the load control devices once the event signal is received.

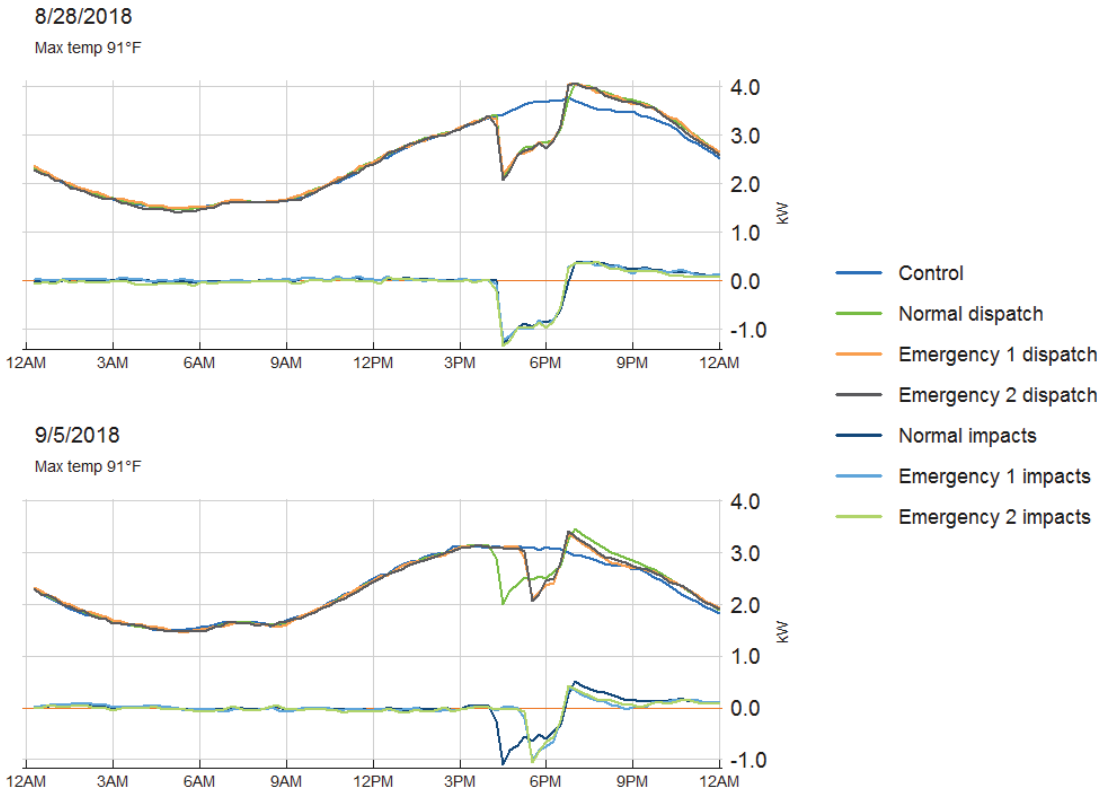
Figure 4-1: Average Customer Loads and Impacts for General Population Event Days



4.2 Side-by-Side Comparison of Normal and Emergency Conditions

Two events called in 2018 allowed for a direct side-by-side comparison of emergency shed to normal event operations. Furthermore, both of these events involved separate dispatches under Emergency 1 and Emergency 2 scenarios, in addition to normal operations, allowing for a three-way comparison of normal operations to both emergency scenarios. Impacts for these events for both normal and emergency operations are presented together in Figure 4-2.

Figure 4-2: Load Profiles for Emergency and Normal Operations on August 28 and September 5



A key takeaway from the side-by-side comparisons is that the customers dispatched under emergency shed options appear to have produced load impacts that are nearly equivalent to the customers dispatched under normal operations on the same day. Nonetheless, emergency operations typically produced slightly larger impacts than normal operations.

On August 28, three distinct groups of customers were dispatched during the same event period (4:00 p.m. to 6:00 p.m.) under different cycling options. Feeder group 2 was released under the Emergency 1 option during the first hour of the event, from 4:00 p.m. to 5:00 p.m., and moved to normal dispatch operations from 5:00 p.m. to 6:00 p.m. Similarly, feeder group 3 was released under Emergency 2 conditions during the first hour, and returned to normal dispatch for the second hour of the event.

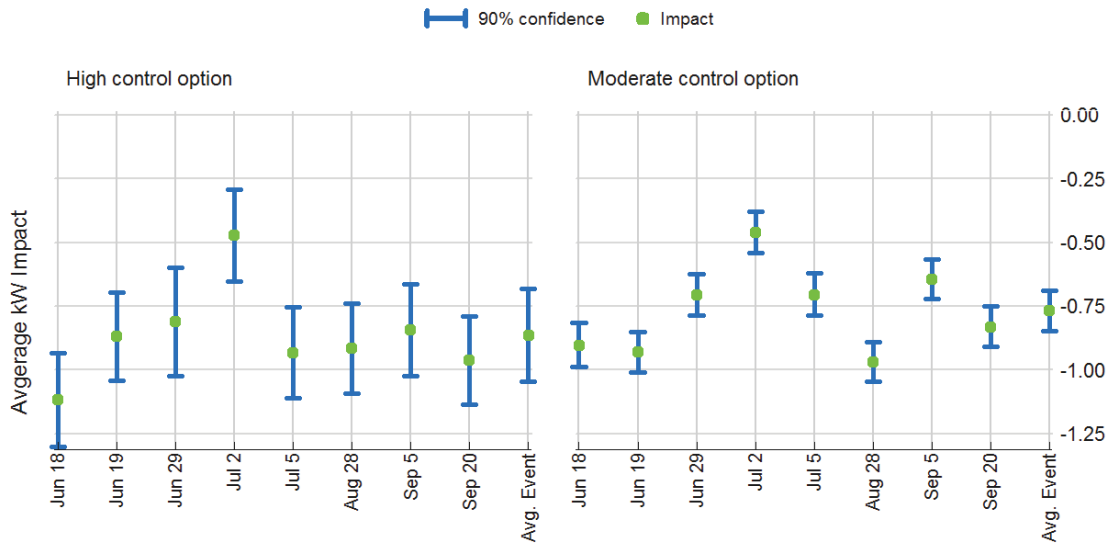
Groups 1, 5 and 10 were all released under normal event conditions for the full two-hour event period, and group 4 was held back as control.

On September 5, feeder groups 3, 4 and 10 were released under normal operations from 4:00 p.m. to 6:00 p.m. Groups 1 and 4 were dispatched separately under Emergency 1 and Emergency 2 conditions, respectively, from 5:00 p.m. to 6:00 p.m. after being withheld during the first hour of the event. Group 5 was held back as the control group for the full event duration.

4.3 Impacts by Load Control Option

Figure 4-33 compares the load impact estimates for customers enrolled in the moderate vs. high load control options, as well as 90% confidence intervals, for each general population event called in 2018. In general, point estimates for load reductions are larger for customers enrolled under the high load control option compared to the moderate control option customers. However, a select few events – specifically June 19 and August 28 – show slightly larger impacts for the moderate option than the high control option. In addition, because there were significantly fewer customers in the high load control option subgroup, the confidence intervals for these point estimates are considerably wider. As a result, any differences in point estimates that do exist are statistically insignificant due to uncertainty. This is also reflected in the average event load impact for each group.

Figure 4-3: Comparison of Load Impact Results by Control Option



4.4 Weather Sensitivity of AC Load and Demand Reductions

Weather sensitivity analysis was not conducted this year due to the uniformity of the temperature conditions seen on event days. The weather sensitivity analysis from the previous evaluation has been placed in Appendix A for reference.

4.5 Key Findings

A few key findings are worth highlighting:

- Demand reductions were 0.81 kW per household for the average general population event.
- Emergency shed events produced load impacts ranging from 0.81 kW to 1.21 kW, with an average of 0.98 kW.
- In general, the magnitude of demand reductions grows larger when temperatures are higher and resources are needed most.
- The difference between impacts between customers enrolled under the moderate and high load control options was minimal and within the range of uncertainty.
- Average customer load profiles during event days indicate that some Power Manager events were called prior to the residential system peak.

5 Within-Subjects Results of PJM Test Event

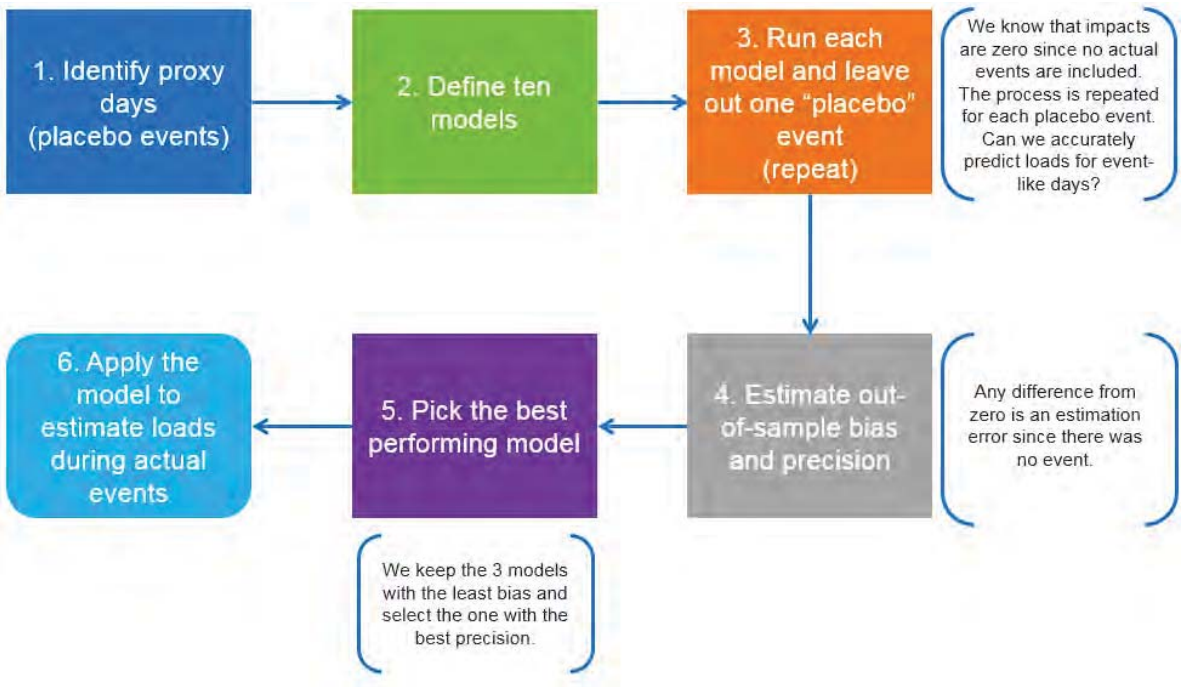
In addition to the regular and emergency shed events described in Section 4, Duke Energy dispatched a PJM test event on September 6. The purpose of the PJM test event was to assess the full extent of program capability for demand reduction under emergency conditions. Under this scenario, the full program population is dispatched for the event and no customers are withheld as a control group. Absent a control group for this event, Nexant employed a within-subjects analysis approach in order to quantify impacts.

5.1 Within-Subjects Analysis Design

In order to quantify impacts of the PJM test event, Nexant modeled the relationship between weather and customer loads on non-event days in order to establish the counterfactual. This approach relies on identifying comparable non-event days and works because the program intervention is introduced on some days, and withheld on other days that could otherwise be considered event-worthy, allowing us to observe load patterns with and without load control.

Using non-event days with similar temperature conditions, regression modeling was applied to estimate the demand reduction as the difference between the predicted baseline loads and the actual event day loads. In order to identify the regression model that best predicts the counterfactual, a rigorous model selection process is applied, whereby ten distinct model specifications were tested and ranked using various accuracy and precision metrics. The best performing model was selected and used to estimate the counterfactual for actual event days. Figure 5-1 summarizes the regression model selection process.

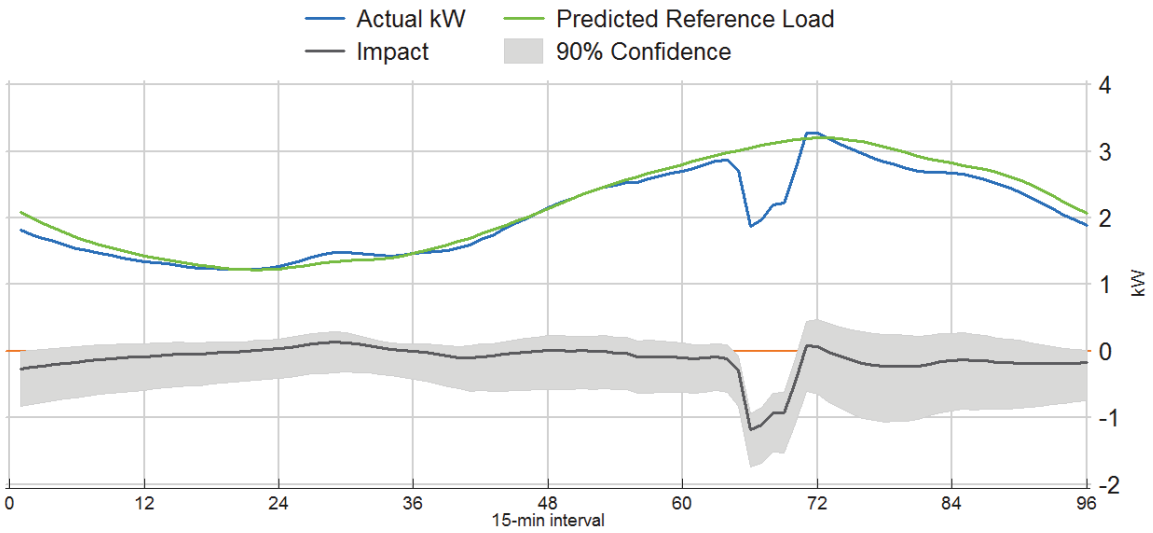
Figure 5-1: Within-Subjects Regression Model Selection



5.2 PJM Test Event Impacts

Load impacts for the September 6 PJM test event are shown in Figure 5-2. The average per household load impact was estimated to be 0.93 kW across the event period. This impact estimate is consistent with the range of impact estimates found for the other emergency shed events via RCT.

Figure 5-2: Load Impacts for PJM Test Event



6 Demand Reduction Capability – Time-Temperature Matrix

A key objective of the 2018 impact evaluation was to quantify the relationship between demand reductions, temperature, hour of day, and cycling strategy. This was accomplished by estimating loads under historical weather conditions and applying observed percent load reductions from the 2018 events. The resulting tool, referred to as the time-temperature matrix, allows users to predict the program's load reduction capability under a wide range of temperature and event conditions. For purposes of reporting program capability, Emergency 1 conditions are used, where both moderate and high customers are cycled at 75% shed.

In an ideal program year, a large number of events would be called under a variety of different weather conditions, dispatch windows and cycling strategies so that demand reduction capability could be estimated for a wide range of operating and planning scenarios. In actuality, opportunities for program events can be sporadic, and based on uncertain weather projections, such that they occur infrequently and under fairly similar conditions. In 2018, events were called under a rather narrow range of temperature conditions, with daily maximum temperatures on event days ranging from 90°F to 94°F. As a result, the ability to predict demand reduction capability across a broader range of conditions was somewhat inhibited.

6.1 Methodology

Figure 6-1 illustrates the weather sensitivity trends of percent load impacts and peak household demand on hot, non-event days. The figure, based on actual 2018 customer load data, shows that Power Manager demand reductions grow on a percentage basis as temperatures increase, and with deeper cycling. At the same time, peak household loads available for curtailment also increase with temperature. The implication is that larger percent reductions are attainable from larger loads, when temperatures are hotter.

Figure 6-1: Weather Sensitivity of Percent Load Impacts and Household Loads

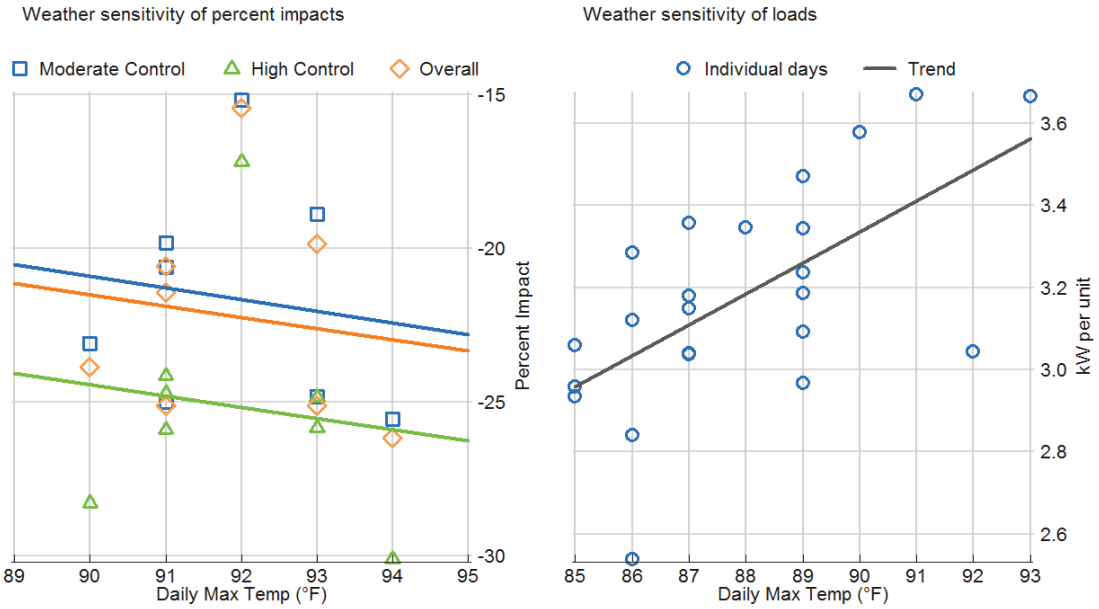
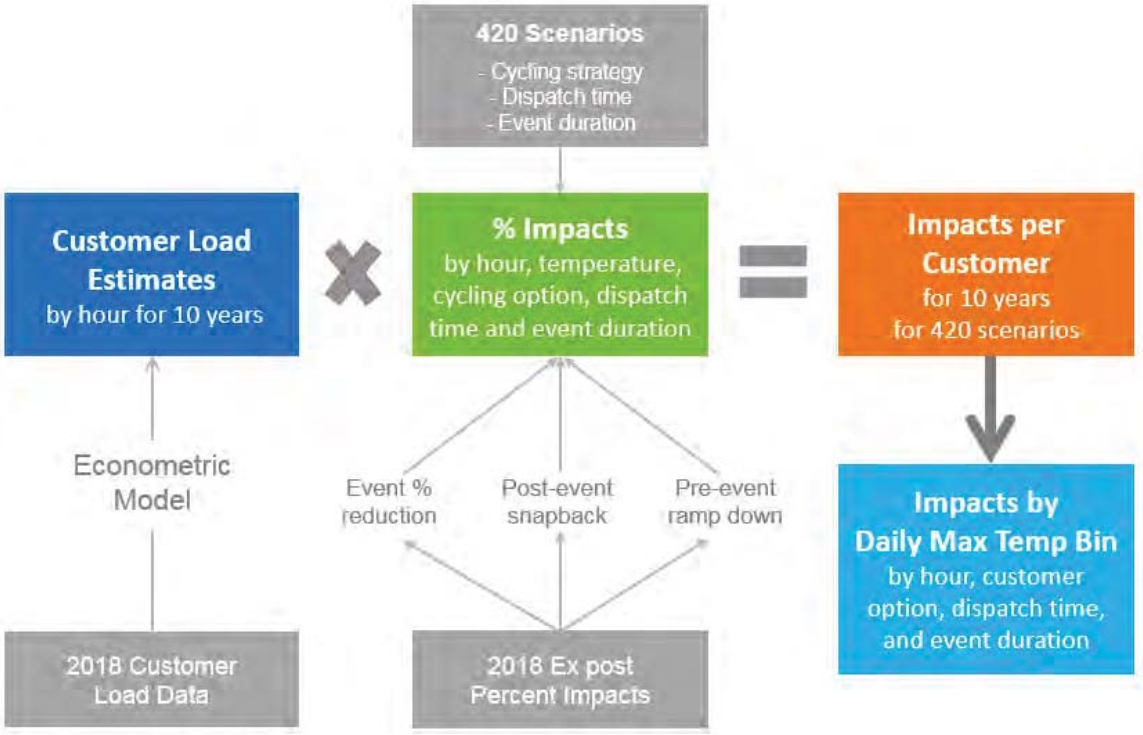


Figure 6-2 summarizes the process used to develop the 2018 time-temperature matrix for estimating demand reduction capability under various scenarios.

Figure 6-2: Time Temperature Matrix Development Process



The process used to produce the time-temperature matrix involved the following primary components:

- Estimates of customer loads were developed by applying 2018 AMI data to the same regression models used to estimate impacts. All weekdays with daily average temperatures above 70˚F were included in the models. The 2018 usage patterns were applied to actual weather patterns experienced over the past ten years rather than hypothetical weather patterns.
- Estimates of the percent reductions were based on three distinct econometric models: load control phase-in, percent reductions during the event, and post-event snapback. The models were based on the percent impacts and temperatures experienced during 2018 events.
- A total of 420 scenarios were developed to reflect various cycling/control strategies, event dispatch times, and event lengths.
- Estimated impacts per customer were produced by combining the estimated household loads, estimated percent reductions, and dispatch scenarios. The process produced estimated hourly impacts for each hot weekday during 2009-2018 under 280 scenarios.
- Multiple days were placed into 2-degree temperature bins and were averaged to produce an expected load reduction profile for each temperature bin.

6.2 Demand Reduction Capability for Emergency Conditions

While Power Manager is typically dispatched for economic or research reasons, its primary function is to deliver demand relief during extreme conditions, when demand is high and capacity is constrained. Extreme temperature conditions can trigger emergency operations, which are designated to deliver larger demand reductions than normal event cycling. During emergency conditions, all program devices are instructed to instantaneously shed loads. While emergency operations are rare and ideally avoided, they represent the full demand reduction capability of Power Manager.

