



---

**To:** John Hayden and Kelli Higdon, LG&E and KU

---

**From:** Tina Yoder, Tetra Tech

---

**cc:** Sue Hanson, Tetra Tech

---

**Date:** January 6, 2022

---

**Subject:** Residential and Small Nonresidential Demand Conservation Program – Benchmarking Findings

---

Louisville Gas and Electric Company and Kentucky Utilities Company (LG&E and KU) offer energy efficiency and demand response programs throughout their Kentucky service territory. These programs cover electric and natural gas energy efficiency measures, as applicable. This memo details the activities and findings from the evaluation activities of the Residential and Small Nonresidential Demand Conservation program, as described in the Detailed Evaluation Plan<sup>1</sup>.

Since 2001, the Residential and Small Nonresidential Demand Conservation program has provided LG&E and KU's residential and small nonresidential customers the opportunity to reduce their short-term demand for energy during peak summer demand time periods. The program has installed switches at residential, multifamily, and small nonresidential customers who volunteer to have their air conditioners, pool pumps, water heaters, and heat pumps cycled off and on during times of peak electricity demand or to help manage grid peak or emergency conditions. Air conditioners and heat pumps have been the primary enrolled measures, with water heaters and pool pumps no longer promoted, though retained from past enrollments. As part of LG&E and KU's 2019-2025 Demand Side Management – Energy Efficiency Program Plan, this program is being operated in a maintenance mode. New participants are allowed to enroll in the program to the extent existing devices are available to deploy since they are not purchasing new devices for the duration of the 2019-2025 DSM-EE Program Plan.

## EXECUTIVE SUMMARY

Through this benchmarking study, Tetra Tech determined that LG&E and KU's Residential and Small Nonresidential Demand Conservation program continues to have many elements that are similar to peer utilities, including overall program design, eligibility requirements, incentive structure, and demand response event dynamics. Additionally, LG&E and KU's transition of its Residential and Small Nonresidential Demand Conservation program to maintenance mode with no additional capital investment in one-way direct control units is not unique. Tetra Tech interviewed three Midwest utilities that indicated decreased enrollment levels and investment in one-way direct control units over the last two years. These utilities also anticipate their one-way direct control devices may be phased out over the next five to six years, as the direct control units reach the end of their useful life and current participants transition to other demand response offerings using newer technologies.

While the Smart Electric Power Alliance (SEPA) 2019 Utility Demand Response Market Snapshot shows load control programs like LG&E and KU's continued to provide the largest enrolled capacity

---

<sup>1</sup> Approved by LG&E and KU staff and finalized on October 21, 2021.

of all technologies through 2018, it also showed a decrease in the number of enrolled customer devices of approximately 10.7 percent over 2017. Several utilities reported substantial reductions in their one-way direct control devices in 2018, similar to actions taken by LG&E and KU. The primary reasons provided for moving away from one-way direct control devices include:

- Program not being cost-effective
- Under-performing devices – removals, tampers, or inoperable- high QAQC field verification required
- Limited paging services
- Regulators no longer support investment in one-way direct control units due to newer technologies.

Utilities are utilizing energy efficiency and demand response programs to address climate and decarbonization goals, grid reliability, and/or utility or local area capacity constraints. This will continue in the years to come. New technologies and tools will allow growth in demand response programs and provide more flexibility and diversity in the types of demand response programs and offerings utilities bring to their customers. ACEEE's 2020 Utility Energy Efficiency Scorecard stresses new uses of AMI data continue to emerge, and utilities should continue to explore ways to use AMI to enhance energy efficiency efforts<sup>2</sup>.

No matter the program's ultimate purpose, various solutions such as those shown below are being incorporated into utility demand response programs and Integrated Resource Plans (IRPs) across the country. Program options include:

- Direct load control: using a combination of one and two-way switches on equipment such as pool pumps, air conditioners, water heating, smart thermostats, and residential generators
- Price-based: time-of-use rates, critical peak pricing, and rebates
- Behavioral: real-time customer communications (sometimes paired with price-based pricing and rebates)
- Electric vehicles: storage/dispatch during events
- Smart homes: grid-interactive efficient building
- Meter-based pay-for-performance
- Conservation Voltage Reduction (CVR)
- Renewable generation integration.

Direct control unit-based air conditioning programs currently provide the highest demand response capacity. In 2019, Bring-Your-Own-Device (BYOD) smart thermostat programs were the most common type and appeared to have the highest growth opportunity in the near future<sup>3</sup>. These BYOD programs continue to show an increased savings potential and allow most equipment types to participate rather than limiting to a specific type of thermostat or other technology. At the same

---

<sup>2</sup> ACEEE 2020 Utility Energy Efficiency Scorecard, February 2020; Report U2004; more information can be found at <https://www.aceee.org/research-report/u2004>

<sup>3</sup> Ibid, SEPA, 18

time, several utilities are exploring using smart water heaters and wireless communications to expand existing or new programs.

As stated previously, LG&E and KU are not alone in transitioning from one-way direct control units. Demand load control programs using one-way direct control devices will continue due to the substantial investment in existing infrastructure, yet the longevity of programs using these types of devices remains unknown. The timing of the transitioning to newer technologies and other program options will vary by utility based on each utility's needs and customer satisfaction with existing programs. LG&E and KU may have the ability to pilot newer demand load control products and rate offerings over the next few years as their advanced meter infrastructure (AMI) deployment is completed. LG&E and KU's current generation capacity, high customer satisfaction with their Residential and Small Nonresidential Demand Conservation program, and future AMI deployment may provide additional flexibility.

## DETAILED RESULTS

Tetra Tech conducted a benchmarking study to characterize programs similar to the Residential and Small Nonresidential Demand Conservation program at peer utilities with AMI already deployed. This study provides insight to LG&E and KU of several demand response programs utilized by peer utilities and how they maximize their AMI investment benefits to customers. Research focused on residential demand response programs and gathered information about:

- Program design and delivery components such as program control strategy, eligibility requirements, incentive structure, and demand response event dynamics
- AMI enabled rates designed to either shave a utility's peak demand or reduce overall demand while assisting residential customers in managing their energy use
- Utility plans for legacy programs using one-way direct control units; typically, one-way radio paging.

Benchmarking information was collected by reviewing publicly-available documentation found on utility websites, through public filings of program implementation or evaluation activities, and/or identifying other industry studies or white papers. Additionally, Tetra Tech senior staff interviewed three utilities to gather insights, including their continued use of one-way direct control units. Program information was collected for the following utilities:

- AES Indiana (formerly Indianapolis Power & Light)
- Alabama Power
- Alliant Energy (Interstate Power & Light)
- Consumers Energy
- Duke Energy
- Evergy (formerly Kansas City Power & Light and Westar Energy)
- Florida Power & Light
- Georgia Power
- Idaho Power
- Public Service Company of Colorado

The table below summarizes the service territory and residential customers served for each utility benchmarked.

**Table 1. Utility Territory and Residential Customer Base**

Utility	Service Territory	Number of Residential Customers Served <sup>4</sup>
LG&E and KU	Northern, Central, Eastern, and Western Kentucky	782,649
AES Indiana	Indiana	253,794
Alabama Power	Alabama	1,291,390
Alliant Energy	Iowa	401,675
Consumers Energy	Michigan	1,626,062
Duke Energy	Florida and Kentucky	1,341,724
Eergy Kansas	South and Central Kansas	623,091
Florida Power & Light	Florida	4,617,964
Georgia Power	Georgia	2,288,312
Idaho Power	Idaho	469,546
Public Service Company of Colorado	Colorado	33,653

Below are detailed findings from the benchmarking research. All program details reflect research completed in October and November of 2021.