Figure 6-3: Demand Reduction Capability – Emergency 1 Dispatch with 94°F Maximum Temperature

Inputs	
Dispatch Type	Emergency 1 Dispatch
Option	Overall
Event Start	4 PM
Event Duration (Hours)	1
Daily Max Temp (°F)	94
# Customers	42,872

Event Window Average Impacts		
Load without DR	3.64	kW per customer
Load with DR	2.38	kW per customer
Impact per customer	-1.27	kW per customer
Impact (MW)	-54.38	MW
% Impact	-34.8	%

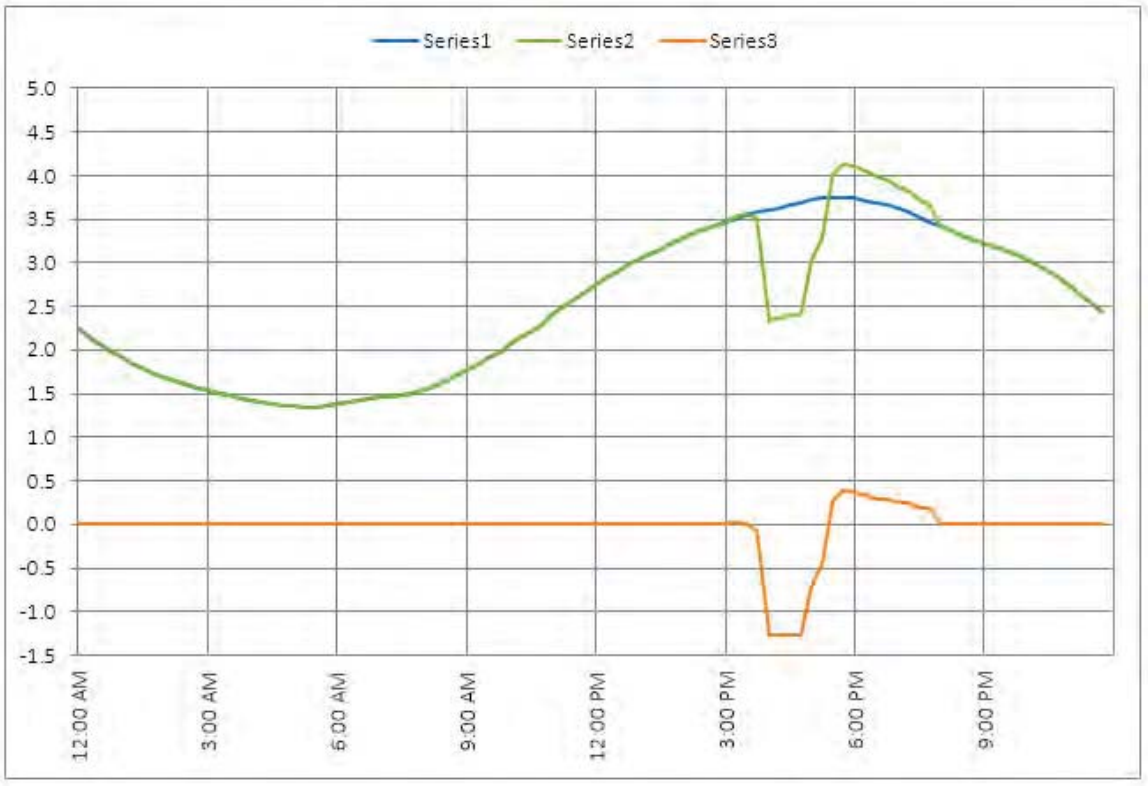


Figure 6-3 shows the demand reduction capability of the program if emergency shed becomes necessary on a day with 94˚F maximum temperature. Individual customers are expected to deliver 1.27 kW of demand reduction over a one-hour event window. Because there are approximately 43,000 customers enrolled in Power Manager, the expected aggregate reduction is 54.4 MW.

6.3 State Bill 310 Compliance

In the state of Ohio, electric distribution utilities (EDUs), including Duke Energy, are required to achieve a cumulative annual energy savings of more than 22% by 2027, in addition to achieving 0.75% peak demand reductions (PDR) in 2017-2020, per Ohio Senate Bill (SB) 310. Under current law, EDUs must implement PDR programs designed to achieve a 1% PDR and an additional 0.75% PDR each year through 2018. SB 310 also introduced new mechanisms that adjust how EDUs may estimate their energy savings

or PDR achieved through demand side management (DSM) programs. Specifically, SB 310 requires the Ohio Public Utilities Commission (PUC) to permit EDUs to account for energy-efficiency or PDR savings estimated on whichever value is higher between an "as-found" or a deemed basis. In the case of the 2018 Power Manager evaluation, the "deemed" savings approach will be applied using results from the 2016 impact evaluation. The relevant language for SB310 is provided in Appendix B.

Table 6-1 compares the deemed peak demand reductions from 2016-2017 to the as-found demand reductions from the 2018 impact evaluation. Note that the impacts reported in Table 6-1 have been converted to reflect per device impacts rather than per customer impacts. Per SB310, Duke Energy will claim the deemed values from 2016-2017 for Power Manager.

Table 6-1: SB 310 Compliance Peak Demand Reductions

Event Conditions	Number of Customers	Average Impact per Device	Aggregate Impact	Source
Emergency Shed	45,000	1.41 kW	67.0 MW	Time-Temperature Matrix based on 2016 and 2017 impacts
Emergency Shed	42,872	1.20 kW	54.4 MW	Time-Temperature Matrix based on 2018 impacts

6.4 Key Findings

Key findings from the development of the time temperature matrix include:

- While emergency operations are rare and ideally avoided, they represent the full demand reduction capability of Power Manager.
- Power Manager demand reductions grow on a percentage basis as temperatures increase, and with deeper cycling. At the same time, peak household loads available for curtailment also increase with temperature.
- If emergency shed becomes necessary on a 94˚F maximum temperature day, Power Manager can deliver 1.27 kW of demand reductions per household during a 1-hour event.
- Because there are approximately 43,000 Power Manager customers, the expected aggregate reductions total 54.4 MW.
- The event start time also influences the magnitude of reductions which, generally, are larger during hours when customer loads are highest.

Appendix A Weather Sensitivity of AC Load and Demand Reductions

Replicated from the 2016 evaluation - the load reduction capacity of Power Manager is dependent on weather conditions, as shown in Figure A-1. The plot shows the estimated average customer impact for each event as a function of daily maximum temperature. There is a clear correlation between higher temperatures and greater load reduction capacity, with the greatest load reductions occurring on the hottest day. Both emergency and normal operation impacts are displayed on this plot for that day, with the greater magnitude impacts attributable to the emergency operations customers.

While the weather correlation is clear, the question remains: How much of the bigger reduction capacity is due to larger air conditioners loads versus larger demand reductions? Both percent reduction and air conditioner loads grow with hotter temperatures. The whole house reductions were 18.9% on the coolest event day (87°F) and 26.1% on the hottest day (93°F). Figure A-2 shows the weather sensitivity of whole house load for the average customer in Power Manager. All nonevent weekdays with a daily high above 70°F were classified into two degree temperature bins. The plot shows how the loads vary by hour as temperatures grow hotter.

The key finding is simple. Demand reductions grow larger in magnitude when temperatures are hotter and resources are needed most. Because peak loads are driven by central air conditioner use, the magnitude of air conditioner loads available for curtailment grows in parallel with the need for resources. Not only are air conditioner loads higher, but the program performs at its best when it is hotter.

Figure A-1: Weather Sensitivity of Load Reduction based on Randomized Control Trial Analysis

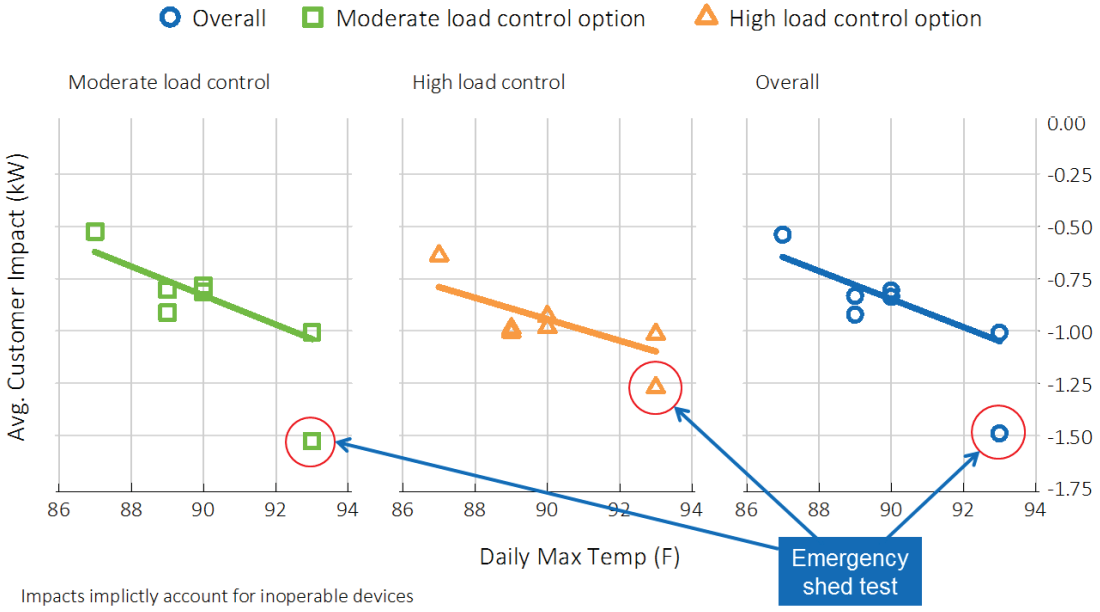
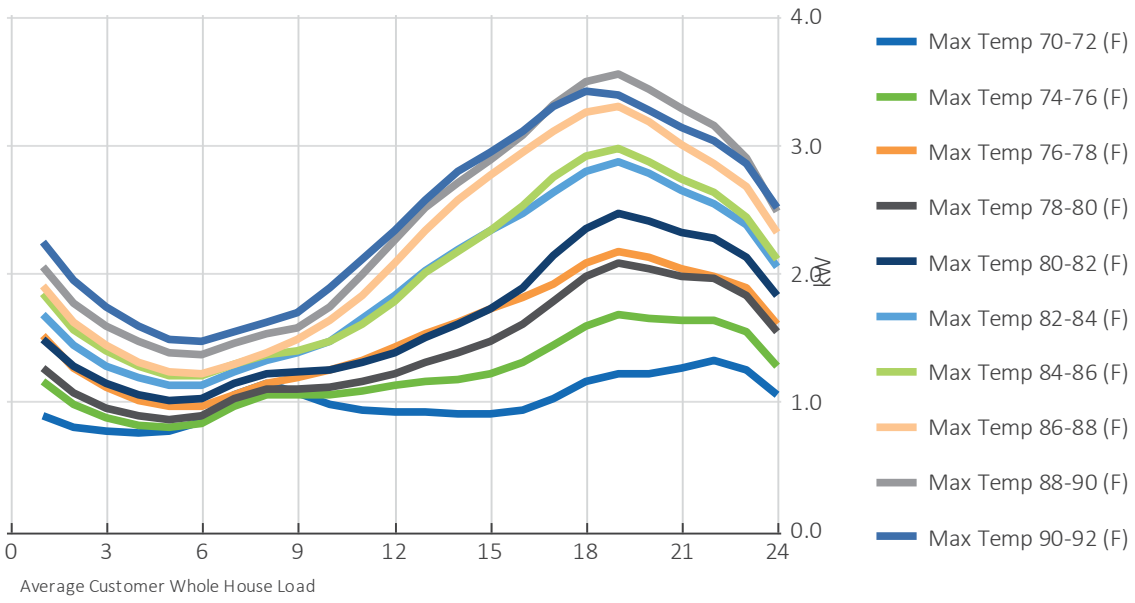


Figure A-2: Weather Sensitivity of Average Customer Loads



Appendix B 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.

Duke Energy PowerShare Program

2018 Evaluation Report for Duke Energy Ohio

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1. DUKE ENERGY POWERSHARE PROGRAM DESIGN

This document presents Navigant's evaluation of the Duke Energy Ohio (DEO) PowerShare® program for program year (PY) 2018. The PowerShare Program is a demand response (DR) program offered to commercial and industrial (C&I) customers that is part of Duke Energy's portfolio of demand-side management (DSM) programs. PowerShare offers participating C&I customers a financial incentive to reduce their electricity consumption when called upon by Duke Energy.

In 2018, the DEO PowerShare program had 39 participating customer accounts with a contracted option load of 44 MW. The DEO program offers customers two participation options to choose from:

- **CallOption:** The CallOption program requires participating customers to reduce and maintain a predetermined load during Emergency Curtailment Periods. Participants receive a monthly credit on their energy bill, and additional Load Reduction Credits are paid for load curtailed during events.

- **QuoteOption:** By enrolling in the QuoteOption program, participants can take part in voluntary Curtailment Periods on a per-event basis. If a participant elects to participate in an event, they should reduce and maintain load to a level they specify prior to the event. A QuoteOption event is initiated at Duke Energy's discretion and participants are typically provided with event notification on the morning of the event.

Participants enrolled in CallOption must further select one of three seasonal participation periods[1]:

1. **Limited Summer** – A maximum of 10 emergency events may occur from June 1 to September 30. Events may only be called on non-holiday weekdays from 12 noon to 8 pm and events may be a maximum of 6 hours in length.
2. **Summer Only** – No limit is placed on the number of emergency events that may occur from June 1 to September 30. Events may be called on any day during those months between 10 a.m. and 10 p.m., and an event may last no more than 10 hours.
3. **Annual** – No limit is placed on the number of events, and events may occur any day through the year (June 1, 2018 to May 31, 2019). Events may last up to 12 hours between June and October, as well as May. Events may last up to 15 hours between November and April.

CallOption participants may choose between one of two compliance options: that of having curtailment evaluated based on a "Firm" demand level ("down to") or a "Fixed" demand reduction ("down by"). CallOption participants must further choose between one of two energy options: "Capacity Only" where they may also participate in PJM energy markets and "Emergency Full" where Duke Energy acts as the participant's sole curtailment service provider.

There are many factors that affect the curtailment potential. For example, as customers install large-scale energy efficiency projects, such as a LED lighting retrofits, their demand is lowered, reducing the potential of curtailable load. The persistence of the contracted curtailable load also fluctuates as DEO participants may leave the program due to business closure. The curtailment potential is also affected by other factors, such as jurisdictional tariffs and federal US Environmental Protection Agency (EPA) emissions guidelines for onsite backup generators.

[1] Participation periods shown are specific to a given calendar period, as specified in the program literature.

2. PROGRAM EVALUATION METHODS

This report summarizes the findings from Navigant's process evaluation of the PowerShare program for PY2018, as well as a brief summary of Navigant's review of program impacts as determined by Duke Energy's Energy Profiler Online (EPO) software developed by Schneider Electric. Navigant used the following questions to guide the evaluation.

- What is the status of the program?
- What are the strengths of the program, and what are areas for improvement?
- What are the barriers to program participation? How can these barriers be addressed?
- In what ways can the program potentially increase kilowatt (kW) impacts?
- What actions can be taken, if any, to increase the efficiency of program implementation?
- Are there opportunities for implementation of the program?
- Why do customers desire to continue with or leave the program?

The research methods used in this evaluation include program materials review, program staff interviews, an implementer interview, surveys and interviews with Duke Energy Account Executives who implement the program, and a survey of participating customers. The evaluation team synthesized the results of the materials review, interviews, and surveys to identify trends, findings, and recommendations. All findings were mapped to the research questions outlined in the evaluation plan.

2.1 Program Impact Evaluation

Process evaluation activities were the primary focus of this evaluation cycle. The impact evaluation for the 2018 program year included a review and summary of the EPO event settlement data provided by Duke Energy. In the period of this evaluation, DEO PowerShare participants were subject to only test events. Navigant reviewed the settlement results to check for relative consistency with previous program years, and this report includes a summary of those results.

2.2 Program Staff Interviews

Navigant conducted a telephone interview with the DEO program manager on May 10, 2018. The interview identified strengths and opportunities to improve Duke Energy's PowerShare Program. Interview findings are incorporated into this report to support the evaluation.

2.3 PowerShare Implementer Interview

Navigant interviewed implementation contractor personnel from Schneider Electric over the phone on June 27, 2018. The interview identified strengths and opportunities to improve Duke Energy's PowerShare Program. As with the program manager interview, interview findings are incorporated into this report to support the evaluation.

2.4 Duke Energy Account Executive Interviews and Surveys

Navigant surveyed five DEO Account Executives over the phone from May 29 through June 28, 2018. These interviews identified how Duke Energy's PowerShare Program is currently operating, how the

process has changed over the past few years, and the effect of those changes on the program and participants to identify improvements to the program.

2.5 PowerShare Participant Surveys

Navigant established a target of 10-20 online participant surveys for the DEO jurisdiction. Survey invitations were sent to all DEO participants in October-November 2018, and 10 usable and completed surveys were received.

2.6 Process Evaluation Analysis Methods

The evaluation team used multiple analysis methods for the various modes of research, which included program materials review, interviews, email surveys with Account Executives, and online participant surveys. The transcription notes from the program manager and implementation contractor interviews and the email survey results were reviewed for consistency of issues and concerns. For the participant surveys, an SPSS analysis of the surveys categorized and summarized the responses. In some cases, the participant contact list contained multiple contacts at a given participant site. When more than one member of a participant's staff responded, those responses were weighted to prevent skewing of the results.

3. POWERSHARE PROGRAM EVALUATION FINDINGS

The following section presents the program evaluation findings, split into several categories:

- Program impacts
- Program strengths
- Areas for improvement
- Barriers to participation
- Opportunities to increase enrolled capacity
- Opportunities to improve program implementation

3.1 Program Impacts

In 2018, the program had a total of 39 participating customers, all of which were enrolled in the CallOption program. Table 1 shows the number of participants and contracted load for each program option.

Table 1. Number of Participants and Contracted Option Load

Program Option	Number of Participants	Total Contracted Option Load (MW)
CallOption Annual	**2**	**13.9**
CallOption Limited Summer	**16**	**15.6**
CallOption Summer Only	**21**	**14.5**
Total	**39**	**44.0**

Source: Navigant summary of Duke Energy Option Load Data, totals subject to rounding

Duke Energy scheduled one test event on September 6, 2018 for all participants. Additional retest events were held on September 18th, 25th and 27th during which some participants retested to improve performance. All events were one hour in length, and held from 4 p.m. to 5 p.m.[2] Table 2 shows the curtailed demand for the program-wide test event on September 6th, as well as the subsequent retests which only included a small number of participants.

[2] A single participant performed a retest from 4:30 to 5:30 p.m. on September 18th.

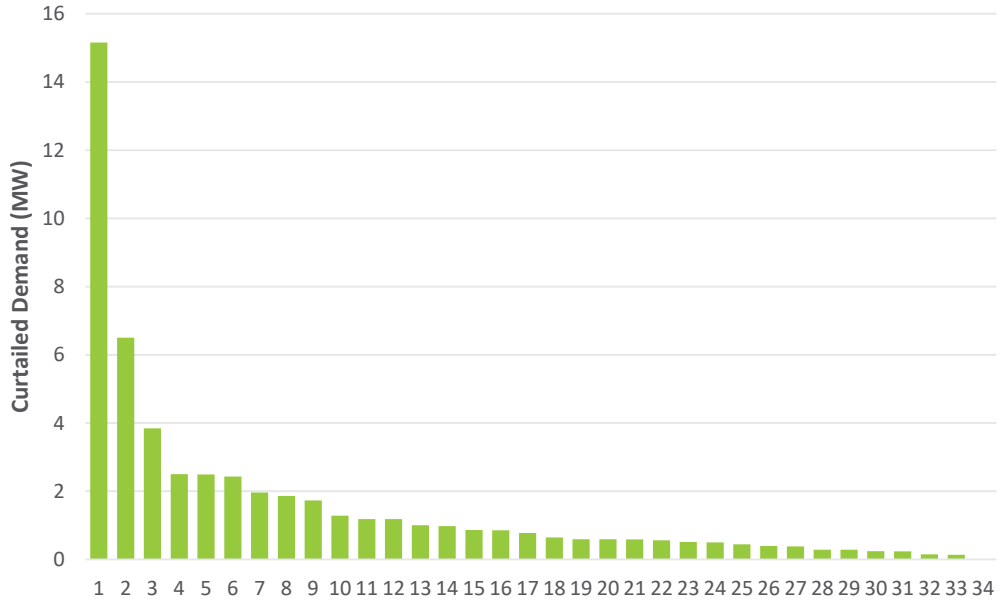
Table 2. Summary of 2018 Curtailed Demand

Curtailed Demand	September 6 Test Event (34 participants)	September 18 Retest (3 participants)	September 25 Retest (1 participant)	September 27 Retest (1 participant)
Firm Contract (MW)	40.07	0.55	0.71	1.13
Fixed Contract (MW)	13.07	0.00	0.00	0.00
Total (MW)	53.14	0.55	0.71	1.13

Source: Navigant summary of Duke Energy EPO Event Settlement Data, results subject to rounding

Figure 1 shows the curtailed demand for each participant for the September 6th test event. A total of 34 unique customer accounts participated in the event. The largest participant curtailed just over 15 MW during the event.

Figure 1. Curtailed Demand by Participant During September 6th Test Event (34 unique accounts)

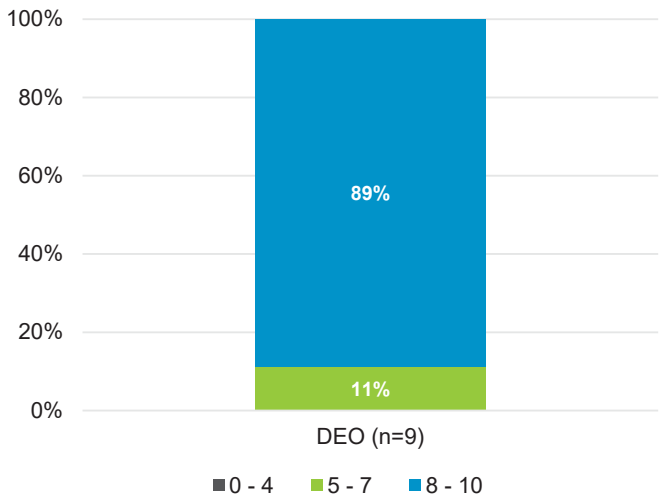


3.2 Program Strengths

Through the participant surveys, many respondents provided positive feedback about the program. Customers reported overall satisfaction with the program, finding the incentives, the notification time before events, and the frequency and duration of events to be acceptable.

Most DEO customers were satisfied with the program, with 89% of survey respondents ranking their satisfaction an 8-10, as shown in Figure 2.

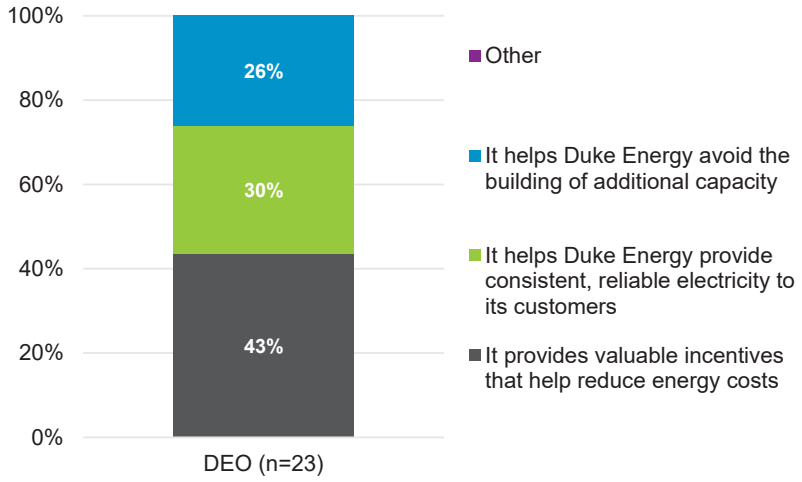
Figure 2. PowerShare Program Satisfaction Scores (0-10 Scale)



Source: Navigant analysis

As shown in Figure 3, 43% of DEO respondents indicated that a primary strength of the program is that it provides valuable incentives that help reduce energy costs. Respondents also felt that their participation allowed Duke Energy to provide consistent, reliable energy to its customers while avoiding building additional capacity.