## PROGRAM DESIGN

### Program Control Strategy

For the past couple of decades, residential demand response programs have involved one-way direct control units. In 2018, 82.9 percent of programs used one-way direct control units<sup>5</sup>. Similar to benchmarking completed for LG&E and KU in 2018, some utilities have maintained the use of one-way direct control units as a sole means of controlling demand during peak demand days, including Duke Energy, Florida Power & Light, and Idaho Power. In contrast, others like Alliant Energy have expanded their residential demand response programs to include smart technologies and price-based demand response offerings due to the recent completion of their AMI deployment.

The emergence of smart technologies and AMI deployment over the past decade has provided utilities with numerous options to employ in demand response programs and other offerings that aid customers in managing their energy consumption. The growth is primarily due to the utilities' need to offset demand during peak periods or emergencies and reduce total demand. In 2020, U.S. electric utilities had completed approximately 102.9 million AMI installations—about 88 percent of

<sup>4</sup> U.S. Energy Information Administration, Form EIA-861 2020 data files, released November 3, 2021. EIA-861 includes self-reported data on accounts, revenues, demand response portfolios, and other pertinent utility data. Report is released annually in November for the prior operating year. More can be found at <https://www.eia.gov/electricity/data/eia861>.

<sup>5</sup> Ibid., 2.

these were residential customer installations<sup>6</sup>. Demand response programs are transitioning away from one-way devices to two-way communication because of these technological changes. Seven of the ten utilities included in this benchmarking study now have smart thermostats included in their residential demand response programs, and two of these seven utilities include price-based demand response rebates in their portfolio as well.

**Table 0. Technologies Employed**

Utility	Technologies Employed
LG&E and KU	Direct Control Unit
AES Indiana	Direct Control Unit, Smart Thermostat
Alabama Power Co	Smart Thermostat
Alliant Energy	Direct Control Unit, Smart Thermostat
Consumers Energy	Direct Control Unit, Smart Thermostat, Critical Peak Pricing, Peak Time Rewards
Duke Energy	Direct Control Unit
Evergy	Smart Thermostat
Florida Power & Light	Direct Control Unit
Georgia Power	Smart Thermostat
Idaho Power	Direct Control Unit
Public Service Company of Colorado	Direct Control Unit, Smart Thermostat

### Eligibility Requirements

Eligibility requirements are generally consistent across the benchmarked programs. To participate in any of the programs involving direct control unit installation, customers need to own their home or be approved eligible renters and have a central air conditioner, water heater, or heat pump. Some utilities like Consumers Energy, Duke Energy, and Florida Power & Light have expanded their programs to include pool pumps and home generators. Households hoping to participate in demand response programs with smart thermostats must have a Wi-Fi-enabled internet connection.

AES Indiana invites small businesses to participate in their Cool Cents program via a smart thermostat which the utility installs at no additional cost to the small business. The equipment controlled through the smart thermostat is similar to the equipment cycled by direct control units: electric heat or central air-cooling systems such as furnaces, air conditioners, and heat pumps.

The table below summarizes eligibility requirements across the ten benchmarked utilities.

<sup>6</sup> U.S. Energy Information Administration, last updated November 2, 2021; more can be found at <https://www.eia.gov/tools/faqs/faq.php?id=108&t=3>

**Table 2. Eligibility Requirements**

Utility	Program Name	Eligibility Requirements
LG&E and KU	<i>Residential and Small Nonresidential Demand Conservation</i>	<i>Residential and small nonresidential customers with central air conditioning or a heat pump</i>
AES Indiana	Cool Cents	Homeowners or approved renters with a smart thermostat Past participants being transitioned to a smart thermostat or upgraded smart switch replacing the original one-way switch Small businesses with a smart thermostat may be eligible to participate based on the size of the air conditioning system
Alabama Power	Smart Advantage and Time Advantage Energy Rate	Residential electric customer with central air conditioning and/or electric furnace or single-stage heat pump and a qualifying thermostat and Wi-Fi availability Participants must also enroll in Time Advantage Energy Rate (TOD)
Alliant Energy	Appliance Cycling	Homeowners with central air conditioning Requires direct control unit to be installed Must not be participating in Smart Hours thermostat program
Alliant Energy	Smart Hours	Home with Wi-Fi availability Wi-Fi-enabled smart thermostats, central air conditioning (for summer program only), and/or a gas or electric furnace (summer and winter program) Must not enroll in TOD or Appliance Cycling
Consumers Energy	Smart Thermostat Program	Residential customer with Wi-Fi-enabled smart thermostat
Consumers Energy	AC Peak Cycling Program	Residential customers with central air conditioning not participating in Smart Thermostat Cycling program Requires direct control unit to be installed
Consumers Energy	Peak Time Rewards	Residential customers must be willing to shift energy use, typically from 2 - 6 p.m., Monday – Friday Up to 19 Energy Savings Event Days per year
Consumers Energy	Critical Peak Pricing	Residential customers must be willing to adjust their habits to consume energy outside of peak load times from June – September Up to 14 events per year
Consumers Energy	Electric Water Heater Cycling Program	Residential customer with electric water heating unit Requires direct control unit to be installed
Consumers Energy	Generator Cycling Program	Homeowners with a generator unit Up to 50 hours annually Requires direct control unit to be installed

Utility	Program Name	Eligibility Requirements
Duke Energy (KY)	EnergyWise Home (FL) Power Manager (KY)	Homeowners or approved renters with electric water heating, pool pumps, and central air conditioning (air conditioning only in Kentucky) Must meet minimum energy consumption requirements Requires direct control unit to be installed Must be in the coverage area for wireless paging signal to be received
Eergy Kansas	Thermostat Cycling Program	Homeowners or approved renters Wi-Fi availability Wi-Fi-enabled smart thermostat and central air conditioning
Florida Power & Light	Residential On Call	Homeowners with electric central air conditioning units, central heating, water heater, or pool pump Requires direct control unit to be installed
Georgia Power	Temp ✓™ and Flex Hours	Homeowners or approved renters with Wi-Fi availability Wi-Fi enabled smart thermostat, all-electric heat pump No participation in any disqualifying electric rate programs
Idaho Power	A/C Cool Credit	Homeowners or approved renters with a central air system or an air-source heat pump Requires direct control unit to be installed
Public Service Company of Colorado	Saver's Switch	Homeowners with central air conditioning Apartment or condominium dwellers with owner approval and with an air conditioner dedicated to the apartment located outside on the ground level near the building Requires direct control unit to be installed Cannot also participate in AC Rewards program
Public Service Company of Colorado	AC Rewards Smart Thermostat Program	Homeowners with eligible Wi-Fi-enabled smart thermostat Natural gas customers with gas heating are eligible if they also have electric service and central air conditioning Cannot also participate in Saver's Switch program

### Incentive Structure

Incentives vary depending on the type of technologies employed as part of each demand response program. Whether the demand response program included direct control units, smart thermostats, or other technologies, the customer participation incentives were typically provided in the form of bill credits on either a monthly or annual basis, and ranged from \$5 to \$100. Utilities offering incentives on the higher end included:

- Duke Energy provides its Kentucky participants bill credits totaling up to \$53 between May and September; Florida participants receive bill credits over the same period totaling up to \$147.
- Florida Power & Light provides monthly bill credits to program participants totaling more than \$90 annually.

In addition to participation incentives, many demand response programs provide additional incentives at the time of enrollment or installation of equipment employed by the program. In

particular, those including smart thermostats. These other incentives may be distributed to customers through a prepaid or gift Mastercard or bill credit.