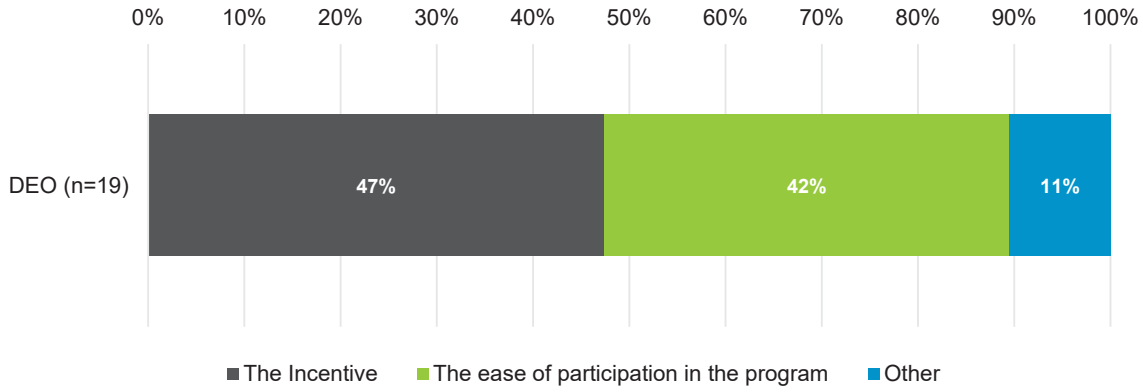
Figure 3. What do you think are the program strengths? (multiple response)



Source: Navigant analysis

The incentive was the main reason 47% of DEO respondents choose to continue in the program, as seen in Figure 4, and 42% of respondents indicated the ease of participating in the program was a key reason for choosing to continue.

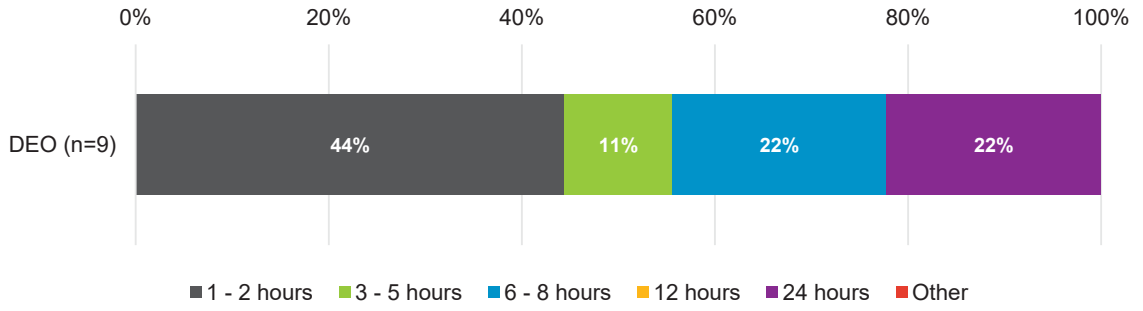
Figure 4. What aspects of the program encourage a customer to continue in the program? (multiple response)



Source: Navigant analysis

Figure 5 shows that 44% of the DEO survey respondents thought a 1-2 hour notification prior to a DR event was reasonable, while 22% said they preferred a 24-hour notification prior to an event.

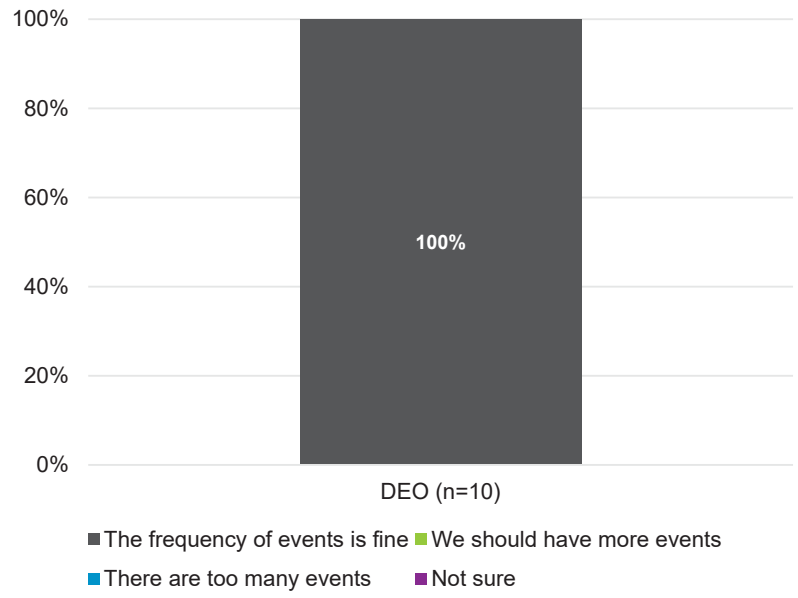
Figure 5. What is the minimum amount of time you would like to be notified ahead of a curtailment event?



Source: Navigant analysis

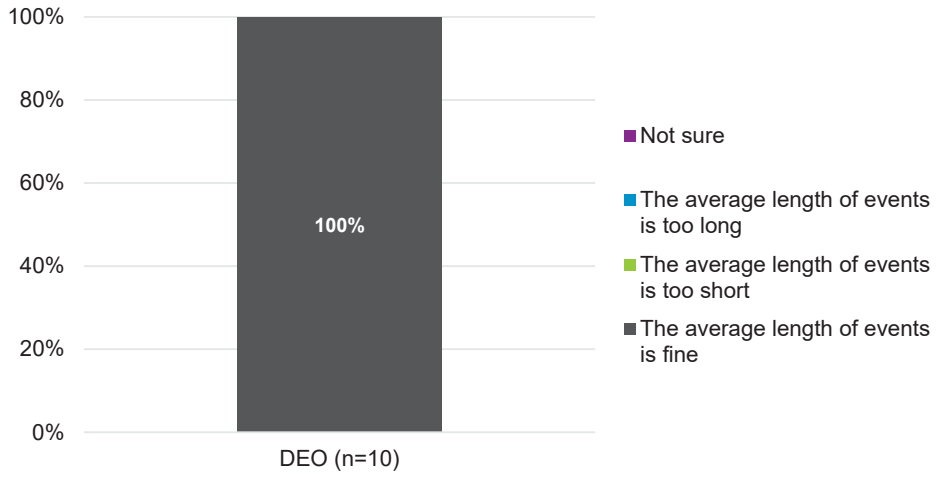
As seen in Figure 6 and Figure 7, 100% of DEO survey respondents thought the frequency of events was reasonable, and 100% felt the length of the events was acceptable as well.

Figure 6. What are your thoughts on the frequency of events?



Source: Navigant analysis

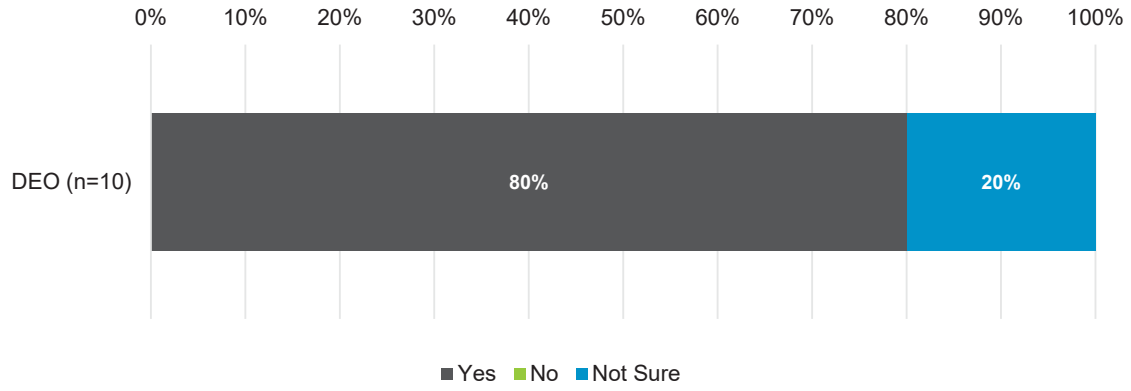
Figure 7. What are your thoughts on the duration of events?



Source: Navigant analysis

Most DEO survey respondents (80%) could meet their curtailment load during an event, as shown in Figure 8. The remaining 20% of respondents were not sure.

Figure 8. Are you able to meet curtailment?



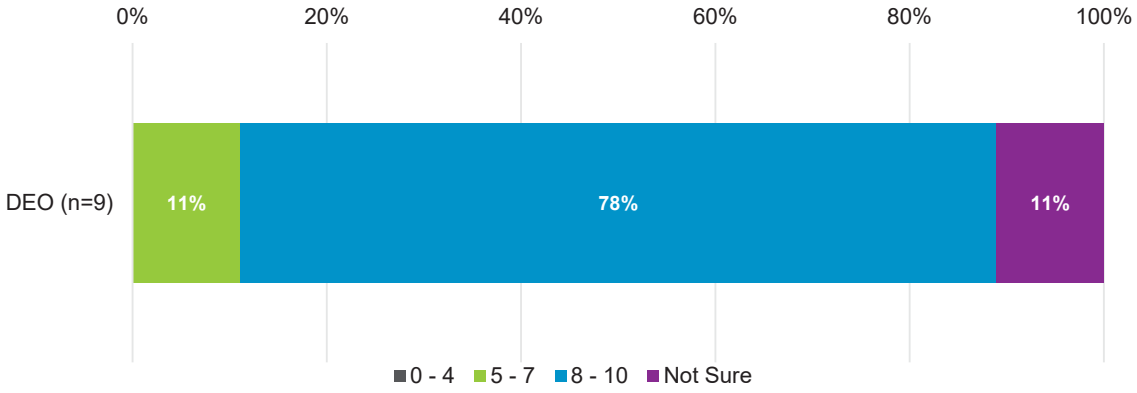
Source: Navigant analysis

3.3 Areas for Improvement

While the PowerShare program is well-liked by participants, there are some opportunities for improvement.

Even though the incentive is the main reason for participation, 22% of DEO respondents do not have a strong understanding of how the incentive is calculated, as shown in Figure 9 as the sum of responses of 7 or less and those who reported "not sure".[3]

Figure 9. How well do you understand the incentive you receive for the load curtailed?

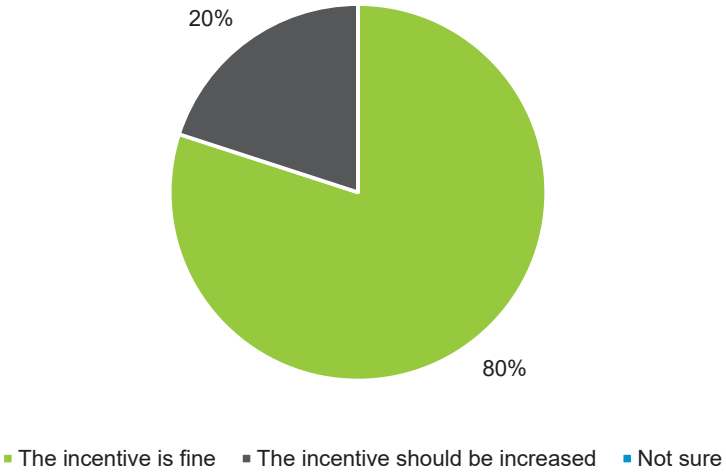


Source: Navigant analysis

[3] Respondents were asked to rate their understanding of the incentive received for the load curtailed on a scale of 0-10, with 0 being "do not understand at all", 5 being "neutral" and 10 being "understand completely".

As seen in Figure 10, the majority (80%) of DEO PowerShare respondents thought the incentive level was reasonable, whereas the remaining 20% thought the incentive should be increased.

Figure 10. What are your thoughts on the PowerShare incentives? (n=10)



Source: Navigant analysis

The program staff and Account Executive interviews also found that PowerShare participants do not receive communication at the end of the season thanking them for participating and ensuring they understand the results of the program. While most Account Executives do conduct an annual DR review with their customers, Duke Energy could increase its efforts to acknowledge/thank participants for contributing to load management and ensuring that participants fully understand their performance and credits. This acknowledgement might go a long way toward participants feeling appreciated and a part of a larger initiative to manage peak demand.

3.4 Barriers to Program Participation

As mentioned previously, the monthly incentive is one of the main motivators for respondent participation in the program. However, the financial benefit of participating is offset by the following costs to the participant:

- Loss of production
- Not meeting manufacturing deadlines
- Impact to employee wages

Duke Energy should consider periodically reviewing the benefit of the incentive levels to ensure they help offset these costs while remaining a cost-effective prog
ram.

The evaluation team also identified the following other barriers to participation:

- If the cost of electricity is a small percentage of overall business costs, a customer will likely not participate.

- While the concept of how to participate in the PowerShare program is easy to understand, understanding the specifics of the performance report can be confusing.

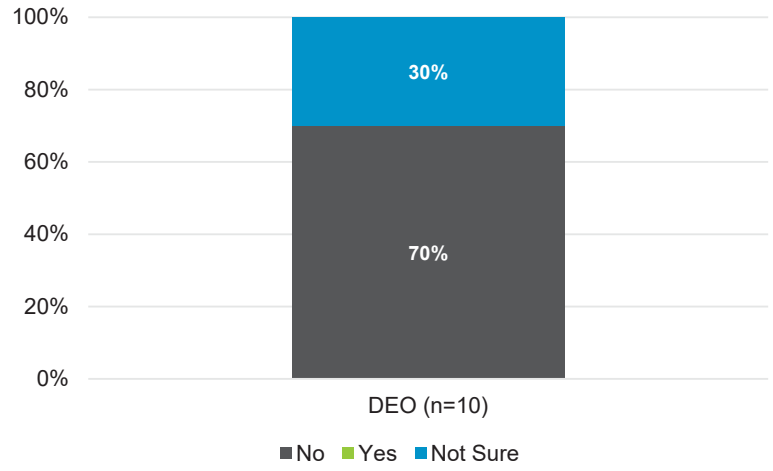
3.5 Opportunities to Increase Enrolled Capacity

None of the DEO respondents were planning on increasing their curtailable load, as shown in Figure 11.

There is also potential to increase the curtailment load by customers in certain segments:

- Customers with EPA-compliant onsite backup generators such as hospitals
- Customers who have a tight profit margin and may benefit from the monthly incentives

Figure 11. Do you have plans to increase the kW enrolled for curtailment?



Source: Navigant analysis

3.6 Opportunities to Improve Program Implementation

Both Duke Energy Account Executives and the survey respondents reported that participants would benefit from near real-time usage data on their load reductions. The ability to monitor the status of their actual curtailment compared to their contracted curtailment at the time of the event will provide participants the information needed to know if additional equipment should be shut down. If Duke Energy could create a web portal, app, or other means of accessing performance data quicker than waiting for their next bill or reviewing EPO the day following an event, participants would be more highly satisfied and could potentially also improve their overall curtailment capabilities. Providing near real-time usage data to the customer may help Duke Energy increase its curtailed load if the participant is able to identify other lines or processes that could be shut down during the event. Having real-time usage information will also provide needed information for the customer when deciding whether to buy-though an event. [4]

As mentioned in Section 3.4, respondents weighed the benefits of participating in a curtailment event against negative impacts to their business such as lost production, lost wages, and missing deadlines. Having the most current information on curtailment schedule changes helps the participant determine if

[4] Participants have the opportunity to "buy-through", rather than curtail during an economic event by paying a charge for their non-curtailed energy that is based on the day-ahead market price for each hour of the event.

they need to notify their employees of schedule or production changes. It should be noted that Duke Energy does provide participants with the ability to view curtailment schedules for each event through EPO, but some survey respondents indicated a need for additional notification of events. Official event notification occurs via the participant's preferred communication channel (e.g. email, text, phone). But Duke Energy may be able to improve participant understanding by providing further communication with participants to ensure they know where to look for event schedules and/or to provide additional notifications via the preferred notification channels.

Supporting the PowerShare program is one of the many responsibilities of an Account Executive. Helping to minimize their workload will improve the efficiency and implementation of the program. The following program delivery considerations can help the Account Executives sell and administer the PowerShare program more efficiently:

- Reduce the paperwork involved in re-signing to the program each year
    - Account Executives re-sign customers to the program every year and while repeat participants need to be made aware of changes to the program rules year to year, there are likely opportunities to reduce the paperwork involved in re-signing.
    - Changing PowerShare enrollment status to opt-out rather than opt-in would reduce the time needed to establish a new contract for both the customer and the Account Executives.
- During curtailment season, provide a daily status update email to all Account Executives that can be edited and sent to their specific customers.
- Similar to other energy efficiency programs, have a team to support the Account Executives in enrolling customers in the program and writing the curtailment agreements.

4. POWERSHARE PROGRAM EVALUATION RECOMMENDATIONS

The following tables present a summary of the findings from the PY2018 program evaluation and associated recommendations. The findings and recommendations are categorized into process improvements, curtailment improvements, and opportunities to increase the enrolled load. Navigant developed these findings and recommendations by synthesizing the information collected during the interviews and surveys performed during this evaluation cycle. This process generated the following list of potential program improvements. Navigant does not suggest that all should be pursued or that any one recommendation is needed to maintain an effective program with high customer satisfaction; however, they are listed here for Duke Energy to consider.

4.1 Process Improvements

Table 3. Recommendations for potential process improvements

#	Finding	Recommendation	Status of Recommendation
1	Participants are not acknowledged/thanked for their contribution.	Consider sending an end of season thank you as a nice goodwill gesture. Include total program impact.	Under consideration by Duke Energy
3	Participants seem to understand the program in face-to-face interactions, but they report the performance report is confusing and may be a deterrent to participation.	Consider ways to simplify the performance report.	Under consideration by Duke Energy
4	Some participants do not understand how their incentives are calculated.	Consider providing training along with the simple breakdown of the incentive structure and how the pro forma is calculated to allow Account Executives and participants to find and use existing information. Consider ways to ensure that participants know where to find this information.	Under consideration by Duke Energy
5	Account Executives must re-sign each customer every year, even if they have participated many years in a row.	Streamline the renewal option, even if customers have to accept minor program changes year to year.	Under consideration by Duke Energy

4.2 Curtailment Improvements

Table 4. Recommendations for potential curtailment improvements

#	Finding	Recommendation	Status of Recommendation
1	Participants lack access to near real-time usage data and need faster performance feedback.	Consider providing access to near real-time usage data through a web portal or other platform.	Under consideration by Duke Energy
2	Some participants would like more notification time.	When possible, offer earlier notification.	Under consideration by Duke Energy
3	Due to the difficulty of shutting down, the length of the curtailment period needs to be worth it.	Consider continuing to ensure all curtailments re 4 hours or longer.	Under consideration by Duke Energy

4.3 Opportunities to Increase Enrolled Load

Table 5. Potential opportunities for increasing enrolled load

#	Finding	Recommendation	Status of Recommendation
1	Certain customer segments may have higher potential for enrolled load.	Periodically revisit program participation opportunities with customers that have EPA-compliant onsite generators (such as hospitals) and those with tight profit margins (such as quarries and textiles). Existing participants may find opportunity to increase enrolled load, and there may be opportunity to recruit additional participants.	Under consideration by Duke Energy

EM&V Report for the Duke Energy Multifamily Energy Efficiency Program

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DISCLAIMER

This report was prepared by Navigant Consulting, Inc., n/k/a Guidehouse Inc. ("Navigant"),[1] for Duke Energy. The work presented in this report represents Navigant's professional judgment based on the information available at the time this report was prepared. Navigant is not responsible for the reader's use of, or reliance upon, the report, nor any decisions based on the report. NAVIGANT MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESSED OR IMPLIED. Readers of the report are advised that they assume all liabilities incurred by them, or third parties, because of their reliance on the report, or the data, information, findings, and opinions contained in the report.

[1] On October 11, 2019, Guidehouse LLP completed its previously announced acquisition of Navigant Consulting Inc. In the months ahead, we will be working to integrate the Guidehouse and Navigant businesses. In furtherance of that effort, we recently renamed Navigant Consulting Inc. as Guidehouse Inc.

1. EVALUATION SUMMARY

1.1 Program Summary

Duke Energy's Multifamily Energy Efficiency Program provides energy efficient equipment to multifamily housing properties at no cost to the property managers or tenant end-users. The program is delivered through coordination with property managers and owners. Tenants are provided with notice and informational materials to inform them of the program and potential for reduction in their energy bills. The program consists of lighting and water measures.

- **Lighting measures:** LED bulbs installed in permanent fixtures. Program measures include A-line, globe, and candelabra lighting products installed onsite at the tenant's premise.
- **Water measures:** Bathroom and kitchen faucet aerators, water-saving showerheads, hot water pipe wrap.

For this evaluation cycle, Navigant assessed lighting and water measures installed through the program in the Duke Energy Ohio (DEO) jurisdiction between April 1, 2018 through July 8, 2019.

Franklin Energy is the implementation contractor for the program. Customers (i.e., property managers) have the option to choose self-installation or direct installation through Franklin Energy. All installation was completed through the direct-install pathway during the period covered by this evaluation. After measures are installed, third-party quality control inspections are completed on about 20 percent of properties in any given month. Within a selected property, the quantity of units to inspect is based on property size as defined by the number of housing units.

1.2 Evaluation Objectives and Program-Level Findings

Navigant's evaluation included assessing the program impacts, structure and delivery. For this Evaluation, Measurement, and Verification (EM&V) effort, the evaluation approach and objectives can be described as follows:

- **Impact evaluation:** To quantify the net and gross energy and coincident demand savings associated with program activity at both the measure level and program level
- **Process evaluation:** To assess program delivery and customer satisfaction

By performing both components of the EM&V effort, Navigant provides Duke Energy with verified energy and demand impacts, as well as a set of recommendations that are intended to aid Duke Energy with improving or maintaining the satisfaction with program delivery while meeting energy and demand reduction targets in a cost-effective manner.

As in the previous 2015 evaluation, Navigant found that Duke Energy is successfully delivering the Multifamily Energy Efficiency Program to customers, participant satisfaction is generally favorable, and the reported measure installations are accurate.

For the evaluation period covered by this report, there were a total of 1,700 housing units at 18 participating properties. The program-level evaluation findings are presented in Table 1 though Table 4. As shown in Table 1, Navigant found the realization rate for gross energy savings to be 91 percent, meaning that total verified gross energy savings were found to be somewhat lower than claimed in the

tracking database provided by Duke Energy. When adjusted to account for Ohio's Senate Bill 310 (SB 310), the realization rate for gross energy savings is 103 percent as shown in Table 2. SB 310 indicates that DEO can claim the higher of the ex ante (i.e. deemed) or ex post (i.e. verified) impacts for each measure.

Navigant found the net-to-gross (NTG) ratio to be 0.98, meaning that for every 100 kWh of reported energy savings, 98 kWh can be attributed directly to the program. The results shown in Table 3 and Table 4 include the verified program impacts before and after adjustments for SB 310, respectively. These findings will be discussed in greater detail throughout this report.

Table 1. Program Claimed and Evaluated Gross Energy and Demand Impacts

DEO Gross Impacts	Reported (ex ante)	Verified (ex post)	Realization Rate
Energy Savings (MWh)	1,340	1,214	91%
Summer Peak Demand Savings (MW)	0.133	0.099	75%
Winter Peak Demand Savings (MW)	0.212	0.132	62%

Source: Navigant analysis, totals subject to rounding.

Table 2. Program Impacts Claimable Under SB 310

DEO Gross Impacts (Claimable Under SB 310)	Reported (ex ante)	Verified (ex post)	Realization Rate
Energy Savings (MWh)	1,340	1,385	103%
Summer Peak Demand Savings (MW)	0.133	0.145	109%
Winter Peak Demand Savings (MW)	0.212	0.219	103%

Source: Navigant analysis, totals subject to rounding.