With the rapid growth in AMI deployment across the country, AMI has assisted in integrating behavioral demand response programs, including price-based rates and rebates, into many demand-side management (DSM) portfolios. Many of the utilities reviewed for this benchmarking study have had time-varying rates structures such as time-of-day (TOD) or time-of-use (TOU) rates available to residential customers for several years. To further expand price-based rates, utilities are pairing smart technologies, like smart thermostats, and real-time usage data to develop new price-based rates and rebates, enabling demand reduction not only during peak events but year-round<sup>7</sup>. For example, Alabama Power and Consumers Energy have incorporated price-based demand response into their portfolios using critical peak pricing strategies. Consumers Energy's Power Savers - Critical Peak Pricing program provides customers with an 18 percent discounted rate for 19 hours per day and weekends from June through September or during energy savings event days. If the customer cannot reduce energy use during an energy savings event day, a \$1 per kilowatt-hour charge is applied to that customer's bill. Consumers Energy also offers a Power Savers - Peak Time Rewards program, with no penalty for reducing energy use during energy savings event days. Alabama Power couples the enrolled smart thermostat with a Time Advantage Energy Rate to automatically shift part of the customer's energy use from peak pricing hours to economy pricing hours during summer and/or winter seasons.

A detailed summary of incentives is shown in the table below.

**Table 3. Incentive Levels**

Utility	Program Name	Incentive Levels
LG&E and KU	Demand Conservation	\$5 bill credit on November bill for participating in the summer program
AES Indiana	Cool Cents	Residential: \$5 bill credit per summer month, up to \$20; \$50 smart thermostat rebate available as well Business: \$5 - \$15 (based on the size of cooling equipment) bill credit per summer month; smart thermostat installed at no additional charge Incentives paid without events
Alabama Power	Smart Advantage and Time Advantage Energy Rate	\$100 prepaid Mastercard for enrolling with already owned eligible thermostat (\$50 for enrolling an eligible thermostat obtained from the utility) Economy pricing all day on weekends, all year long, and economy pricing all day, every day in April, May, and October
Alliant Energy	Appliance Cycling	The amount of credit depends on which specific program Ranges from \$20 to \$40 annually Incentives paid without events
Alliant Energy	Smart Hours	\$50 prepaid Mastercard for enrolling \$25 prepaid Mastercard for each season (summer and winter) of participation Incentives paid without events

<sup>7</sup> American Council for an Energy-Efficient Economy (ACEEE), Leveraging Advanced Metering Infrastructure to Save Energy, January 3, 2020. Revised January 27, 2020, Report U2001, 16-20.



Utility	Program Name	Incentive Levels
Consumers Energy	Smart Thermostat Program	\$75 prepaid Mastercard for enrolling \$25 prepaid Mastercard at the end of each season of participation Incentives paid without events
Consumers Energy	AC Peak Cycling Program	\$32 in bill credits on customers' summer energy bills annually Incentives paid without events
Consumers Energy	Peak Time Rewards	Bill credits equal \$1 per kWh for customer shifts during energy savings event days Risk-free best fit when unsure of how much electric use can be shifted
Consumers Energy	Critical Peak Pricing	18% discounted rate for energy used from midnight to 2 p.m. and 7 p.m. to midnight on weekdays, weekends, and holidays from June through September in exchange for when an energy savings event day is called If the customer cannot reduce energy use, a charge of \$1 per kWh per event will be applied to the bill
Consumers Energy	Electric Water Heater Cycling Program	\$75 gift card for enrolling in the program Incentives paid without events
Consumers Energy	Generator Cycling Program	Incentive paid upon enrollment and annually for participation in the program Incentives paid without events
Duke Energy	Power Manager (KY)	Up to \$53 in monthly bill credits Incentives paid without events
Duke Energy	EnergyWise Home (FL)	Up to \$147 in monthly bill credits Incentives paid without events
Evergny Kansas	Thermostat Cycling Program	Various activation rewards and a \$25 annual bill credit
Florida Power & Light	Residential On Call	Monthly bill credit for each type of equipment enrolled totaling up to more than \$90 annually Incentives paid without events
Georgia Power	TEMP ✓™ and Flex Hours	\$50 prepaid Mastercard upon enrollment in TEMP✓™ \$50 smart thermostat rebate available as well
Idaho Power	A/C Cool Credit	\$5 bill credit per summer month Incentives paid without events
Public Service Company of Colorado	Saver's Switch	\$40 annual bill credit in October Incentives paid without events
Public Service Company of Colorado	AC Rewards Smart Thermostat	\$100 bill credit for enrolling \$25 annual bill credit Incentives paid without events

### Demand Response Event Timing

During an event, the utility can control eligible equipment for a set amount of time during each day during a specified period. More details on the timing of and the maximum number of demand response events are summarized in the table below. Not all information was readily available through publicly-available documentation or filings.