Table 3. Program Evaluated Net Energy and Demand Impacts

DEO Net Impacts	Verified Net Impact
Energy Savings (MWh)	1,187
Summer Peak Demand Savings (MW)	0.097
Winter Peak Demand Savings (MW)	0.129

Source: Navigant analysis, totals subject to rounding.

Table 4. Program Evaluated Net Energy and Peak Demand Impacts Claimable Under SB 310

DEO Net Impacts (Claimable Under SB 310)	Verified Net Impact
Energy Savings (MWh)	1,354
Summer Peak Demand Savings (MW)	0.141
Winter Peak Demand Savings (MW)	0.214

Source: Navigant analysis, totals subject to rounding.

1.3 Evaluation Parameters and Sample Period

To accomplish the evaluation objectives, Navigant performed an engineering review of measure savings algorithms, field verification to assess installed quantities and characteristics, as well as surveys with

tenants and property managers to assess satisfaction and decision-making processes.[2] The evaluated parameters are summarized in Table 5. For field and phone verification, the expected sampling confidence and precision was 90 percent ± 10 percent, and the achieved was 90 percent ± 11.6 percent.

Table 5. Evaluated Parameters

Evaluated Parameter	Description	Details
Efficiency Characteristics	Inputs and assumptions used to estimate energy and demand savings	1. LED wattage 2. LED operating hours 3. Aerator flow rates (gpm) 4. Showerhead flow rates (gpm) 5. Water temperature (F) 6. Pipe wrap length (ft)
In-Service Rates	The percentage of program measures in use as compared to reported	1. LED, aerator, and showerhead quantities 2. Pipe wrap length
Satisfaction	Customer satisfaction	1. Satisfaction with program 2. Satisfaction with contractor 3. Satisfaction with program measures
Free Ridership	Fraction of reported savings that would have occurred anyway, even in the absence of the program	1. Property Manager Interviews
Spillover	Additional, non-reported savings that occurred as a result of participation in the program	1. Property Manager Interviews 2. Tenant Phone Surveys

This evaluation covers program participation from April 1, 2018 through July 8, 2019, and is the first evaluation of this program in DEO since LEDs were introduced as a measure offering. Table 6 shows the start and end dates of Navigant's sample period for evaluation activities.

Table 6. Sample Period Start and End Dates

Activity	Start Date	End Date
Field Verification	September 16, 2019	October 11, 2019
Tenant Phone Surveys	September 6, 2019	September 20, 2019
Property Manager Interviews	September 9, 2019	October 23, 2019

[2] A billing analysis was also considered, but Navigant determined that the engineering-based approach was appropriate for the evaluation objectives due to the frequency of tenant turnover at multifamily facilities and the small impact of energy savings from program measures relative to annual facility energy consumption.

1.4 Evaluation Considerations and Recommendations

Navigant developed a few recommendations for Duke Energy to consider. These recommendations are intended to assist Duke Energy with enhancing the program delivery and customer experience, as well as to support future EM&V activities and possibly increase program impacts.

1. Navigant recommends that Duke Energy should adopt the ex post, per-unit energy and demand impacts from this evaluation and use them going forward. We recommend that Duke Energy use the impacts claimable under Ohio SB 310.
2. Duke Energy should consider improving the program materials distributed to tenants that describe the program measures and energy savings that might be achieved due to the installation of the new equipment. Communicating tips to save energy and water with the new equipment could increase customer satisfaction and continue to build the strong trust and rapport Duke Energy has established with their customer base.
3. Duke Energy should consider leaving a few cases of backup LED bulbs with property managers. LEDs were the only measure removed by tenants and burn out was the primary reason for the removal. Leaving additional LEDs with property managers could help increase the customer satisfaction rate for this measure.
4. Duke Energy should consider whether smart thermostats or other HVAC-related measures would be reasonable offerings for this program. About 25 percent of survey respondents who did not have a smart thermostat indicated they would like to get one. Also, three out of four property managers recommended adding exterior and common area lighting to the program, so they can continue to make their properties energy efficient.
5. Duke Energy should consider making modifications to the Multifamily Energy Efficiency Program Direct Installation Service Agreement to include information about EM&V activities that may occur in the months or years following program participation. Navigant experienced significant resistance from property managers while recruiting for onsite field verification and process evaluation interviews. Many property managers indicated they had already received multiple site visits during the implementation phase and subsequent QC inspections, and that it was a challenge to accommodate additional inspections and interviews for EM&V.

2. PROGRAM DESCRIPTION

2.1 Design

The Multifamily Energy Efficiency Program is designed to provide energy efficiency to a sector that is often underserved or difficult to reach via traditional, incentive-based energy efficiency programs. This market can be difficult to penetrate because multifamily housing units are often tenant-occupied rather than owner-occupied, meaning that the benefits of performing energy efficiency upgrades may be realized by the tenant whereas the incremental costs are absorbed by the owner.

Duke Energy's Multifamily Energy Efficiency Program provides energy efficient equipment at no cost to multifamily housing property owners. The program is delivered through coordination with property managers and owners. Tenants are provided with notice and informational materials to inform them of the program and potential for reduction in their energy bills. The program consists of lighting and water measures.

- **Lighting measures:** LED bulbs installed in permanent fixtures. Program measures include A-line, globe, and candelabra lighting products installed onsite at the tenant's premise.
- **Water measures:** Bathroom and kitchen faucet aerators, water-saving showerheads, hot water pipe wrap.

2.2 Implementation

Franklin Energy is the implementation contractor for the program. To recruit participants, Franklin Energy conducts onsite visits, in combination with internet searches, and SalesGenie[3] lists, to identify properties, property managers, or property management companies that it believes are likely to participate. Franklin Energy then sends an outreach team of Energy Advisors to coordinate with property managers and explain the program delivery and benefits. This is considered an Energy Assessment. This is the time for Energy Advisors to determine the type of measures along with associated quantities that can be installed. One potential delay in committing to the program is the need for the property manager to get approval to participate from their corporate office.

Once a property has been fully assessed and a service agreement has been signed, the project is handed over to a different group at Franklin Energy to schedule the installations. The installation crew performs the work as scheduled, while displaying Duke Energy branded clothing, badges, and vehicle decals as directed. The installation crews record the quantities and locations of installed measures for each housing unit via a tablet device, which are entered into a tracking database.

When energy efficient program measures are installed, Franklin Energy removes the existing or baseline equipment and generally disposes of it onsite. If the property management previously requested to keep the existing equipment, Franklin Energy will package it up and leave it behind with property management or maintenance personnel. Franklin Energy records the baseline characteristics (e.g. lamp type wattage, aerator flow rates) for a sample of measures removed and makes that information available to Duke Energy and Navigant for evaluation purposes.

[3] SalesGenie is a business and consumer lead generation tool that sales and marketing professionals can use to search for targeted leads, get contact names and phone numbers, and view detailed information. The tool also provides marketing and data solutions designed to help businesses reach their intended audiences more effectively.

There can be logistical complications associated with performing these types of retrofits at multifamily housing properties. Franklin Energy indicated that some units may be skipped at a property due to safety issues, lack of access to equipment, pet barriers, or refusal from tenants.

Franklin Energy stated that they have internal and external forms of quality control (QC) to ensure consistent measure installation. On the internal side, a Franklin Energy supervisor may accompany installation crews to ensure quality work. On the external side, a third-party inspector, Thorpe Services, conducts inspections on a least five percent of participating housing units each year. The QC inspections are required to happen within 22 business days of installation. If a property is selected for a QC inspection, at least 20 percent of the units at the property are targeted for inspection.

During each month of QC inspections, Franklin Energy is provided with a discrepancy report that indicates when measures were missing, installed incorrectly, or if there were missed opportunities. Franklin Energy attempts to address the discrepancies, and subsequently updates the tracking data to reflect the QC findings. The tracking data is ultimately provided to Duke Energy, and subsequently to Navigant for EM&V.

3. KEY RESEARCH OBJECTIVES

As outlined in the Statement of Work, the key research objectives were to conduct impact and process evaluations, as well as a net-to-gross (NTG) analysis.

The primary purpose of the evaluation, measurement, and verification (EM&V) assessment is to estimate net annual energy and demand impacts associated with participation from April 1, 2018 through July 8, 2019. Secondary objectives include the following:

- Estimate net and gross impacts by measure
- Perform detailed review of deemed savings estimates for each measure, and provide updates if necessary
- Assess the installed quantities and efficiency characteristics of program measures
- Evaluate the strengths and weaknesses of current program processes and customer perceptions of the program offering and delivery
- Recommend improvements to program rules and processes that support greater savings, enhanced cost-effectiveness, and improved customer satisfaction

Key impact and process research questions to be explored include:

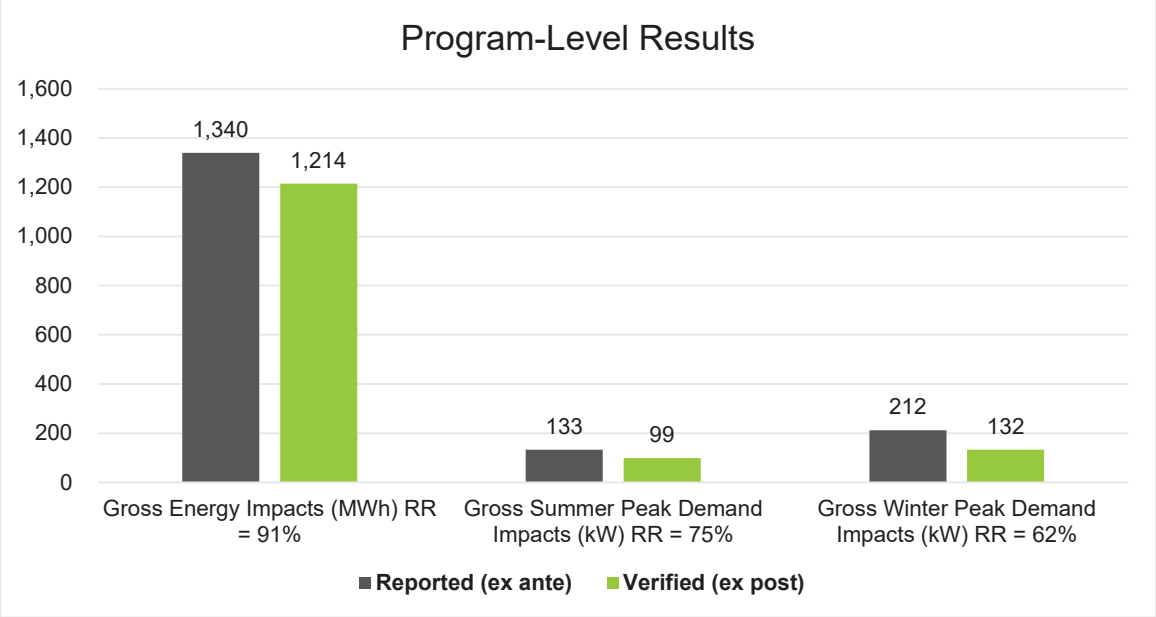
- Is the program achieving targeted energy and demand savings at the measure level?
- How do customers learn about the program, and can participation be increased?
- How is the persistence of savings impacted by participant removal of measures installed through the program?
- Are there opportunities for additional measure offerings through the program?
- Provide the effect on baseline lamp wattage from EISA, including some discussion on the projected degradation of baseline lamp wattage in future years.

4. IMPACT EVALUATION

4.1 Impact Results

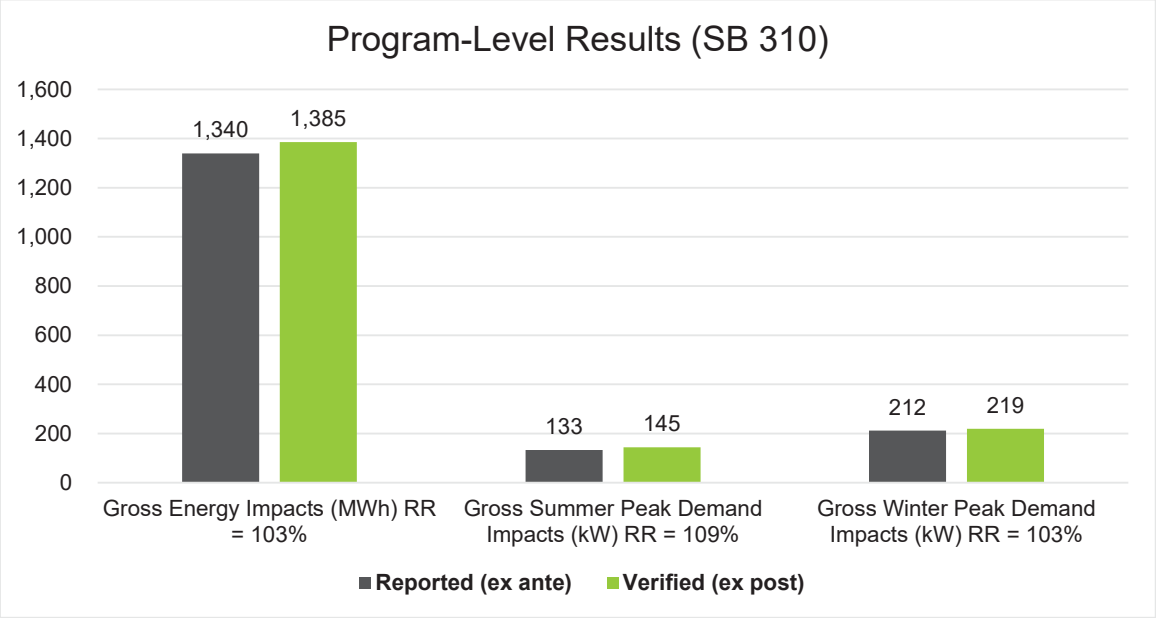
Figure 1 shows the program-level results for gross energy and demand savings, and Figure 2 shows the corresponding results using the impacts claimable under SB 310. Table 7 shows a more complete list of program-level findings, separated by the unmodified evaluation findings and those claimable by SB 310. The evaluation team calculated the results in Table 7 by multiplying the measure quantities found in the tracking database by the verified energy and demand savings estimated during the EM&V process for each measure. The net impacts were found by multiplying the gross impacts by the NTG ratio of 0.98. The NTG methodology and results are discussed in detail in Section 5 of this report. To arrive at the SB 310 adjusted results shown in Figure 2 and Table 7, Navigant used the higher of ex ante or ex post impacts for each measure.

Figure 1. Reported and Verified Gross Program-Level Impacts



Source: Navigant analysis, totals subject to rounding.

Figure 2. Reported and Verified Gross Program-Level Impacts Claimable Under SB 310



Source: Navigant analysis, totals subject to rounding.

Table 7. Summary of Program Impacts

	Energy (MWh)	Summer Coincident Demand (MW)	Winter Coincident Demand (MW)
Verified Gross Impacts	1,214	0.099	0.132
Verified Net Impacts	1,187	0.097	0.129
Verified Gross Impacts (SB 310)	1,385	0.145	0.219
Verified Net Impacts (SB 310)	1,354	0.141	0.214

Source: Navigant analysis, totals subject to rounding.

A summary of each measure's contribution to program energy savings and realization rate between reported savings and verified savings is shown in Table 8. At the measure level, there were considerable differences between ex ante and ex post impacts. This is because LEDs had not been previously evaluated for this program, and because many factors that affect the ex post calculations for water measures are different than they were during the previous evaluation cycle, which was the source for ex ante water impacts. The driving factors for these differences include:

- The availability of baseline flow rate data for water measures, and baseline wattage data for LED measures improved the impact estimates by incorporating primary data.
- Updated impact algorithms for water measures that leverage the 2015 Indiana Technical Reference Manual (TRM)[4]

[4] Navigant believes the Indiana TRM is a more robust reference than the 2010 Ohio TRM because it includes calculation parameters that are specific to the multifamily housing sector whereas the Ohio TRM does not.

Table 8. Distribution of Program Gross Energy Savings by Measure

Measure	Measure Count from Tracking Data	Total Ex Ante Savings from Tracking Data (MWh)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (MWh)	Realization Rate
A-Line LED	11,294	572	43%	552	97%
Candelabra LED	2,299	60	4%	71	119%
Globe LED	3,339	84	6%	102	121%
Bathroom Faucet Aerator	1,005	59	4%	40	67%
Kitchen Faucet Aerator	738	86	6%	103	119%
Low Flow Showerhead	944	320	24%	291	91%
Water Heater Pipe Wrap (ft)	3,077	158	12%	55	35%
Total	22,696	1,340	100%	1,214	91%

Source: Navigant analysis, totals subject to rounding.

The results for gross summer coincident demand by measure are shown in Table 9.

Table 9. Distribution of Summer Coincident Demand Savings by Measure

Measure	Total Savings from Tracking Data (kW)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (kW)	Realization Rate
A-Line LED	56	42%	45	81%
Candelabra LED	6	4%	10	183%
Globe LED	8	6%	15	194%
Bathroom Faucet Aerator	8	6%	3	36%
Kitchen Faucet Aerator	11	9%	7	60%
Low Flow Showerhead	26	20%	13	49%
Water Heater Pipe Wrap (ft)	18	14%	6	34%
Total	133	100%	99	75%

Source: Navigant analysis, totals subject to rounding.

The results for gross winter coincident demand by measure are shown in Table 10.

Table 10. Distribution of Winter Coincident Demand Savings by Measure

Measure	Total Savings from Tracking Data (kW)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (kW)	Realization Rate
A-Line LED	105	50%	72	69%
Candelabra LED	6	3%	13	228%
Globe LED	18	9%	18	100%
Bathroom Faucet Aerator	11	5%	3	25%
Kitchen Faucet Aerator	16	8%	7	42%
Low Flow Showerhead	37	17%	13	35%
Water Heater Pipe Wrap (ft)	18	9%	6	34%
Total	212	100%	132	62%

Source: Navigant analysis, totals subject to rounding.

4.2 Impact Evaluation Methodology

Navigant's methodology for evaluating the gross and net energy and demand impacts of the program included the following components:

1. Detailed review of deemed savings estimates including: engineering algorithms, key input parameters, and supporting assumptions.
2. Onsite field verification to assess measure characteristics and in-service rates (ISRs)
3. Net-to-gross (NTG) analysis
4. Incorporating supplemental impact findings from tenant surveys

4.2.1 Detailed Review of Ex Ante Deemed Savings

Navigant reviewed the ex-ante savings and supporting documentation used to estimate ex ante program impacts. Duke Energy provided Navigant with a spreadsheet containing the deemed savings estimates for LED and water measures, as well as some of the inputs used to develop those estimates. The deemed savings for LED measures are shown in Table 11 below.

Table 11. Ex Ante Savings Estimates for LED Measures

LED Measure	Annual Gross Energy Savings (kWh)	Winter Coincident Demand Impacts (kW)	Summer Coincident Demand Impacts (kW)	Annual Non-Coincident Demand Impacts (kW)
Candelabra (per lamp)	26.0	0.002	0.002	0.005
Globe (per lamp)	25.2	0.006	0.002	0.006
A-Line (per lamp)	50.7	0.009	0.005	0.011

Source: Duke Energy

Duke Energy provided Navigant with wattages from both the program LEDs and the average baseline lamps, as recorded in the sampled data by Franklin Energy, shown in Table 12.

Table 12. Baseline and Efficient Wattage Values for LEDs

Measure	Baseline Lamp Wattage	Efficient (LED) Lamp Wattage
Candelabra (per lamp)	40.0	5
Globe (per lamp)	40.6	6
A-Line (per lamp)	59.9	9

Source: Duke Energy, values subject to rounding

This is the first program evaluation since Duke Energy began offering LEDs. In the spreadsheet provided by Duke Energy, the deemed savings values were sourced from recent evaluation reports completed by a different evaluator for DEO's Online Savings Store and Free LED programs. Navigant performed a high-level review of the evaluation reports for the Online Savings Store and Free LED programs, and recommended some adjustments to the impact analysis that would be more appropriate for the Multifamily Energy Efficiency Program. A key distinction is the Multifamily Energy Efficiency Program is a direct install program targeting multifamily properties, whereas the Online Savings Store and Free LED programs rely on customer action for installation targeting primarily single-family housing sector.

Similar to the other evaluation reports and the 2015 Indiana TRM, Navigant used standard lighting equations to assess impacts for LED measures, as shown in Equation 1 and Equation 2.

Equation 1. Energy Savings Algorithm for LEDs

$$kWh\ savings = \left[\frac{(Watts_{base} - Watts_{EE})}{1000}\right] \times ISR \times HOU \times (1 + HVAC_C)$$

Equation 2. Coincident Demand Savings Algorithm for LEDs

$$kW\ savings = \left[\frac{Watts_{base} - Watts_{EE}}{1000}\right] \times ISR \times CF\ x\ (1 + HVAC_D)$$

Where the parameters are defined as:

$Watts_{base}$ = wattage of baseline lamp removed
$Watts_{EE}$ = wattage of LED lamp installed
ISR = in-service rate
HOU = annual operating hours
$HVAC_C$ = HVAC system interaction factor for energy
$HVAC_D$ = HVAC system interaction factor for demand
CF = coincidence factor (summer and winter)

Navigant's review of the LED ex ante savings found that the estimates were reasonable, but that the ex post values were likely to differ because the measures had not been evaluated before.

Duke Energy also provided Navigant with the deemed savings estimates for water measures shown in Table 13. These deemed savings were sourced from Navigant's previous 2015 evaluation of this program. Navigant also expected all ex post values to differ from these previous evaluations because Duke Energy provided Navigant with data for baseline water measure flow rates from the sample collected by Franklin Energy, and Navigant updated several impact calculation parameters (discussed in Section 4.3.2.

Table 13. Ex Ante Savings Estimates for Water Measures

Measure	Annual energy savings (kWh)	Annual Winter Coincident demand savings (kW)	Annual Summer Coincident demand savings (kW)	Annual Non-Coincident demand savings (kW)
Faucet Aerators MF Direct 1.0 GPM - bath (per aerator)	58.7	0.011	0.008	0.161
Faucet Aerators MF Direct 1.0 GPM – kitchen (per aerator)	116.8	0.022	0.015	0.320
LF Showerhead MF Direct 1.5 GPM (per showerhead)	339.0	0.039	0.028	0.929
Pipe Wrap MF Direct (per linear foot)	51.5	0.006	0.006	0.013

Source: Duke Energy

4.2.2 Onsite Field Verification and Phone Verification

Navigant performed onsite field verification at 36 housing units across 3 participating properties, as well as phone verification with 34 individual tenants at properties that received program measures. Navigant faced recruiting challenges in both the field and phone verification efforts. For field visits, some property managers who recently participated in the program didn't want to further inconvenience tenants with another verification visit. Field and phone verification efforts were designed to assess the measure characteristics as reported in the tracking data and to assess measure parameters that can be used to verify inputs and assumptions used to estimate energy and demand savings for individual measures. Table 14 shows a summary of the parameters assessed by Navigant during field verification, and used to evaluate ISRs for each measure. Table 15 shows the sample disposition for field and phone verification.

Table 14. Parameters Evaluated During Field Verification

	LEDs	Faucet Aerators	Water-saving Showerheads	Hot Water Pipe Wrap
Installed quantity	x	x	x	x
Installed wattage	x			
Flow rates (gpm)		x	x	
Water heating system characteristics		x	x	x
Water Temperatures		x	x	x
Pipe length				x
Measure location	x	x	x	x

Table 15. Field and Phone Verification Sample

Program Measure	Number of Housing Units in Sample	Number of Measures Reported in Sample
LEDs	64	591
Bathroom Faucet Aerators	37	47
Kitchen Faucet Aerators	43	43
Showerheads	43	48
Pipe Wrap	30	169 ft

Source: Navigant analysis

A summary of findings from field verification is included in Section 4.3.

4.2.3 Tenant Surveys

Navigant incorporated supplemental findings from 34 tenant phone surveys to inform the impact analysis where applicable. The findings from the tenant surveys will be addressed later in this report.

4.3 Impact Evaluation Findings

The impact evaluation findings for lighting measures and water measures are discussed separately.

4.3.1 LED Lighting Measures

Table 16 shows a summary of Navigant's ex-post, verified findings for LEDs. To calculate verified energy and demand impacts, Navigant applied the parameters from Table 16 to the algorithms from Equation 1 and Equation 2.

Table 16. Summary of LED findings

Evaluation Parameter	Source	A-Line	Candelabra	Globe
In-Service Rate	Navigant field and phone verification	0.97	1.00	1.00
Baseline Lamp Wattage	Duke Energy	60	40	41
Efficient Lamp Wattage	Navigant field verification	9	5	6
Annual Operating Hours	2018 Evaluation Report of DEO's Online Savings Store and Free LED programs	1,001	888	888
Summer Coincidence Factor	2018 Evaluation Report of DEO's Online Savings Store and Free LED programs	0.07	0.11	0.11
Winter Coincidence Factor	2018 Evaluation Report of DEO's Online Savings Store and Free LED programs	0.13	0.16	0.16
$HVAC_C$	2018 Evaluation Report of DEO's Online Savings Store and Free LED programs	-0.0058	-0.0058	-0.0058
$HVAC_D$ (summer)	2018 Evaluation Report of DEO's Online Savings Store and Free LED programs	0.167	0.167	0.167
$HVAC_D$ (winter)	2018 Evaluation Report of DEO's Online Savings Store and Free LED programs	0	0	0
Gross Energy Savings Per Lamp (kWh)		48.9	30.9	30.5
Gross Summer Coincident Demand Savings Per Lamp (kW)		0.0040	0.0045	0.0044
Gross Winter Coincident Demand Savings Per Lamp (kW)		0.0064	0.0056	0.0055

Source: Navigant analysis, totals subject to rounding

The evaluated impacts per lamp shown in Table 16 differ from the deemed impacts shown in Table 11. SB 310 indicates that DEO can claim the higher of the two impacts for each measure. Table 17 shows the impacts claimable for each LED measure under SB 310, which include the higher impact for each measure from Table 11 or Table 16.

Table 17. LED Impacts Claimable Under SB 310

Program Measure	A-Line	Candelabra	Globe
Gross Energy Savings Per Lamp (kWh)	50.7	30.9	30.5
Gross Summer Coincident Demand Savings Per Lamp (kW)	0.0049	0.0045	0.0044
Gross Winter Coincident Demand Savings Per Lamp (kW)	0.0093	0.0056	0.0055

Source: Navigant analysis, totals subject to rounding

4.3.1.1 In-Service Rate

At the 36 housing units inspected by Navigant that had LEDs, there were a total of 262 reported program LEDs in the tracking database. During the inspections, Navigant found 257 of the program LEDs. Additionally, during phone surveys with tenants, Navigant interviewed customers representing an additional 329 LEDs, and respondents indicated having removed 10 program LEDs for reasons ranging from burnout to personal preference. Navigant used a weighted average to combine the ISR from field verification with the ISR from phone surveys to calculate a final ISR.

4.3.1.2 Wattage

Duke Energy provided Navigant with wattage data from lamps removed during the retrofit process. This data was collected by Franklin Energy from a sample of participant sites. Since this program is a direct install program, we used this data for the baseline wattage in the impact calculations.

4.3.1.3 Waste Heat and Coincidence Factors

Navigant used the waste heat factors from the DEO's 2018 evaluation of the Online Savings Store and Free LED programs.

4.3.1.4 Lighting Hours of Use

Navigant used the annual hours of use from the DEO's 2018 evaluation of the Online Savings Store and Free LED programs. Those evaluations included lighting logger studies in the DEO territory, and results were similar to those found in the 2015 Indiana TRM.

4.3.1.5 Effect of Baseline Wattage Requirements for EISA

Due to the EISA standards and changing market for lighting, the baseline wattage for energy efficiency lighting programs will continue to decrease. If Duke Energy continues to collect baseline wattage information from removed lamps during the retrofit process, Navigant believes it is reasonable to use those values in future evaluations as necessary because this is a direct install program. In the absence of baseline data, it will be reasonable to incorporate EISA standards into baseline wattage values.

4.3.2 Water Flow Regulation Measures

For field verification of program water measures, Navigant collected information to validate the efficiency characteristics of the equipment. This included verifying the reported number of measures and specified flow rates of the retrofit equipment.

4.3.2.1 In-Service Rate

The ISRs for water measures are shown in Table 18. These were calculated using a weighted average of results from the onsite field verification inspections and the tenant phone surveys.

Table 18. In-Service Rates for Water Measures

Measure	ISR
Kitchen aerators	0.95
Bathroom aerators	0.87
Showerheads	0.98
Pipe wrap	0.96

Source: Navigant analysis, values subject to rounding

4.3.2.2 Energy Savings

To calculate verified savings for aerators and showerheads, Navigant used the algorithms from the 2015 Indiana Technical Reference Manual, shown in Equation 3, Equation 4, Equation 5 and Equation 6.[5] Navigant subsequently applied inputs collected during field verification or assumptions as listed below in Table 19. The resulting estimates for impacts of aerators and showerheads are presented in Table 20.

Equation 3. Algorithm for Calculating Energy Savings for Faucet Aerators

$$\textit{Annual kWh savings faucet aerators} = ISR \times (GPM_{base} - GPM_{low}) \times \text{MPD} \times \frac{PH}{FH} \times DR \times 8.3\frac{Btu}{gal\cdot°F} \times (T_{mix} - T_{in}) \times \frac{365\frac{days}{yr}}{RE \times 3,412}$$

Equation 4. Algorithm for Calculating Energy Savings for Showerheads

$$\textit{Annual kWh savings for low flow showerheads} = ISR \times (GPM_{base} - GPM_{low}) \times MS \times SPD \times \frac{PH}{FH} \times 8.3\frac{Btu}{gal\cdot°F} \times (T_{mix} - T_{in}) \times \frac{365\frac{days}{yr}}{RE \times 3,412}$$

Equation 5. Algorithm for Calculating Coincident Demand Savings for Faucet Aerators

$$\textit{Coincident kW savings for faucet aerators} = ISR \times (GPM_{base} - GPM_{low}) \times 60 \times DR \times 8.3\frac{Btu}{gal\cdot°F} \times \frac{(T_{mix} - T_{in})}{RE \times 3,412} \times CF$$

Equation 6. Algorithm for Calculating Coincident Demand Savings for Showerheads

$$\textit{Coincident kW savings for low flow showerheads} = ISR \times (GPM_{base} - GPM_{low}) \times 60 \times 8.3\frac{Btu}{gal\cdot°F} \times \frac{(T_{mix} - T_{in})}{RE \times 3,412} \times CF$$

[5] Navigant believes the Indiana TRM is the most appropriate regional source to use for this evaluation because it includes calculation parameters that are specific to the multifamily housing segment.

Table 19. Input Parameters and Assumptions for Aerator Savings Calculations

Input	Definition	Value	Source
ISR	In-service rate	Refer to Table 18	Navigant field verification and phone surveys
GPM_{base}	Baseline flow rate	Bathroom Aerators 2.0 Kitchen Aerator 2.2 Shower 2.5	Data Provided by Duke Energy from Franklin Energy Sample
GPM_{low}	Retrofit flow rate	Bathroom Aerators 1.0 Kitchen Aerator 1.0 Shower 1.5	Navigant field verification[a]
MPD	Minutes of aerator use per day	Kitchen 4.5 Bathroom 1.6	2015 Indiana TRM
MS	Minutes of shower use per person per shower	7.8	2015 Indiana TRM
PH	Number of people per household	1.83	2015 Indiana TRM
FH	Average number of aerators or showerheads per household	Kitchen 1.0 Bathroom 1.1 Shower 1.0	Navigant field verification
SPD	Number of showers per person per day	0.6	2015 Indiana TRM
DR	Percent of water flowing down drain	Kitchen 50% Bathroom 70% Shower 100%	2015 Indiana TRM
T_{mix}	Temp of water flowing from faucets (F)	Kitchen 93 Bathroom 86 Shower 101	2015 Indiana TRM
T_{in}	Temp of water entering water heater (F)	60	Building American Benchmark annual mains temp for Cincinnati
RE	Recovery efficiency of water heater	0.98	2015 Indiana TRM
CF	Coincidence Factor	Kitchen 0.0033 Bathroom 0.0012 Shower 0.0023	2015 Indiana TRM
60	Minutes per hour		

a. *Navigant measured flow rates during onsite field verification and found them to be lower than the nameplate value of the program devices. However, since the baseline values provided by Duke Energy are also nameplate and the Indiana TRM equation does not include a throttling factor, Navigant used the nameplate flow rates for impact calculations.*

Table 20. Verified Per Unit Impacts for Aerators and Showerheads[6]

Measure	Kitchen aerator (1.0 GPM)	Bathroom aerator (1.0 GPM)	Low flow showerhead (1.5 GPM)
Gross Energy Savings Per Device (kWh)	139.3	39.5	308. 8
Gross Summer Coincident Demand Savings Per Device (kW)	0.0092	0.0028	0.0136
Gross Winter Coincident Demand Savings Per Device (kW)	0.0092	0.0028	0.0136

Source: Navigant analysis, values subject to rounding

The evaluated impacts for aerators and showerheads shown in Table 20 differ from the ex-ante values shown in Table 13. SB 310 indicates that DEO can claim the higher of the two impacts for each measure. Table 21 shows the impacts claimable for each measure under SB 310, which include the higher impact for each measure from.

Table 21. Aerator and Showerhead Impacts Claimable Under SB 310

Measure	Kitchen aerator (1.0 GPM)	Bathroom aerator (1.0 GPM)	Low flow showerhead (1.5 GPM)
Gross Energy Savings Per Device (kWh)	139.3	58.7	339.0
Gross Summer Coincident Demand Savings Per Device (kW)	0.0154	0.0077	0.0279
Gross Winter Coincident Demand Savings Per Device (kW)	0.0221	0.0111	0.0390

Source: Navigant analysis, values subject to rounding

4.3.3 Water Heater Pipe Wrap

During field verification, Navigant found some instances where pipe wrap was installed at lengths greater than three feet on the cold water pipe. Industry standards are to install pipe wrap on all hot water pipes, and only the first three feet of the cold-water pipe because savings are minimal from insulating cold water pipes.[7] Therefore, when calculating the ISR, Navigant did not attribute savings to greater than three feet of pipe wrap installed on cold water pipes.

To estimate impacts from the pipe wrap measure, Navigant used algorithms from the 2015 Indiana TRM shown in Equation 7 and Equation 8 below. The ex-post impacts are shown Table 22.

Equation 7. Energy savings for water heater pipe wrap

$$\Delta kWh = ISR \times \left(\frac{1}{R_e} - \frac{1}{R_n}\right) \times (L \times C) \times \Delta T \times 8760 \div nDHW \div 3413$$

[6] The program may offer aerators and showerheads at other flow rates in the future. However, the tracking data indicated that 100 percent of the water measures installed during the period covered by this evaluation cycle were the flow rates shown in **Table 20**, so a verified savings are shown here for only those measures.

[7] In apartments, Navigant recognizes there's a higher likelihood of limited exposed pipe, therefore pipe wrap may be found on both the hot and cold inlet pipes. http://www.energy.gov/energysaver/projects/savings-project-insulate-hot-water-pipes-energy-savings

Equation 8. Demand savings from water heater pipe wrap

$$\Delta kW = \Delta kWh \div 8760$$

The following list defines the parameters used in the equations above:

ISR = in-service rate (0.96 from Navigant field and phone verification)
R_e = R-value of existing, uninsulated pipe (R = 1 from Indiana TRM)
R_n = insulation R-value of pipe after retrofit (R = 3 from Indiana TRM)
L = length of pipe (per foot)
C = circumference of pipe (Navigant assumed average of 0.5" and 0.75" diameter pipe)
ΔT = temperature difference between water in pipe and ambient air (65F from Indiana TRM)
nDHW = heat recovery efficiency (0.98 from Indiana TRM)
3,413 = conversion from Btu to kWh

Table 22. Verified Impacts for Water Heater Pipe Wrap

Measure	Water Heater Pipe Wrap (per foot)
Gross Energy Savings Per Foot (kWh)	17.8
Gross Summer Coincident Demand Savings Per Foot (kW)	0.0020
Gross Winter Coincident Demand Savings Per Foot (kW)	0.0020

Source: Navigant analysis, values subject to rounding

Table 23 shows the pipe wrap impacts claimable under SB 310, which match the ex-ante values shown in Table 13 because the ex-ante values are the higher of the two.

Table 23. Pipe Wrap Impacts Claimable Under SB 310

Measure	Water Heater Pipe Wrap (per foot)
Gross Energy Savings Per Foot (kWh)	51.5
Gross Summer Coincident Demand Savings Per Foot (kW)	0.0059
Gross Winter Coincident Demand Savings Per Foot (kW)	0.0059

Source: Navigant analysis, values subject to rounding

5. NET-TO-GROSS ANALYSIS

Navigant conducted an NTG analysis to estimate the share of program savings that can be attributed to participation in or influence from the program. Table 24 shows the results of Navigant's NTG analysis. Navigant anticipated low free ridership and spillover given that the program is structured to offer energy efficient equipment at no cost to multifamily housing units, which are typically not owner-occupied. The results shown here are in line with expectations and very similar to our previous evaluations of this program. Navigant chose to present a program-level NTG ratio rather than measure level due to the difficulty in estimating spillover by measure. Navigant believes it is more appropriate to present the NTG ratio in aggregate.

Table 24. NTG Results

Estimated Free Ridership	3.5%
Estimated Spillover	1.3%
Estimated NTG	0.98

Source: Navigant analysis, values subject to rounding

5.1 Overview of Net-to-Gross Methodology

As indicated in the evaluation plan, Navigant used a survey-based, self-report methodology to estimate free ridership and spillover for the Multifamily Energy Efficiency Program. A self-report approach is outlined in the Universal Methods Protocol (UMP), and Navigant has previously used this method to estimate a NTG ratio for several other Duke Energy programs. Navigant primarily targeted property managers for the NTG surveys, because they are the decision makers for participation in the program.[8] Navigant also incorporated supplemental data gathered during tenant phone surveys into the analysis.

5.1.1 Definitions of Free Ridership, Spillover, and NTG Ratio

The methodology for assessing the energy savings attributable to a program is based on a NTG ratio. The NTG ratio has two main components: free ridership and spillover.

Free ridership is the share of the gross savings that is due to actions participants would have taken anyway (i.e., actions that were not induced by the program). This is meant to account for naturally occurring adoption of energy efficiency measures. The Multifamily Energy Efficiency Program and most other Duke Energy programs cover a wide range of energy efficiency measures and are designed to advance the overall energy efficiency market. However, it is likely that, for various reasons, some participants would have wanted to install some high-efficiency measures even if they had not participated in the program or been influenced by the program in any way.

Spillover captures program savings that go beyond the measures installed through the program. Also called market effects, the term spillover is often used because it reflects savings that extend beyond the bounds of the program records. Spillover adds to a program's measured savings by incorporating indirect (i.e., non-incentivized) savings and effects that the program has had on the market above and beyond the directly incentivized or directly induced program measures.

[8] Navigant recognizes that some property managers may have been instructed to participate by higher-level decision makers at the corporate level. Although we do not think this was the case very often, we do think that the local property managers were still privy to the decision-making process.

The overall NTG ratio accounts for both the net savings at participating projects and spillover savings that result from the program but are not included in the program's accounting of energy savings. When the NTG ratio is multiplied by the estimated gross program savings, the result is an estimate of energy savings that are attributable to the program (i.e., savings that would not have occurred without the program). The NTG formula is shown in Equation 9:

Equation 9. Net-to-Gross Formula

$$NTG = 1 - free\ ridership + spillover$$

The underlying concept inherent in the application of the NTG formula is that only savings caused by the program should be included in the final net program savings estimate but that this estimate should include all savings caused by the program.

5.1.2 Estimating Free Ridership

Data to assess free ridership was gathered through the self-report method using a series of survey questions asked to the property managers at participating properties. The survey assessed free ridership using both direct questions, which aimed to obtain respondent estimates of the appropriate free ridership rate that should be applied to them, and supporting or influencing questions, which could be used to verify whether the direct responses were consistent with participants' views of the program's influence.

Each respondent to the survey provided perspectives on the measures that they had installed through the program. The core set of questions addressed the following three categories:

- **Likelihood:** To estimate the likelihood that they would have incorporated measures "of the same high level of efficiency," if not for the assistance of the program. In cases where respondents indicated that they might have incorporated some but not all of the measures, they were asked to estimate the share of measures that would have been incorporated anyway at high efficiency. This flexibility in how respondents could conceptualize and convey their views on free ridership allowed respondents to give their most informed response, thus improving the accuracy of the free ridership estimates.
- **Prior planning:** To further estimate the probability that a participant would have implemented the measures without the program. Participants were asked the extent to which they had considered installing the energy efficient measure prior to participating in the program. The general approach holds that if customers were not definitively planning to install all of the efficiency measures prior to participation then the program can reasonably be credited with at least a portion of the energy savings resulting from the high-efficiency measures. Strong free ridership is reflected by those participants who indicated they had already allocated funds for the purchase and selected the equipment and an installer.
- **Program importance:** To clarify the role that program components (e.g., information, incentives) played in decision-making and to provide supporting information on free ridership. Responses to these questions were analyzed for each respondent, not just in aggregate, and were used to identify whether the direct responses on free ridership were consistent with how each respondent rated the influence of the program.

Free ridership scores were calculated for each of the three categories.[9] Navigant then calculated a weighted average from each respondent based on their share of sample energy savings, and divided by 100 to convert the scores into a free ridership percentage. Next, a timing multiplier was applied to the average of the three scores to reflect the fact that respondents indicating that their energy efficiency actions would not have occurred until far into the future may be overestimating their level of free ridership. Participants were asked when they would have installed the equipment without the program. Respondents who indicated that they would not have installed the equipment for at least two years were not considered free riders and received a timing multiplier of 0.[10] If they would have installed at the same time as they did, they received a timing multiplier of 1; within one year, a multiplier of 0.67; and between one and two years, a multiplier of 0.33. Participants were also asked when they learned about the financial incentive; if they learned about it after the equipment was installed then they received a timing multiplier of 1.

5.1.3 Estimating Spillover

The basic method for assessing participant spillover was an approach that asked a set of questions to determine the following:

- **Whether spillover exists at all.** These were yes-or-no questions that asked, for example, whether the respondent incorporated energy efficiency measures or designs that were not recorded in program records and did not receive any rebates from Duke Energy.
- **The savings that could be attributed to the influence of the program.** Participants were asked to list the extra measures they installed, and the evaluation team assigned a savings value. See below for the method of assigning savings.
- **Program attribution***.* Estimates were derived from a question asking the program importance on a 0 to 10 scale. Participants were also asked how the program influenced their decisions to incorporate additional energy efficiency measures.

If respondents said no, they did not install additional measures, they were assigned a 0 score for spillover. If they said yes, then Navigant estimated the energy spillover savings on a case-by-case basis.

[9] Scores were calculated by the following formulas:

- Likelihood: The likelihood score is 0 for those that "definitely would NOT have installed the same energy efficient measure" and 1 for those that "definitely WOULD have installed the same energy efficient measure." For those that "MAY HAVE installed the same energy efficient measure," the likelihood score is their answer to the following question: "On a scale of 0 to 10, where 0 is DEFINITELY WOULD NOT have installed and 10 is DEFINITELY WOULD have installed the same energy efficient measure, can you tell me the likelihood that you would have installed the same energy efficient measure?" If more than one measure was installed in the project, then this score was also multiplied by the respondent's answer to what share they would have done.
- Prior Planning: If participants stated they had considered installing the measure prior to program participation, then the prior planning score is the average of their answers to the following two questions: "On a scale of 0 to 10, where 0 means you 'Had not yet planned for equipment and installation' and 10 means you 'Had identified and selected specific equipment and the contractor to install it,' please tell me how far along your plans were" and "On a scale of 0 to 10, where 0 means 'Had not yet budgeted or considered payment' and 10 means 'Already had sufficient funds budgeted and approved for purchase,' please tell me how far along your budget had been planned and approved."
- Program Importance: This score was calculated by taking the maximum importance on a 0 to 10 scale of the four program importance questions and subtracting from 10 (i.e., the higher the program importance, the lower the influence on free ridership).

[10] Navigant believes a two-year horizon is appropriate for assessing free ridership as it likely reduces certain types of bias and it becomes difficult for respondents to predict behavior beyond that horizon.

It is important to note that although free ridership questions were only asked of property managers, Navigant surveyed both property managers and tenants for spillover.[11]

5.1.4 Combining Results Across Respondents

The evaluation team determined free ridership estimates for each of the following:

- Individual respondents, by evaluating the responses to the relevant questions and applying the rules-based approach discussed above.
- The program as a whole, by taking a weighted average of the individual results based on each respondent's share of reported energy savings.

5.2 Results for Free Ridership, Spillover, and Net-to-Gross

5.2.1 Review of Data Collection Efforts for Attribution Analysis

Surveys were conducted with decision makers to provide the information to estimate free ridership, and thus, NTG ratios. Navigant completed surveys with 4 property managers, who represented 5 of the 18 participating properties.[12]

5.2.2 Free Ridership Results

As described above, surveyed participants responded to a series of questions intended to elicit explicit estimates of free ridership, as well as ratings of program influence. Estimates are based on questions regarding the likelihood, scope, and timing of the investments in energy efficiency if the respondent had not participated in the program. For the Multifamily Energy Efficiency Program, free ridership was estimated at 3.5 percent, which is in-line with other evaluations of direct install programs.

Navigant developed the free ridership estimate presented above based on responses to a variety of questions that related to survey respondents' intentions prior to participating in the program and to the influence of the program itself. Below are summaries by scoring component.

Prior Planning: Two of the respondents indicated they had some level of prior plans for installing some of the energy efficient measures, but both indicated their plans were not well-developed. The other two respondents indicated that they did not have plans.

Program Importance: Respondents stated that the program was very important in having the measures installed. All property managers noted that their decision to install energy efficient equipment at their property was highly influenced by Duke Energy's program.

Likelihood: Respondents were asked in the absence of the program, if they would have had at least some of the work done. One respondent stated they "definitely would have" installed the water measures in the absence of the program because he/she was responsible for water payments, and three said they "definitely would not have" installed any measures in the absence of the program.

[11] The reason for not assessing free ridership at the tenant level is because tenants generally participated in the program via their property managers rather than personal choice. It is possible that tenants would have installed the same measures themselves, but Navigant does not believe they should be considered free riders to the program because the timing of those installations would have been difficult to evaluate and tenants would still have the ability to install LEDs in non-retrofitted fixtures. If a tenant already had equivalent measures in place, it is unlikely that the implementer would have replaced them with program measures.