**Table 4. Load Control Details**

Utility and Program (as needed)	Load Control Season	Load Control Times	Load Control Limitations
LG&E and KU	June 1 – September 30, not including holidays and weekends	2:00 p.m. – 6:00 p.m.	4 hours per event 20 days per year
AES Indiana	June – September	Unknown	Unknown
Alabama Power	Summer: June 1 – September 30 Winter: November 1 – March 31	Summer: 1:00 p.m. – 7:00 p.m. Winter: 5:00 p.m. – 9:00 p.m.	Unknown
Alliant Energy – Appliance Cycling	May – September Not including weekends and holidays	1:00 p.m. – 7:00 p.m.	Up to 15 minutes on and off for up to 6 hours a day
Alliant Energy – Smart Hours	Summer: June 1 – September 30 Winter: December 1 – March 31 Not on weekends or holidays	Summer: 1:00 p.m. – 7:00 p.m. Winter: 6:00 a.m. – 10:00 a.m.	Up to 15 times each season Events will not last longer than 4 hours
Consumers Energy – Smart Thermostat Program	Select Summer days	Unknown	Unknown
Consumers Energy – AC Peak Cycling Program	Select Summer days	Unknown	Unknown
Consumers Energy – Peak Time Rewards	All year, not including weekends	2:00 p.m. – 6:00 p.m.	Up to 19 energy saving event days
Consumers Energy – Critical Peak Pricing	June – September, not including weekends	2:00 p.m. – 7:00 p.m.	Up to 14 Summer and 5 Winter energy savings event days
Consumers Energy – Electric Water Heater Cycling Program	Select Summer days	Unknown	When a cycling event is happening, the electric water heater will turn off but the hot water in the tank will still be available for use After the cycling event ends, the unit will resume normal operations
Consumers Energy – Generator Cycling Program	Select Summer days	Unknown	During a limited number of days, up to 50 hours annually

Utility and Program (as needed)	Load Control Season	Load Control Times	Load Control Limitations
Duke Energy (KY)	Between May and September	Events typically occur on weekdays (rarely on weekends or holidays) 2 to 3.5 hours on weekday afternoons between 2 p.m. and 6 p.m.	None, per se Cycling events may occur a few times per month when electricity demand reaches peak levels If the weather is mild, cycling may not occur at all
Duke Energy (FL)	Summer: April – October Winter: November – March Rarely on holidays and weekends	Summer: 1:00 p.m. – 11:00 p.m. Winter: 6:00 a.m. – 11:00 and/or 6:00 p.m. – 11:00 p.m.	Cycling can only occur for up to 16.5 minutes per 30-minute period
Evergy Kansas	Summer: June – September Not including holidays and weekends	12:00 p.m. – 9:00 p.m.	No more than one event per day or three per week
Florida Power & Light	Summer: April – October Winter: November – March	Unknown	Up to 3 hours per event
Georgia Power	Summer: June 1 – September 30 Winter: December 1 – March 31 Not including weekends and holidays	Unknown	Up to 10 flex hour events each season. Up to 4 hours per event
Idaho Power	June 15 – August 15 Not including weekends and holidays	4:00 p.m. – 8:00 p.m.	Unknown
Public Service Company Colorado – Saver's Switch	Summer	2:00 p.m. – 7:00 p.m.	Cycled in 15 – 20-minute intervals
Public Service Company Colorado – AC Rewards Smart Thermostat	Summer	Unknown	Unknown