[12] One property manager was responsible for two properties.

Timing: The respondent who stated they would have done some of the work in the absence of the program stated the installation would have occurred within one year, but that the work would have only applied to water measures and not LED measures.

In summary, respondents indicated that the program was very important in their decisions to have the energy efficient measures installed. Some indicated that they did have some prior plans to install the measures, and the free ridership estimates account for those responses.

5.2.3 Spillover Results

One of the surveyed property managers indicated that the program influenced him/her to install additional, non-incentivized energy efficiency measures at the property. The additional measures included a small number of LEDs in outdoor spaces. In addition to the one property manager reporting spillover, a few tenants reported installing a small number of LEDs and reducing the hours they use their lights as a result of participating in the program.

Navigant estimated spillover from the equipment reported by property managers and tenants by applying simple engineering equations along with the self-reported measure quantities and characteristics. Navigant calculated the total spillover to be 1.3 percent.

5.2.4 NTG Results

The NTG ratio was calculated as written in Equation 10:

Equation 10. Net-to-Gross Ratio

$$NTG = 1 - free\ ridership + spillover = 1 - 0.035 + 0.013 = 0.978$$

This suggests that for every one kWh reduced from program measures, about 0.98 kWh of savings can be directly attributed to the program.

6. PROCESS EVALUATION

Navigant conducted a process evaluation of the Multifamily Energy Efficiency Program to assess program delivery and customer satisfaction. The process findings summarized in this section are based on the results of customer surveys with 34 program participants, and detailed surveys with 4 property managers. The property manager interviews and tenant surveys were also used to inform the NTG analysis.

6.1 Key Findings

Overall, property managers and tenants are pleased with the program. Some key findings from the property manager interviews and tenant phone surveys are listed below:

- Most tenants (71 percent) learned about the program through their property managers, while about 3 percent of tenants reported learning about the program through Duke Energy's website. Some participants also recall learning about the program because they saw representatives onsite, indicating that onsite visits are an effective way of marketing the program and reaching new customers.
- 32 percent of tenants reported they noticed savings on their energy bills since the installation of the measures, but 26 percent are unsure if their bill has decreased. The phone survey was conducted shortly after the measure installations at some properties, meaning some customers may not have recognized savings at the time of the survey.
- A majority of program tenants were satisfied with the program. On a scale of 0 to 10, where 0 indicates "very dissatisfied" and 10 indicates "very satisfied":
    - About 62 percent of tenants reported an 8 -10 satisfaction score with the overall program. The mean satisfaction score was 8.1 out of 10.
    - About 71 percent of tenants indicated 8 - 10 for satisfaction with the installer's quality of work.
    - About 79 percent of tenants indicated 8 - 10 for satisfaction with Duke Energy.
- High satisfaction ratings by tenants were often associated with money savings as the primary benefit. Low satisfaction ratings were often associated with complaints about the equipment, such as low water pressure and water spray from aerator measures.
- Tenant satisfaction was higher for pipe wrap and kitchen faucet aerators than for LEDs, low flow showerheads and bathroom faucet aerators.
- On a scale of 0 to 10, where 0 indicates "very dissatisfied" and 10 indicates "very satisfied", the average satisfaction rating from property managers was 7.8 for the program.
- Property managers expressed high satisfaction with the free program measures and free installation by an external contractor. Property managers noted the contractor's quality of work as "efficient."
- Three out of the four property managers mentioned they were slightly frustrated with the number of requests to audit the installation of program measures.
    - "It seems like there are a lot of people wanting to come back to review. I have to keep bothering the tenants. A third party has gone onsite twice to audit this year."
    - "There were multiple requests to come back and get into the units."

- One property manager indicated that installation staff did not properly install aerator equipment, which resulted in leaks.
- General suggestions for program improvement from property managers and maintenance staff included adding exterior or common space lighting.

6.2 Documentation Review

Navigant requested program documentation and tracking data to conduct a complete review of current processes. The program tracking data was sufficient to identify the measure characteristics and quantities of installed measures for each tenant at the participating properties.

Navigant performed a detailed review of the following:

Multifamily Energy Efficiency Program Direct Installation Service Agreement – this document provides a reasonable summary of program expectations, eligibility requirements for each measure, and customer responsibilities. However, it does not include any mention of subsequent EM&V activities, which may be an added benefit for facilitating efficient EM&V.

Site Assessment Reports – these documents include a summary of program measure characteristics and facility floorplan information for each participating property.

6.3 Coordination with Duke Energy Program Manager and Franklin Energy Implantation Staff

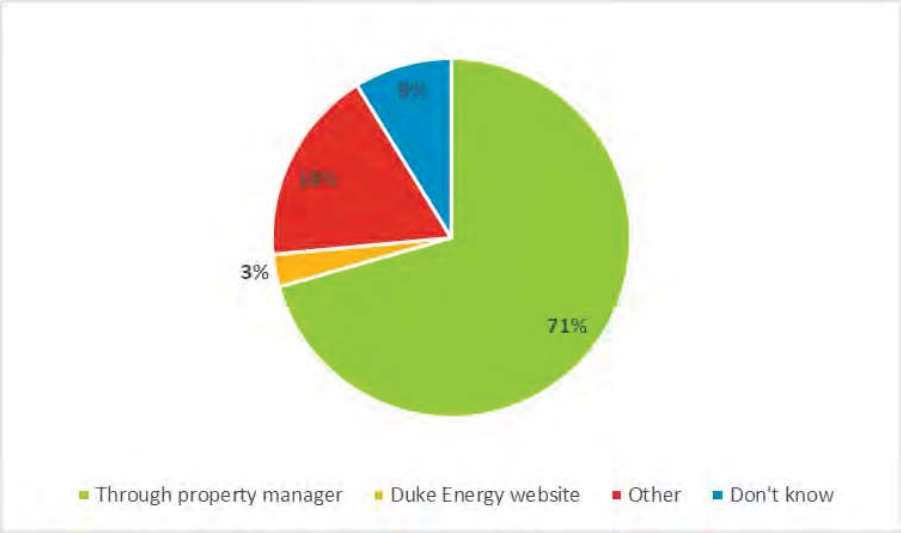
Navigant coordinated with Duke Energy's program manager and Franklin Energy implementation staff while recruiting for onsite field verification. Both were helpful with assisting Navigant in customer outreach for EM&V.

6.4 Tenant Surveys

Navigant conducted phone surveys with 34 residential tenants to assess program satisfaction. Navigant had the goal of receiving 60 survey responses. However, due to limited sample and numerous call back attempts through a survey house, overall survey completes fell short of the target. The surveys contained a number of questions to assess satisfaction with program participation, satisfaction with new equipment, as well as questions to assess measure baseline and any measures removed by the tenant after participation. This section discusses findings gleaned from survey results.

It is critical for programs to be aware of their marketing channels, as outreach leads to continued participation, so several questions in the tenant survey and property manager interviews were included to address this. Figure 3 show how tenants learned about the program. Survey results showed tenant participants were asked to indicate all of the sources through which they learned about the program, and about 71 percent indicated they had learned about the program through property managers as would be expected given the program model and design. Tenants also indicated they learned about the program through Duke Energy's website, and other resources, which includes mail, phone, and in-person installers who visit the location to install equipment.

Figure 3. How Tenant Learned About the Program (n=34)



Source: Navigant analysis, values subject to rounding

Survey results revealed customer satisfaction with the program is high. On a scale of 0 to 10, where 0 indicates "very dissatisfied" and 10 indicates "extremely satisfied," about 6 out of 10 tenants rated satisfaction with the program as an 8-10 as shown in Figure 4. The average overall tenant satisfaction rating with the program was 8.1 out of 10. Verbatim responses reflected this high satisfaction rating.

- "I think it is a great thing to do. I save money and it's good for the environment."
- "Because it has saved me money on my bill, dramatically."

Some participants ranked their overall satisfaction low because they disliked the products or did not recognize monetary savings from their participation.

- "Duke Energy doesn't send out notices, practical mathematical numbers regarding what you should see as expected in energy savings. They don't tell you what kind of LEDs you are getting."
- "Because, again, I knew about the equipment long before [the] landlord [participated in the] program, and the [LEDs I bought myself] are better."
- "I don't have many complaints. I did not give it a 10 because I did not see any cut back on energy."

Figure 4. Tenant Satisfaction with Overall Program Experience (n=34)

Source: Navigant analysis, values subject to rounding

Tenant satisfaction with the contractor quality of work was also high, as shown by Figure 5. The mean satisfaction rating for the contractor's quality of work was 8.6 out of 10. No participant expressed dissatisfaction with the quality of the installation.

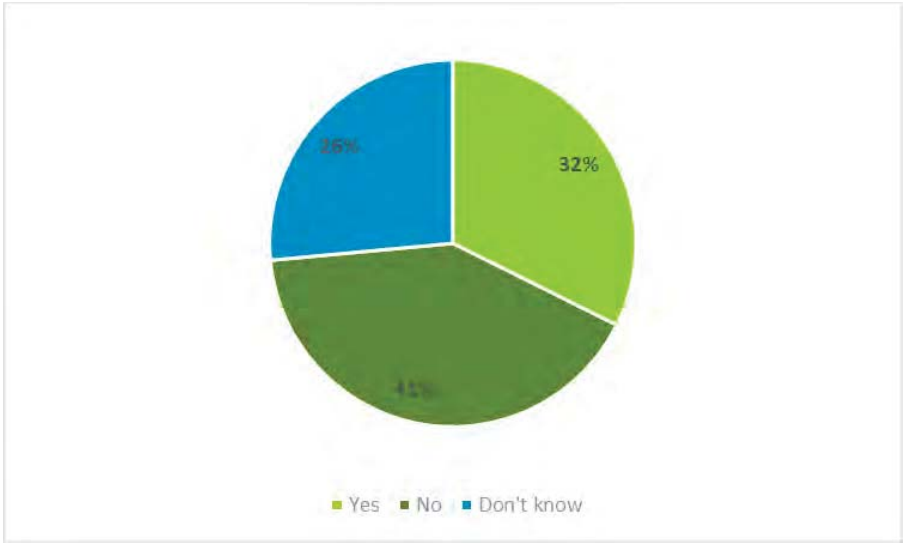
Figure 5. Tenant Satisfaction with Contractor's Quality of Work (n=34)

Source: Navigant analysis, values subject to rounding

As shown in Figure 6, 32 percent of tenants noticed a decrease in their energy bills after the new measures were installed, while 26 percent are unsure if they are saving energy. The surveys were conducted shortly after the measure installations at some properties, which may explain why some tenants may not have recognized monetary savings. Nevertheless, 41 percent of tenants did not notice a

decrease in their bill. This represents an opportunity for Duke Energy to communicate energy savings to tenants and help provide them with guidance and tips to save energy and water after the new measure have been installed in their home.

Figure 6. Tenants Who Noticed a Decrease in Their Energy Bill After Installing Program Measures (n=34)



Source: Navigant analysis, values subject to rounding

While a majority of tenants were satisfied with the new measures, some were not. Navigant asked the tenants to rate their satisfaction for each measure installed in their home. Average satisfaction ratings ranged across the product offering. Pipe wrap received the highest overall satisfaction rating, 8.3 out 10. On the other hand, bathroom faucet aerators received the lowest satisfaction rating, 7.7 out of 10.

Figure 7. Tenant Satisfaction Rating for Each Measure

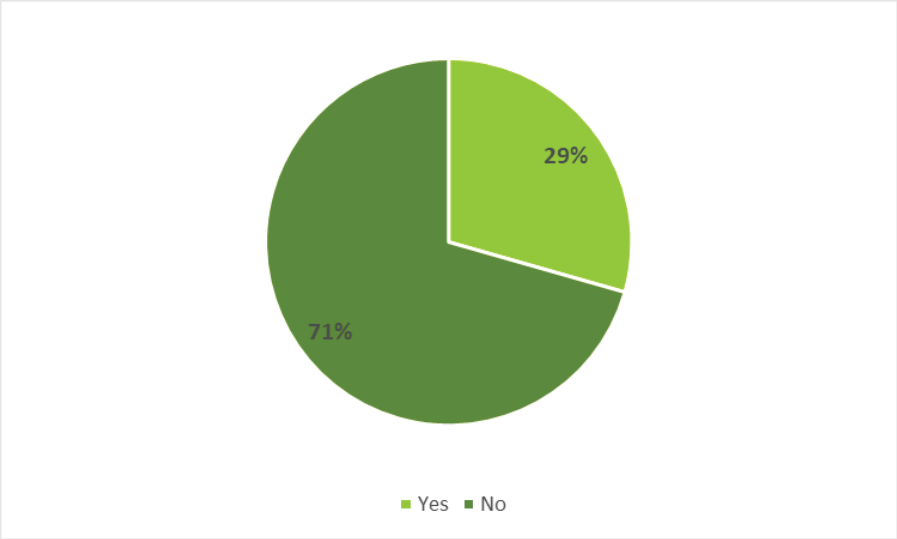
Source: Navigant analysis, values subject to rounding. Don't know responses were excluded from analysis.

Tenants expressed slight dissatisfaction with bathroom and kitchen faucet aerators as well as low flow showerheads due to poor water pressure or leaks. Some respondents were less satisfied with the LEDs because they disliked dim lighting. However, these were isolated responses, and overall customers are pleased with the products.

Despite slight dissatisfaction with some program measures, a small percentage of tenants reported removing some of their program measures. Three respondents reported removing a total of 10 LEDs, for a few different reasons. One respondent removed lamps because they burned out. One respondent removed lamps because they were not bright enough. One respondent disliked the quality of the product. Although some tenants expressed dissatisfaction for low flow showerheads and bathroom faucet aerators, LEDs were the only type of program measure that customers removed.

As a result of particpation in the program, some tenants (29 percent) purchased additional energy efficiency equipment where they did not receive a rebate, as shown in Figure 8.

Figure 8. Tenants Who Purchased Additional Energy Efficient Equipment (n = 10)



Source: Navigant analysis, values subject to rounding.

Of the tenants who reported purchasing additional energy efficient equipment, most tenants (60 percent) indicated they made a behavior change, while 30 percent purchased additional LEDs. The primary motivation for customers decision to purchase additional equipment and to change their behavior is to save energy and money.

When asked how important program participation was in their decision to install additional energy efficiency measures, the mean importance rating was 6.2 out of 10, indicating that the program partially influenced tenants. As discussed previously, Navigant incorporated these responses into the spillover calculations used in the NTG analysis.

6.4.1.1 Participant Suggestions

Navigant also included a question in the tenant satisfaction survey that allowed respondents to offer suggestions for improving the program. About 21 percent of respondents offered suggestions, which can be summarized as follows:

- Several respondents asked for more information about the program and better advertising of the program.
- Two tenants requested that different types of light be offered through the program, but did not offer specific suggestions.
- One respondent suggested having a different type of showerhead available as the low flow showerhead product had inconsistent water pressure.
- One respondent requested offering windows as a new program measure.

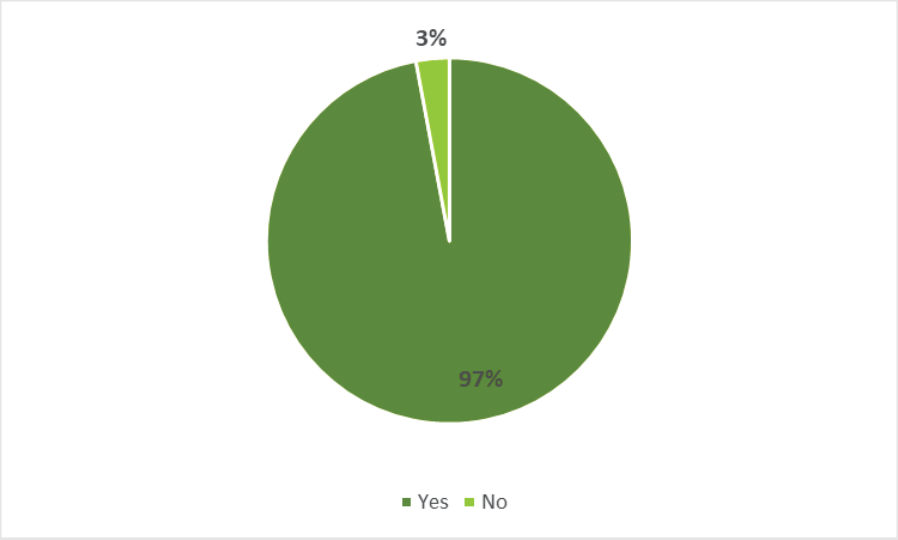
6.4.1.2 Participant Familiarity with Duke Energy

Navigant asked tenants a series of questions about their perception of Duke Energy and their awareness of other Duke Energy programs. As shown in Figure 9, 97 percent of respondents said they consider Duke Energy as a resource for energy efficiency information, positively reflecting on the utility. When asked why they consider Duke Energy to be a resource for information, verbatim responses indicated that tenants trust Duke Energy to provide them with exceptional customer service and reliable information.

- "I would say because they never let me down."
- "When I call them and work with them, they give you knowledgeable information."
- "Because they take the initiative to change all the lights and the water and to save money on energy."

One respondent, did not consider Duke Energy to be a trusted resource, indicating they, "don't trust I am getting the best rate for the services I get."

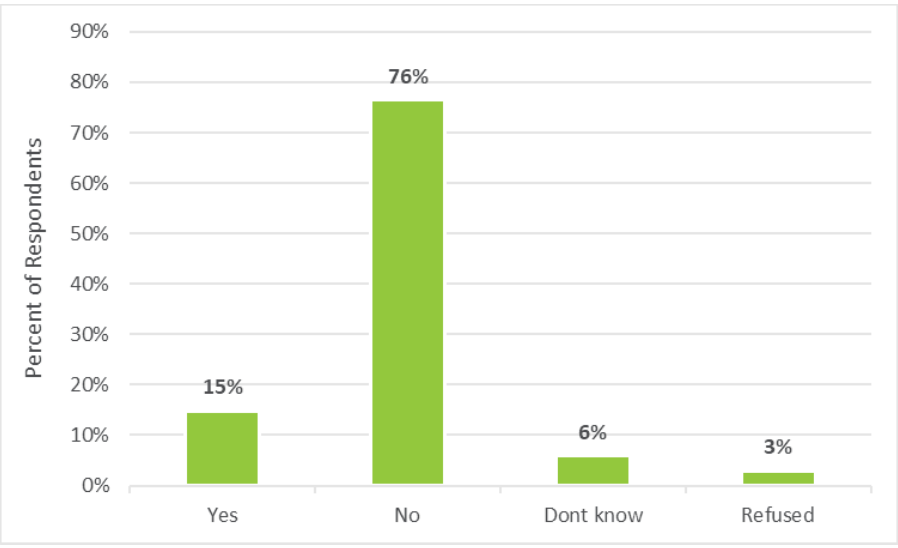
Figure 9. Tenants Who Consider Duke Energy a Resource for Energy Efficiency Information (n=34)



Source: Navigant analysis, values subject to rounding

When asked about their awareness of other Duke Energy programs, tenants were not able to list any other programs solutions, as shown in Figure 10. This represents a large opportunity for Duke Energy to increase channeling to drive awareness in other programs and increase participation across their portfolio.

Figure 10. Tenants Who Could Name Other Duke Energy Solutions/Programs to Help Them Save Energy and Money (n=34)



Source: Navigant analysis, values subject to rounding

Navigant also asked tenants about their preferences related to other technologies such as smart thermostats, solar and electric vehicles. Responses showed that:

- 18 percent of respondents currently have a smart thermostat (15% were unsure or preferred not to respond)
- Of the respondents who do not have a smart thermostat, about one out of every four are interested in smart thermostats
- Over half of respondents say they would like to see solar PV installed at their property
- None of the respondents currently own an electric vehicle (EV), but about 15 percent are interested in purchasing an EV in the future and about 9 percent of respondents are aware of EV charging stations at their properties

6.5 Property Manager Surveys

The evaluation team conducted interviews with property managers from the participating properties to assess decision-making (which will ultimately feed into the NTG analysis) and overall satisfaction with the program. The evaluation team interviewed four of the 16 property managers. Navigant made extensive attempts to complete additional interviews but faced numerous challenges when scheduling interviews. Some property managers expressed frustration towards the number of calls they had received for onsite visit verifications and interviews regarding their experience with the program (this includes QC inspections during the implementation phase). As a result, they refused to participate in EM&V site visits. This section presents details of the interviews Navigant was able to complete with property managers.

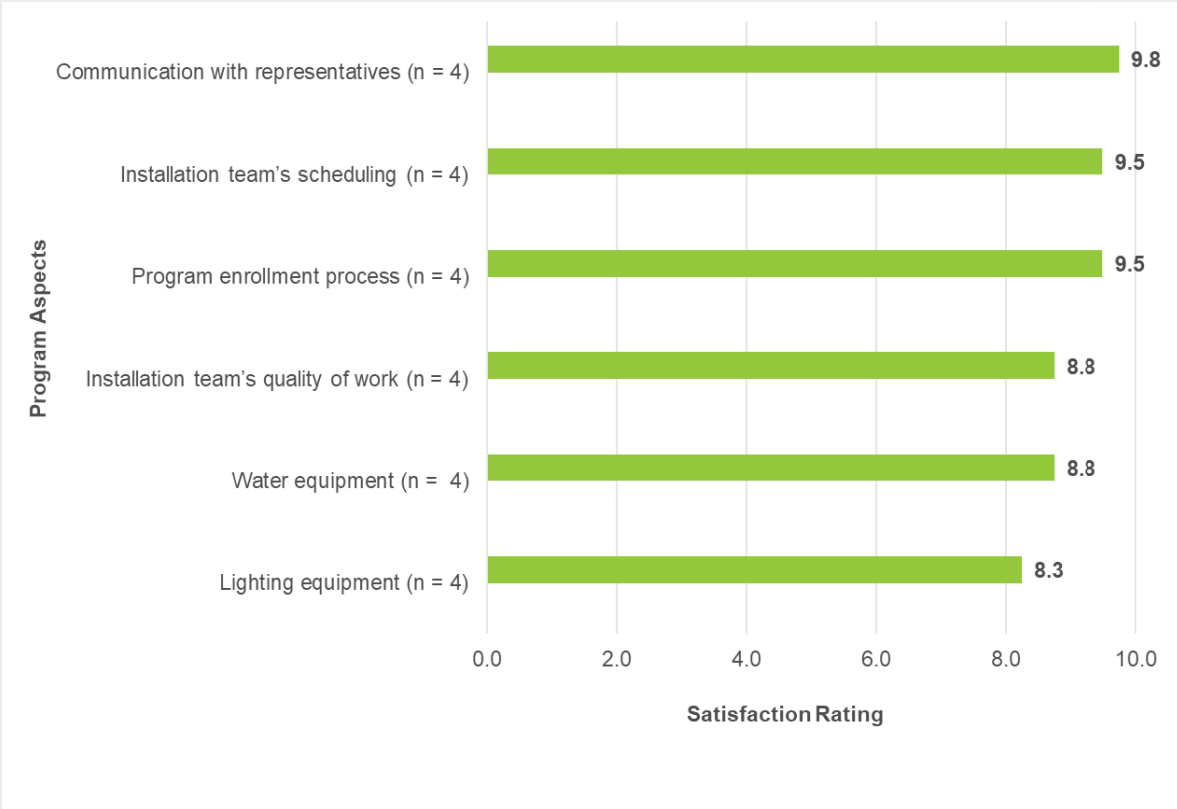
Property managers indicated the primary motivations for participating in the program included to save energy, to save water, to save money on utility/electric bills, and to improve tenant satisfactions. These motivations can help shape marketing and outreach materials.

Property managers reacted positively to their participation in the program and expressed high program satisfaction. When asked how they would rate their satisfaction on a 0 to 10 scale with 0 meaning “very dissatisfied” and 10 meaning “very satisfied”, the mean satisfaction rating for their overall experience with the program was 7.8 out of 10. This is slightly lower than the overall satisfaction rating provided by the tenants, and may be partially a result of the dissatisfaction property managers expressed due to numerous inspections during the implementation and EM&V process. Three out of four property managers expressed this in verbatim responses:

- “There were multiple requests to come back and get into the units [to inspect measures]. [I] probably would not do it again.”
- “The installation went very well. The people that did the installing did well. I did not like the follow-up audit. I was called on numerous times for a follow-up audit.”
- “It seems like there are a lot of people wanting to come back to review. I have to keep bothering the tenants.”

Overall, the property managers were very satisfied with specific aspects of the program. Communication with program representatives had the highest satisfaction rating of 9.8 out of 10 from property managers. On the other hand, tenant communications and program materials had the lowest satisfaction rating of 6.5 out of 10, as shown in Figure 11.

Figure 11. Satisfaction with Program Aspects (n = 4)



Source: Navigant analysis, values subject to rounding

Property managers were pleased with their interactions with program staff and the installation team. One property manager stated the installation team was, "really good and efficient. They all worked together." Property managers were less satisfied with LEDs because some bulbs had already burned out.

Property managers indicated they consider Duke Energy to be a resource for energy efficiency, rating Duke Energy on 8.3 out of 10. The property managers also indicated their decision to install the energy efficient equipment at the property was largely motivated by Duke Energy's program. The program influenced their decision to participate because it allowed them to install efficient LEDs and water measures much faster than they would have otherwise. All respondents indicated they would not have installed the same energy efficiency products and the same quantity without Duke Energy's technical and financial assistance, showing the program is very beneficial for property managers. As a result, property managers very likely to recommend the program to others. The average likelihood score was 9.3 out of 10.

6.5.1.1 Participant Suggestions

Navigant also captured any suggestions for improving the program from the property managers.

- Three out of four property managers suggested adding outdoor or common area lighting to the program, so they can continue to increase the energy efficiency of their property.

7. SUMMARY FORM

Multifamily Energy Efficiency Program

Completed EMV Fact Sheet

Description of program

Duke Energy's Multifamily Energy Efficiency Program provides energy efficient equipment to multifamily housing properties at no cost to the property managers or tenant end-users. The program is delivered through coordination with property managers and owners. Tenants are provided with notice and informational materials to inform them of the program and potential for reduction in their energy bills. Typically, measures are installed directly by the implementation contractor rather than tenants or onsite maintenance staff.

The program consists of lighting and water measures.

- **Lighting measures:** Light Emitting Diode (LED) bulbs installed in permanent fixtures
- **Water measures:** Bathroom and kitchen faucet aerators, water-saving showerheads, hot water pipe wrap

Evaluation Methods

The evaluation team used engineering analysis and onsite field inspections as the primary basis for estimating program impacts. Additionally, telephone surveys were conducted with tenants and multifamily housing units to assess customer satisfaction and spillover. Detailed interviews were conducted with property managers to assess their decision-making process, and ultimately to estimate a net-to-gross ratio.

Impact Evaluation Details

- **Field inspections were conducted at 36 housing units.** The evaluation team inspected program equipment at 36 housing units to assess measure quantities and characteristics to be compared with the program tracking database.
- **In-Service rates (ISRs) varied by equipment type.** The evaluation team found ISRs ranging from 87% for bathroom aerators to 100% for candelabra and globe LED lamps.
- **Participants achieved an average of 714 kWh of energy savings per year, or 815 when adjusted to account for SB 310**.

Date:	December 26, 2019
Region:	Duke Energy Ohio
Evaluation Period	4/1/18 – 7/8/19
Annual kWh Savings	1,214,045 1,385,367 (adjusted for SB 310)
Per Participant kWh Savings	714 815 (adjusted for SB 310)
Net-to-Gross Ratio	0.98

8. CONCLUSIONS AND RECOMMENDATIONS

Navigant developed a few recommendations for Duke Energy to consider. These recommendations are intended to assist Duke Energy with enhancing the program delivery and customer experience, as well as to support future EM&V activities and possibly increase program impacts.

1. Navigant recommends that Duke Energy should adopt the ex post, per-unit energy and demand impacts from this evaluation and use them going forward. We recommend that Duke Energy use the impacts claimable under Ohio SB 310.
2. Duke Energy should consider improving the program materials distributed to tenants that describe the program measures and energy savings that might be achieved due to the installation of the new equipment. Communicating tips to save energy and water with the new equipment could increase customer satisfaction and continue to build the strong trust and rapport Duke Energy has established with their customer base.
3. Duke Energy should consider leaving a few cases of backup LED bulbs with property managers. LEDs were the only measure removed by tenants and burn out was the primary reason for the removal. Leaving additional LEDs with property managers could help increase the customer satisfaction rate for this measure.
4. Duke Energy should consider whether smart thermostats or other HVAC-related measures would be reasonable offerings for this program. About 25 percent of survey respondents who did not have a smart thermostat indicated they would like to get one. Also, three out of four property managers recommended adding exterior and common area lighting to the program, so they can continue to make their properties energy efficient.
5. Duke Energy should consider making modifications to the Multifamily Energy Efficiency Program Direct Installation Service Agreement to include information about EM&V activities that may occur in the months or years following program participation. Navigant experienced significant resistance from property managers while recruiting for onsite field verification and process evaluation interviews. Many property managers indicated they had already received multiple site visits during the implementation phase and subsequent QC inspections, and that it was a challenge to accommodate additional inspections and interviews for EM&V.

9. MEASURE-LEVEL INPUTS FOR DUKE ENERGY ANALYTICS

Navigant used the findings from field verification, surveys, and review of Duke Energy's deemed savings to estimate an updated set of deemed savings for Duke Energy to use for tracking program activity. Table 25 provides the measure-level inputs that can be used by Duke Energy Analytics for estimates of future program savings. The table includes both the evaluation findings and the adjusted impacts that can be claimed under SB 310.

Table 25. Gross Measure-Level Impacts

	Measure*	Unit Basis for Impacts	Annual Energy Savings Per Unit (kWh)	Annual Summer Coincident Demand Savings Per Unit (kW)	Annual Winter Coincident Demand Savings Per Unit (kW)
Evaluation Findings	A-Line LED	Per lamp	48.9	0.0040	0.0064
	Candelabra LED	Per lamp	30.9	0.0045	0.0056
	Globe LED	Per lamp	30.5	0.0044	0.0055
	Bathroom Faucet Aerator	Per aerator	39.5	0.0028	0.0028
	Kitchen Faucet Aerator	Per aerator	139.3	0.0092	0.0092
	Low Flow Showerhead	Per showerhead	308. 8	0.0136	0.0136
	Water Heater Pipe Wrap	Per foot	17.8	0.0020	0.0020
Impacts Claimable Under SB 310	A-Line LED	Per lamp	50.7	0.0049	0.0093
	Candelabra LED	Per lamp	30.9	0.0045	0.0056
	Globe LED	Per lamp	30.5	0.0044	0.0055
	Bathroom Faucet Aerator	Per aerator	58.7	0.0077	0.0111
	Kitchen Faucet Aerator	Per aerator	139.3	0.0154	0.0221
	Low Flow Showerhead	Per showerhead	339.0	0.0279	0.0390
	Water Heater Pipe Wrap	Per foot	51.5	0.0059	0.0059

Source: Navigant analysis, values subject to rounding

Multifamily DEO
DSMore table 26Dec

APPENDIX A. DETAILED SURVEY RESULTS

This appendix contains additional results from the property manager interviews and tenant surveys. It is meant as a supplement to other sections of the report.

A.1 Property Manager Interviews

Navigant conducted in-depth interviews with 4 property managers. This section presents additional details of the interviews that were not presented in the body of the report, section 6.5. The responses to each question shown are paraphrased to maintain confidentiality and summarize the key points. The information below described the properties that participated in the program.

Table 26. How many housing units does your property have?

Respondent #	Response
1	28
2	Facility 1: 40, Facility 2: 24
3	71
4	12

Source: Navigant analysis

Table 27. Can you tell me the approximate percentage of housing units at your facility that have the following number of bedrooms?

Respondent #	Response
1	One-bedroom: 97%, two-bedroom: 3%
2	Facility 1: One-bedroom: 90%, two-bedroom: 10% Facility 2: One-bedroom: 100%
3	One-bedroom: 50%, two-bedroom: 50%
4	One-bedroom: 50%, two-bedroom: 50%

Source: Navigant analysis

Table 28. Can you tell me the average number of occupants that live in a typical unit at your property?

Respondent #	Response
1	One-bedroom 1.5, two-bedroom 2
2	One-bedroom: 2, two-bedroom: 3
3	One-bedroom: 1, two-bedroom: 2
4	One-bedroom: 1, two bedrooms: 3

Source: Navigant analysis

Table 29. Can you tell me the low and high range for rent costs for a unit at your property?

Respondent #	Response
1	$500 - 700
2	Facility 1: $530 - 775 Facility 2: $515-749
3	$1084 - 1254
4	$425-750

Source: Navigant analysis

Table 30. Is there anything you would suggest to improve Duke Energy's Multifamily Energy Efficiency Program?

Respondent #	Response
1	Offer it to multifamily where landlords pay
2	Common area lighting
3	Nothing
4	The amount of time they keep wanting to come back is bothersome. Less of that would be great. Bothersome to tenants and bothersome for him to walk auditor around.

Source: Navigant analysis

APPENDIX B. TENANT SURVEY GUIDE

DUKE ENERGY MULTIFAMILY ENERGY EFFICIENCY PROGRAM
TENANT SATISFACTION SURVEY

This survey guide will be administered to residents who have received energy efficient equipment through Duke Energy's Multifamily Energy Efficiency Program (MEEP). The goal of the tenant satisfaction survey includes informing, updating and improving MEEP the. Recruiting calls for tenant surveys will be made between 10:00am-8:30pm ET on weekdays, and 10:00am-5:00pm ET on Saturdays. No calls are to be made on Sundays.

Company: _____ Telephone: _____
Name: _____ Cell phone: _____
Title: _____ Fax: _____
City: _____ State: _____ Zip: _____
Interview date: _____ Time: _____

[PROGRAMMER: INSERTS FOR "MEASURE(S)": (add MEASURE_NAME_# to sample)
IF LED_LIGHT_BULBS_1 ≥ 1, [INSERT MEASURE(S)] = "LED LIGHT BULBS"
IF BATHROOM_FAUCET_AERATORS_2 ≥ 1, [INSERT MEASURE(S)] = "BATHROOM FAUCET AERATORS"
IF KITCHEN_FAUCET_AERATORS_3 ≥ 1, [INSERT MEASURE(S)] = "KITCHEN FAUCET AERATORS"
IF HOT_WATER_HEATER_PIPE_WRAP_4 ≥ 1, [INSERT MEASURE(S)] = "HOT WATER HEATER PIPE WRAP"
IF LOW_FLOW_SHOWERHEADS_5 ≥ 1, [INSERT MEASURE(S)] = "LOW FLOW SHOWERHEAD"

INTRO **[IF COMPLEX_NAME = 2 USE THIS INTRO.]** **(individual - add "2"to sample)**
Hello, my name is (YOUR NAME) calling from Bellomy Research. I'm calling on behalf of DUKE ENERGY about the energy saving equipment that your landlord or property manager installed in your home as a part of a Duke Energy efficiency program. These may have included light bulbs, aerators, pipe wrap or showerheads. Is this the **[INSERT CONTACT_NAME FROM SAMPLE]** residence? (IF NOT AVAILABLE, SCHEDULE A CALLBACK.)

INTRO 2 **[IF COMPLEX_NAME = 1 USE THIS INTRO.]** **(complex – add to "1"sample)**
Hello, my name is (YOUR NAME) calling from Bellomy Research. I'm calling on behalf of DUKE ENERGY about the energy saving equipment that your landlord or property manager installed in your home as a part of a Duke Energy efficiency program. These may have included light bulbs, aerators, pipe

wrap or showerheads. Do you reside at a property managed by **[INSERT CONTACT_NAME FROM SAMPLE]**? (IF NOT AVAILABLE, SCHEDULE A CALLBACK.)

SC1. Safety is always first at Duke Energy. Are you able to safely take this call right now?
1. Yes **[CONTINUE]**
2. No **[SCHEDULE A CALLBACK]**
99. Refused **[THANK AND TERMINATE]**

[FOR TERMINATIONS]: I thank you for your time.

[IF RESPONDENT ASKS HOW LONG, SAY: "APPROXIMATELY 10-12 MINUTES."]

S1. I am calling for your opinion on your experience with the Multifamily Energy Efficiency Program from Duke Energy. We will keep all of your responses confidential. For quality purposes, this call may be monitored and recorded. I just need to ask a few screening questions before we get started. Our records show that your household received new energy efficient lighting and/or water-saving equipment **[IF TERRITORY = DEO "THIS YEAR OR IN 2018", IF TERRITORY = DEK "IN 2017, 2018, OR THIS YEAR"]**. Your landlord or property manager organized your participation in this program, and a work crew or maintenance staff would have installed **[INSERT MEASURE(S)]** in your home.

Do you recall these **[INSERT MEASURE(S)]** being installed in your home?

1. Yes, respondent recalls the program **[CONTINUE TO PS1.]**
2. No **[THANK AND TERMINATE]**

98. Don't know **[ASK S3]**

99. Refused **[ASK S3]**

[FOR TERMINATIONS]: I have been asked to conduct interviews with people who are familiar with the energy efficient equipment installed as part of this Duke Energy Multifamily Energy Efficiency Program. Since you do not recall this process, these are all the questions I have at this time. Thank you for your time and have a nice day.

[IF S1 = 98 OR 99, CONTINUE to S3. OTHERWISE SKIP TO PS1.]

S3. Is there anyone available who might know? (IF NOT AVAILABLE, SCHEDULE A CALL BACK).

1. Yes **[REPEAT S1 WITH NEW RESPONDENT TO CONFIRM MEASURES INSTALLED.]**
2. No

99. Refused

[IF S3 = 2 OR 99, THANK AND TERMINATE]

[FOR TERMINATIONS]: I thank you for your time.

==========

NTG Survey: Res

Notes for Client:

- Scoring and multipliers are for FR (not NTGR).
- Text in brackets {} serve as a placeholder and will be concluded with the survey firm

==========

PARTICIPATION and SATISFACTION

PS1. The following survey pertains to the energy efficiency improvements you had completed in your home: **[INSERT MEASURE(S)]**.This survey contains questions relating to your overall satisfaction with the Multifamily Energy Efficiency Program as well as questions about your experience with the energy efficient equipment that were installed.

How did you first hear about Duke Energy's Multifamily Energy Efficiency Program? (DO NOT READ LIST. RECORD ALL MENTIONS.)

1. Through property manager
3. Duke Energy website
7. Participation in other Duke Energy Programs
9. Other (Please Specify)
98. Don't know
99. Refused

PS2 TURNED OFF

PS3. On a scale of 0 to 10, with 0 being "Not at all satisfied", and 10 being "Extremely satisfied", how satisfied are you with your **[INSERT MEASURE(S)]? [REPEAT FOR EACH MEASURE INSTALLED BY PARTICIPANT.]**

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS3 < 5, ASK PS4]

PS4. Why do you say that? (RECORD VERBATIM.)

_____**[OPEN-END]**

[LOOP PS3/PS4 WILL BE ASKED MULTIPLE TIMES, BASED ON NUMBER OF MEASURES INSTALLED.]

PS5A. **[IF LED_LIGHT_BULBS_1 ≥ 1, ASK. OTHERWISE, SKIP TO PS7.]**
In your own words, can you tell me about your experience ~~so far~~ with the LED Light Bulbs? This can include your opinion on quality of lighting, brightness, color, or any other observations that you have? (RECORD VERBATIM.)

_____**[OPEN-END]**

PS10. On a scale of 0 to 10, where 0 is "Not at all likely" and 10 is "Very likely", how likely are you to purchase **[IF LED_LIGHT_BULBS_1 ≥ 1, display** "additional"**]** LEDs in the future?

Not at all likely										Very likely	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS10 < 5, ASK PS10A]

PS10a. Why do you say that? (RECORD VERBATIM.)

_____**[OPEN-END]**

[IF PS10 > 5, ASK PS10B]

PS10b. What type(s) of LED would you most likely purchase? (READ LIST ONLY IF NECESSARY. RECORD ALL MENTIONS.)

1. A-lamps
2. Globe lamps

3. Candelabra lamps
4. Track lights
5. Can lights
6. Decorative lamps
7. Other (Please Specify)
8. Don't know

PS7. Have you noticed any savings on your electric bill since the installation of your new **[INSERT MEASURE(S)]**?

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

PS8 TURNED OFF

PS9. We understand that the energy efficient items may have been installed by a contractor hired by Duke Energy. How would you rate your satisfaction with your installer's "quality of work" on a scale of 0 to 10, with 0 meaning "Not at all satisfied" and 10 meaning "Extremely satisfied"?

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS9 < 5, ASK PS9A]

PS9a. What is the main reason for your satisfaction rating? (RECORD VERBATIM.)

_____**[OPEN-END]**

PS11. Using a scale from 0 to 10, with 0 being "Not at all satisfied" and 10 being "Extremely satisfied", how satisfied are you with the Duke Energy Multifamily Energy Efficiency Program?

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS11 = 0-10, ASK PS11A]

PS11a. Why do you give it that rating? (RECORD VERBATIM.)

_____**[OPEN-END]**

PS12. Do you have any suggestions to improve the Multifamily Energy Efficiency Program?

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

[IF PS12 = 1, ASK PS12A.]

PS12a. What are those suggestions? (RECORD VERBATIM. PROBE FOR CLARIFICATION.)
_____**[OPEN-END]**

PS13. How would you rate your overall satisfaction with Duke Energy on a scale of 0 to 10, with 0 meaning "Not at all satisfied" and 10 meaning "Extremely satisfied"?

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS13 < 5, ASK PS13A.]

PS13a. Why do you say that? (RECORD VERBATIM.)
_____**[OPEN-END]**

M1, M2, M3, M4, M4A, M5 TURNED OFF

Measures

Now I'd like to ask you a few questions about your experience with the energy efficient equipment installed through the Duke Energy Multifamily Energy Efficiency Program.

M6. Have you removed any of the **[INSERT MEASURE(S)]** that were installed in your home through this Duke Energy program?
1. Yes
2. No
98. Don't know

[IF M6 = 2 OR 98, SKIP TO IS1. OTHERWISE CONTINUE.]

M6aa. As I read the following measures, please tell me which ones you removed. Did you remove…(READ LIST. RECORD ALL MENTIONS)? **[INSERT MEASURE(S)] ONLY INCLUDE MEASURE INSTALLED IN THE UNIT. FOR THIS INSERT, WE NEED TO READ THE 3 LED TYPES IN THE MEASURE INSERT (INCLUDE A-LAMPS, GLOBE LAMPS, CANDELABRAS, BUT NOT TOTAL LED)**
7. LED A-lamps
8. LED Globe lamps
9. LED Candelabras

~~1. LED light bulbs~~ **TURN OFF**
2. Bathroom faucet aerators
3. Kitchen faucet aerators
4. Hot water heater pipe wrap
5. Low flow showerhead
6. (DO NOT READ) None were removed

[IF M6AA = 6, SKIP TO IS1. OTHERWISE CONTINUE.]

M6ab. Please tell me the quantity of items you removed for each of the following. How many (READ LIST) did you remove? (INTERVIEWER: RECORD-QUANTITY FOR EACH MEASURE. USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.) **[INSERT MEASURE(S)] ONLY INCLUDE MEASURE INSTALLED IN THE UNIT. FOR THIS INSERT, WE NEED TO READ THE 3 LED TYPES IN THE MEASURE INSERT (INCLUDE A-LAMPS, GLOBE LAMPS, CANDELABRAS, BUT NOT TOTAL LED)**

Measure Description	Quantity Removed
[IF M6aa = 2, 3, 4, 5, 7, 8 OR 9 INSERT MEASURES BELOW.]	
M6ab_7. LED A-lamps	_____
M6ab_8 LED Globe lamps	_____
M6ab_9 LED Candelabras	_____
~~M6ab_1. LED light bulbs~~	_____ **TURN OFF**
M6ab_2. Bathroom faucet aerators	_____
M6ab_3. Kitchen faucet aerators	_____
M6ab_4. Hot water heater pipe wrap (in feet)	_____
M6ab_5. Low flow showerheads	_____

[IF M6AB_7,_8, OR _9 GT "0", CONTINUE. OTHERWISE, SKIP TO M7B.]

M7a. You told me you removed LED light bulbs. Why did you remove those items? (RECORD VERBATIM.)

_____**[OPEN-END]**

M7aa. From which rooms did you remove LEDs? (DO NOT READ. RECORD ALL MENTIONS.)

1. Bathroom(s)
2. Bedroom(s)
3. Kitchen/Pantry
4. Living room/Family room/Den/Playroom
5. Home office
6. Laundry room
7. Exterior room (garage/patio/outdoor area)
8. Dining room
9. Hall
10. Other (Please Specify)

[IF M6AB_2 GT "0", CONTINUE. OTHERWISE, SKIP TO M7C.]

M7b. You also told me you removed bathroom faucet aerators. Why did you remove those items? (RECORD VERBATIM.)

_____**[OPEN-END]**

M7bb. Did you remove an aerator from the master bathroom or another type of bathroom? (RECORD ONE ANSWER ONLY.)

1. Master bathroom
2. Another type of bathroom

[IF M6AB_3 GT "0", CONTINUE. OTHERWISE, SKIP TO M7D.]

M7c. You also told me you removed kitchen faucet aerators. Why did you remove those items?

(RECORD VERBATIM.)
_____**[OPEN-END]**

[IF M6AB_4 GT "0", CONTINUE. OTHERWISE, SKIP TO M7E.]

M7d. You also told me you removed hot water heater pipe wrap. Why did you remove those items? (RECORD VERBATIM.)
_____**[OPEN-END]**

[IF M6AB_5 GT "0", CONTINUE. OTHERWISE, SKIP TO IS1.]

M7e. You also told me you removed low flow showerheads. Why did you remove those items? (RECORD VERBATIM.)
_____**[OPEN-END]**

M7ee. Did you remove a showerhead from the master bathroom or another type of bathroom? (RECORD ONE ANSWER ONLY.)
1. Master bathroom
2. Another type of bathroom

M8, M8A, M9, M90, M9A, M10 TURNED OFF

Spillover (INSIDE SPILLOVER)

IS1. As a result of your experience with the program, did you purchase additional energy efficiency equipment for your home or adopt any energy efficient behavior for which you did not receive a rebate/discount from any other Duke Energy program
1. Yes **[CONTINUE]**
2. No
98. Don't know

[IF IS1 = 2 OR 98, SKIP TO PS14.]

IS2. Please tell me the types of additional energy efficient items and the quantity you had installed where you did not receive a program rebate.

	Measure Description	Quantity
IS2a.	1._____	2._____
IS2b.	3._____	4._____
IS2c.	5._____	6._____
IS2d.	7._____	8._____
IS2e.	9._____	10._____

IS3. Please briefly describe how the program has influenced your decisions to incorporate additional energy efficient items in your home that were not part of a program rebate. (RECORD VERBATIM.)
_____**[OPEN-END]**

IS4. On a scale of 0 to 10, where 0 is "Not at all important" and 10 is "Extremely important," how important was your participation in the program in your decision to install additional energy efficiency measures?

Not at all important										Extremely important	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

DEMOGRAPHICS AND ADDITIONAL FEEDBACK

PS14. Thank you for your time and patience; there are only a few more questions.

Do you consider Duke Energy as a trusted resource for energy efficiency information?

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

[IF PS14 = 1 "YES", ASK PS14A.]

PS14a. Why do you consider Duke Energy to be a trusted resource? (RECORD VERBATIM.)
_____**[OPEN-END]**

[IF PS14 = 2 "NO", ASK PS14B.]

PS14b. Why do you not consider Duke Energy to be a trusted resource? (RECORD VERBATIM.)
_____**[OPEN-END]**

PS15. Can you list any other Duke Energy solutions or programs to help you save energy and money in your apartment? (DO NOT READ LIST. RECORD ALL MENTIONS.)

1. Equipment incentives through the Smart Saver Energy Home Rebate Program, including HVAC, Water Heater, Insulation, Ductwork, Pool & Drives, and Refrigeration
2. Outdoor Lighting Solutions
3. Duke Online Savings Store for lighting measures
4. Lighting discounts at local retail stores
5. Refrigeration and Appliance Replacement
6. Heating and Cooling system replacement
7. ~~Duke Free LED Program~~ **TURN OFF**
8. Other (Please Specify)
9. No **[EXCLUSIVE]**
98. Don't Know
99. Refused

PS16, PS16O, PS16A TURNED OFF

P15a. How many bedrooms does your home have?

1. 1
2. 2
3. 3
4. More than 3
98. Don't know
99. Refused

PS15b. How many people live in your home?

1. 1
2. 2
3. 3
4. More than 3
98. Don't know
99. Refused

PS17. A smart thermostat heats or cools your home through the use of automation. Do you currently have a smart thermostat at your home?

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

[IF PS17 = 2, ASK PS17A.]

PS17a. Would you be interested in a smart thermostat?

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

PS18. Do you currently own an electric vehicle?

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

[IF PS18 = 2, ASK PS18A.]

PS18a. Would you consider purchasing an electric vehicle in the next 1 to 3 years?

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

PS19. Does your housing property have charging stations for electric vehicles?

1. Yes
2. No

98. Don't know
99. Refused

PS20. Does your housing property have solar panels?

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

[IF PS20 = 2, ASK PS20A.]

PS20a. Would you like to see your housing property have solar panels installed?

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

CLOSING: This completes the survey. Your responses are very important to Duke Energy and will help as we design future energy efficiency programs. We appreciate your participation and thank you for your time. Have a good day.

APPENDIX C. PROPERTY MANAGER SURVEY GUIDE

This survey guide will be administered to property managers who participated in Duke Energy's Multifamily Energy Efficiency Program (MEEP). The goal of property manager surveys includes informing, updating and improving MEEP. This survey guide walks the interviewer through the phone calls, which are to be made between 10:00am-8:30pm ET on weekdays, and 10:00am-5:00pm ET on Saturdays. No calls are to be made on Sundays. Navigant interviewer will introduce himself/herself and inform the customer about the purpose of the interview.

Company: _____ Telephone: _____
Name: _____David Wolfe_____ Cell phone: _____
Title: _____ Fax: _____
City: _____ State: _____ Zip: _____
Interview date: _____ Time: ___12:00 MT____

S1. According to our records, your property participated in Duke Energy's Multifamily Energy Efficiency Program during **2019]** and received free installation of energy efficient **lighting and water equipment**. Is that correct?

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

[If S1 = 2 or 99, TERMINATE. Otherwise, Continue]
[*FOR TERMINATIONS]*: This study is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during **[If DEK: 2017, 2018 or 2019. If DEO: 2018 or 2019]**. Since you did not, these are all the questions I have at this time, and I thank you for your time.

S2. Are you the primary person who was involved in making the decision to receive the installation for the energy efficient **lighting and/or water efficiency equipment?**

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

[If S2 = 1, Move to PS1. If S2 = 99, Terminate. Otherwise, Continue]
[*FOR TERMINATIONS]*: This study is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during **[If DEK: 2017, 2018 or 2019. If DEO: 2018 or 2019]**. Since you did not, these are all the questions I have at this time, and I thank you for your time.

S2a. I understand that the decision to install the **lighting and water equipment** may have been driven by someone other than yourself. However, if you had some involvement in the decision process

to participate in the program, your input will be helpful. Are you somewhat familiar with the program participation and installation process?

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

[If S2a = 1, proceed to PS1. If S2 = 2 or 98, proceed to S2b. If S2a= 99, Terminate]
[*FOR TERMINATIONS]:* This study is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during **[If DEK: 2017, 2018 or 2019. If DEO: 2018 or 2019]**. Since you did not, these are all the questions I have at this time, and I thank you for your time.

S2b. Can you direct me to the person who was involved in the decision making?

1. Yes [Gather correct contact information before terminating]
2. No [Terminate]
98. Don't know [Terminate]
99. Refused [Reassure participant prior to Terminating]

[If S2b = 1, Gather correct contact information before ending. If S2 = 2, 98 or 99, Terminate]
[*FOR ENDING*]: Thank you for providing us this information and thank you for your time.
[*FOR TERMINATIONS]:* This study is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during **[If DEK: 2017, 2018 or 2019. If DEO: 2018 or 2019]**. Since you did not, these are all the questions I have at this time, and I thank you for your time.

Survey Introduction

My questions are about the energy efficient **lighting and water equipment** installed at **[Insert Property]** through the Duke Energy Multifamily Energy Efficiency Program in **[If DEK: 2017, 2018 or 2019. If DEO: 2018 or 2019]**: I will ask about your satisfaction with the program as well as questions relating to your decision to participate in the program. Finally, I am also interested in hearing about any decisions to pursue efficiency projects at other properties your company manages.

Participation and Satisfaction

The first set of questions relate to your satisfaction with the program. Using a scale from 0 to 10, with 0 being "not at all satisfied" and 10 being "extremely satisfied", how would you rate your satisfaction with the following aspects of Duke Energy's Multifamily Energy Efficiency program? *(INTERVIEWER: USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)*

Questions	Ratings and explanations												
PS1. Overall experience with the program	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused

PS1a. What's the reason for your rating*? (RECORD VERBATIM)*													
PS2. Communication with program representatives	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS2 < 5, ASK] PS2a. What's the reason for your rating*? (RECORD VERBATIM)*													
PS3. Program enrollment process	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS3 < 5, ASK] PS3a. What's the reason for your rating*? (RECORD VERBATIM)*													
PS4. Tenant communications and program materials to help you communicate with tenants about the program	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS4 < 5, ASK] PS4a. What's the reason for your rating*? (RECORD VERBATIM)*													
PS5. The lighting equipment offered in the program	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS5 < 5, ASK] PS5a. What's the reason for your rating*? (RECORD VERBATIM)*													
PS6. The water-saving equipment offered in the program	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS6 < 5, ASK]PS6a. What's the reason for your rating*? (RECORD VERBATIM)*													
PS7. Installation team's scheduling and timely installation in tenant-units	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS7 < 5, ASK] PS7a. What's the reason for your rating*? (RECORD VERBATIM)*													
PS8. Installation team's quality of work	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS8 < 5, ASK] PS8a. What's the reason for your rating*? (RECORD VERBATIM)*													

PS9. **[If property received lighting equipment ask PS9, otherwise skip to PS10]**

On a scale of 0 to 10, with 0 being "not at all satisfied", and 10 being "extremely satisfied", how satisfied would you say *your tenants* are with the new **lighting equipment**? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

PS9a. What is the reason for your rating? *(RECORD VERBATIM)*

_____

PS9b. Can you tell me about any feedback that you have received from your tenants about their experience with the LED lights? [Probe to understand any improvements to aesthetics in the space, reduced energy bills, etc.) (RECORD VERBATIM)

PS10. **[If property only received lighting equipment skip to PS11]** On a scale of 0 to 10, with 0 being "not at all satisfied", and 10 being "extremely satisfied", how satisfied would you say your tenants are with the new **water equipment**? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

PS10a. What is the reason for your rating? *(RECORD VERBATIM)*

_____

PS10b. Can you tell me about any feedback that you have received from your tenants about their experience with the water equipment? [Probe to understand any improvements to aesthetics in the space, reduced energy bills, etc.) (RECORD VERBATIM)

PS11. When speaking to prospective tenants, do you highlight the energy efficient features of your units?

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

PS12. Are there other energy efficiency options you think the program should include? Some examples might be outdoor lighting solutions, heating and cooling solutions, programmable or smart thermostats (i.e. nests), electric vehicle charging stations, etc.? (RECORD VERBATIM)

PS13. On a scale of 0 to 10, where 0 is "not at all likely" and 10 is "very likely", how likely are you to

recommend the Duke Energy Multifamily Energy Efficiency Program to other property managers? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

[If PS13 <5 Ask]

PS13a. Why do you say that? (RECORD VERBATIM)

_____

Awareness Questions

The next set of questions relate to your decision to participate in the program.

A1. What was the primary reason for your decision to participate in the program? [DO NOT READ LIST. RECORD ONLY ONE MENTION.]

1. To save money on utility bills; save money on electric bills
2. Because the equipment was free to me
3. To replace old equipment
4. To replace broken equipment
5. To get more efficient equipment or the latest technology
6. To reduce maintenance costs
7. Because the program was sponsored by Duke Energy
8. Previous experience with other Duke Energy programs
9. To help protect the environment
10. To save energy
11. To improve tenant satisfaction
12. To attract new tenants
13. Part of a broader remodeling or renovation
14. Recommended by contractors/trade allies
15. Recommended by family, friend, or neighbor
16. Existing equipment was due for its regularly-scheduled checkup
17. Duke Energy Advertising
18. Advertising other than Duke Energy
19. No other reasons
20. Other [SPECIFY] _____

98. Don't know
99. Refused

A2. Are there any other reasons you decided to install **lighting and water equipment**?
[DO NOT READ LIST. RECORD ALL MENTIONS]

1. To save money on utility bills; save money on electric bills
2. Because the equipment was free to me
3. To replace old equipment
4. To replace broken equipment
5. To get more efficient equipment or the latest technology
6. To reduce maintenance costs
7. Because the program was sponsored by Duke
8. Previous experience with other Duke programs
9. To help protect the environment
10. To save energy
11. To improve tenant satisfaction
12. To attract new tenants
13. Part of a broader remodeling or renovation
14. Recommended by contractors/trade allies
15. Recommended by family, friend, or neighbor
16. Existing equipment was due for its regularly-scheduled checkup
17. Duke Advertising
18. Advertising other than Duke.
19. Federal tax credit
20. No other reasons
21. Other [SPECIFY] _____

98. Don't know
99. Refused

A3. On a scale of 0 to 10 where 0 means "strongly disagree" and 10 means "strongly agree," please rate your agreement with the following statements:

A3a. I consider Duke Energy to be a decent resource for energy efficiency information.
1. Record response 0-10
98. Don't know
99. Refused

A3b. My decision to install energy efficient equipment at my property was largely motivated by Duke Energy's program.
1. Record response 0-10
98. Don't know
99. Refused

Prior Plans

[Ask if property received lighting equipment]

PP1. Prior to participating in the Duke Energy program, had you considered installing the energy efficient **lighting equipment** at the property?

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

[Ask if property received water equipment]

PP2. Prior to participating in the Duke Energy program, had you considered installing the energy efficient **water equipment** at the property?

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

[If PP1 OR PP2 = 1 or 98, ASK PP2A. Otherwise ASK L3]

PP2a. Please describe any plans you had to install the **lighting and water equipment** prior to participating in the Duke Energy program.
[Record PM Response verbatim]: _____

PP3. Thinking about before you decided to participate in the Duke Energy Multifamily Energy Efficiency program. On a scale of 0 to 10, where 0 means you "had not yet started to plan for equipment or installation" and 10 means you "had identified and selected specific equipment and the contractor to install it", please tell me how far along you were in your plans to install the equipment before participating in the program. (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Had not Yet planned for Equipment and Installation										Identified and selected specific equipment and the contractor to install it	Don't know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

Own

O1. Please tell me in your own words how the program influenced your decision to install the

lighting and water equipment. (RECORD VERATIM)

_____

Likelihood

L1. Given everything you've just told me, what is the likelihood that you would have installed the same energy efficient **lighting and water equipment** without the Duke Energy program and its financial and technical assistance? Would you say you … [READ LIST]?

1. Definitely would NOT have installed the same **lighting and water equipment without the Duke Energy program**
2. MAY HAVE installed the same **lighting and water equipment**, even without the Duke Energy program
3. Definitely WOULD have installed the same **lighting and water equipment,** even without the Duke Energy program
98. (DO NOT READ) Don't know
99. Refused

[If L1 = 2, ASK L1A. Otherwise ASK L2]

L1a. You indicated you may have installed the same energy efficient **[INSERT MEASURES DENOTED ABOVE]**, even without the Duke Energy program. On a scale of 0 to 10 where 0 is "DEFINITELY WOULD NOT have installed" and 10 is "DEFINITELY WOULD have installed", can you tell me the likelihood that you would have installed the same **equipment** without the program?

Definitely Would Not										Definitely Would	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

L2. Thinking about the quantity of lighting and water equipment you installed through the program, what is the likelihood that you would have installed the same quantity of the same measures without the program's financial and technical assistance? Would you say you … [READ LIST]

1. Definitely would NOT have installed the same quantity of the same **lighting and water equipment** without the Duke Energy program
2. MAY HAVE installed the same quantity of the same energy efficient **lighting and water equipment**, even without the Duke Energy program
3. Definitely WOULD have installed the same quantity of the same energy efficient **lighting and water equipment**, even without the Duke Energy program
98. (DO NOT READ) Don't know
99. Refused

[If L2 = 2, ASK L2A. Otherwise ASK L3]

L2a. You indicated you may have installed the same quantity of the same lighting and water equipment even without the Duke Energy program. Using a scale of 0 to 10 where 0 is "DEFINITELY WOULD NOT have installed" and 10 is "DEFINITELY WOULD have installed", can you tell me the likelihood that you would have installed the same quantity of the same measures **without the program**?

Definitely Would Not										Definitely Would	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

L3. **[If L2 = 3, proceed to L3a. Otherwise, continue]**

Is there a chance you would have had at least some of the work done without the program?

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

[If L3 = 2, ASK IS1. Otherwise, continue]

L3a. Could you estimate the percentage of the work that you might have had done without the program? _____%

L3b. On a scale of 0 to 10 where 0 is "DEFINITELY WOULD NOT have installed" and 10 is "DEFINITELY WOULD have installed", what is the likelihood you might have installed [INSERT L3A ANSWER] percent of the **lighting and water equipment** without the Duke Energy program? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

L3c. You mentioned you might have done some work without the program, please describe what you might have had done. (RECORD VERBATIM)

_____

L4. Without the program, about when would you have installed the **lighting and water equipment**? Would it have been… (READ LIST)?

1. At the same time as you did
2. Within 1 year of the time you did
3. Between 1 and 2 years within the time you did
4. Between 2 and 4 years within the time you did

5. Sometime after 4 years within the time you did
6. Would have never installed without the program

Spillover

Thank you for your time and patience, we are almost done and the next few questions pertain to how the program may have influenced you to perform other energy efficiency activities are your property.

IS1. Did your experience with the program in any way influence you to incorporate additional energy efficiency equipment where you did not receive a program rebate at your property?

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

[IF IS1 = 2, SKIP TO IS2]

IS1a. Please tell me the types of additional energy efficient equipment and the quantity you had installed where you did not receive a program rebate. [INTERVIEWER: RECORD MEASURE DESCRIPTION AND QUANTITY FOR EACH. AFTER EACH QUANTITY, ASK: Any others?]

	Measure Description	Quantity
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____

100. IS1b. Please briefly describe how the program influenced your decisions to incorporate additional energy efficiency equipment at your property that were not part of a program rebate. (RECORD VERBATIM)

_____

101. IS1c. On a scale of 0 to 10, where 0 is "not at all important" and 10 is "extremely important," how important was your participation in the program in your decision to install the additional energy efficiency equipment? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

IS2. Aside from the primary property that participated in the program, did your experience with the program in any way influence you to incorporate additional energy efficiency equipment where you did not receive a program rebate at any other properties managed by your company?

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

[IF IS2 = 2, SKIP TO P1]

102. IS2a. Please briefly describe how the program influenced your decisions to incorporate additional energy efficiency equipment at another property that were not part of a program rebate. (RECORD VERBATIM)

_____

Property Characteristics

The last few questions are about the size and occupancy characteristics of your property.

P1. How many housing units does your property have?

1. Record Verbatim
98. Don't know
99. Refused

P2. Can you tell me the approximate percentage of housing units at your facility that have the following number of bedrooms?

1. One-bedroom (record percentage of units):
2. Two-bedrooms (record percentage of units):
3. Three-bedrooms (record percentage of units):
4. More than three bedrooms (record percentage of units):
98. Don't know
99. Refused

P3. Can you tell me the average number of occupants that live in a typical unit at your property?

103. (RECORD VERBATIM AND PROBE FURTHER IF THEY HAVE OCCUPANCY BY NUMBER OF BEDROOMS)

1. One-bedroom (enter average number of occupants)
2. Two-bedrooms (enter average number of occupants)
3. Three-bedrooms (enter average number of occupants)
4. More than three bedrooms (enter average number of occupants)
98. Don't know
99. Refused

P4. Can you tell me the low and high range for rent costs for a unit at your property?

1. Record low and high range
98. Don't know
99. Refused

P5. Is there anything you would suggest to improve Duke Energy's Multifamily Energy Efficiency Program?

(RECORD VERBATIM)

_____

CLOSING:

This completes the survey. Your responses are very important to DUKE ENERGY and will help as we design future energy efficiency programs. We appreciate your participation and thank you for your time. Have a good day.

Annual Report Appendix Template

Ohio Utility Energy Efficiency Savings Summary

1 Incremental Savings from Programs in Year 2019

	Ex Ante Gross Savings			Realization Rate (1)		Actual Expenditures			Participation		Weighted Program Measure Life	TRC Test Ratio	PAC Test Ratio
	A	B	C	D	E	F	G=F/A	H=F/C	I	J	K=C/A	L	M
	First Year Annual Energy Savings	First Year Peak Demand Savings	Lifetime Savings	Energy Savings (Ex Ante Gross/Ex Post Gross)	Demand Savings (Ex Ante Gross/Ex Post Gross)	Program Costs	Ex Ante First Year Cost Per First Year Annual Savings (F/A)	Ex Ante First Year Cost per Lifetime Savings (F/C)	Participation Number	Description (Units Description is provided in the PSR)	Years	By Program	By Program
	MWh	MW	MWh	%	%	$	$/kWh	$/kWh				C/E Ratio	C/E Ratio
Residential Programs													
Energy Efficiency Education Program for Schools	3,743	1.0	26,204	N/A	N/A	$ 588,894	$ 0.16	$ 0.02	6,998	Per Participant	7	3.92	4.15
Home Energy Comparison Report	93,717	23.9	93,717	N/A	N/A	$ 2,551,218	$ 0.03	$ 0.03	358,956	Per Participant	0	3.43	3.43
Low Income Neighborhood Program	603	0.2	4,827	N/A	N/A	$ 577,536	$ 0.96	$ 0.12	1,340	Per Participant	8	0.67	0.75
Residential Energy Assessments	4,170	0.4	58,954	N/A	N/A	$ 1,073,007	$ 0.26	$ 0.02	18,001	Various	14	2.19	2.25
Smart $aver® Residential	128,957	14.2	1,624,508			$ 10,686,442	$ 0.08	$ 0.01	2,161,052	Various	13	4.32	5.94
Smart $aver Residential - Mulit-family				91%	75%								
Low Income Weatherization - Pay for Performance	693	0.1	4,577	N/A	N/A	$ 211,158	$ 0.30	$ 0.05	9,016	Per KWH	7	4.35	1.20
Power Manager®	-	71.5	-	N/A	100%	$ 1,587,960	N/A	N/A	-	N/A	0	15.38	9.14
Total Residential	**231,884**	**111.3**	**1,812,786**			**17,276,216**	**$ 0.07**	**$ 0.01**	**2,555,363**		**7**	**4.48**	**5.34**
Non-Residential Programs													
Power Manager® for Business	925	4	7,396	N/A	N/A	$ 806,567	N/A	N/A	989	N/A	8	1.89	1.67
Small Business Energy Saver	11,337	2.0	115,114	N/A	N/A	$ 2,218,735	$ 0.20	$ 0.02	10,260,212	Per KWH	10	2.00	3.32
Smart $aver® Non Residential Custom	22,293	4.1	325,778	N/A	N/A	$ 2,776,874	$ 0.12	$ 0.01	9,208	Various	15	1.72	5.84
Smart $aver® Non Residential Prescriptive	44,816	8.1	653,127	N/A	N/A	$ 3,599,502	$ 0.08	$ 0.01	587,754	Various	15	5.41	8.74
Smart $aver® Non Residential Performance Incentive	-	-	-	N/A	N/A	$ 5,257	N/A	N/A	-	Various	0	0.00	0.00
PowerShare®	-	78.4	-	N/A	100%	$ 3,308,207	N/A	N/A	-	N/A	0	N/A	4.64
Total Non-Residential	**79,370**	**96.9**	**1,101,415**			**12,715,143**	**$ 0.16**	**$ 0.01**	**10,858,163**		**8**	**3.61**	**5.64**
Other Programs													
Mercantile Self-Direct	3,122	0.4	44,872	N/A	N/A	$ 230,964	$ 0.07	$ 0.01	1,219	Various	14	0.47	9.89
Low Income Weatherization	372	0.1	N/A	N/A	N/A	N/A	N/A	N/A	353	Various	N/A	N/A	N/A
Total Other	**3,494**	**0.5**	`			**230,964**	**$ 0.07**	**$ 0.01**	**1,572**		**14**	**0.47**	**9.89**
Portfolio Total	**314,749**	**208.7**	**2,959,073**			**30,222,323**	**$ 0.10**	**$ 0.01**	**13,415,098**		**10**	**3.67**	**5.50**

(1) - Realization rate for programs with EMV results filed in 2019 status update filing. See Appendices D-F.

2 Information Relative to Statutory Targets for Year 2019

3 year baseline retail normalized (mercantile, weather, opt-out, etc.) sales.	19,772,340
2019 Annual Benchmark Target (%)	1%
2019 Savings (MWh)	408,010
2019 Achievement (%)	2%

3 Banked Savings in Year 2019

2019 Excess Savings Banked Toward Future Compliance	210,287
Total Banked Savings Remaining After 2019	2,578,729

4 Opt Out - Three year baseline in 2019

Total Opt Out load (MWh)	6,172,267