

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

ELECTRONIC JOINT APPLICATION OF)	
LOUISVILLE GAS AND ELECTRIC)	
COMPANY AND KENTUCKY UTILITIES)	
COMPANY FOR A CERTIFICATE OF PUBLIC)	CASE NO. 2018-00005
CONVENIENCE AND NECESSITY FOR FULL)	
DEPLOYMENT OF ADVANCED METERING)	
SYSTEMS)	

RESPONSE OF
LOUISVILLE GAS AND ELECTRIC COMPANY
AND
KENTUCKY UTILITIES COMPANY
TO COMMISSION STAFF'S FIRST REQUEST FOR INFORMATION
DATED APRIL 2, 2018

FILED: APRIL 13, 2018

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 1

Witness: John P. Malloy

- Q-1. Refer to the Application, paragraph 11. Explain why the Companies have determined that now is the appropriate time for full deployment of the program.
- A-1. As the Companies stated in their 2016 rate-case and AMS-related applications in Case Nos. 2016-00370 and 2016-00371, they believe the appropriate time to have begun a full AMS deployment was in the third quarter of 2017 due to the considerable cost savings and operational and service benefits AMS promise to bring. The Companies withdrew the AMS-related requests from those applications in the interest of settling the cases and addressing intervenor concerns through an AMS Collaborative process, not because the Companies believed it was not the right time for a full AMS deployment. Now that the AMS Collaborative is complete, it is time to begin fully deploying AMS, which the Companies' analysis projects will result in net savings of \$268.8 million (nominal revenue requirements benefits) and \$34.1 million (net present value revenue requirements benefits) between 2018 and 2040, in addition to operational and service benefits to customers.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 2

Witness: John P. Malloy

- Q-2. Refer to the Application, paragraph 11. Explain how the Companies determined the 0.8 percent projected opt-out rate.
- A-2. The Companies determined the 0.8 percent projected opt-out rate by averaging the experienced opt out rates of 8 other utilities. See the table below for the individual opt out rates experienced by each of the 8 utilities.

Utility	Location	Date	Meters	Refusals	Opt Out Percentage
A	Northeast	Dec '14	1,600,000	2,750	0.17%
B	Southeast	Jan '14	4,100,000	12,000	0.29%
C	Texas/South/Midwest	Aug '13	2,200,000	40	0.00%
D	West	Jan '12	6,000,000	28,000	0.47%
E	West	May '12	4,900,000	28,000	0.57%
F	West	May '12	1,400,000	365	0.03%
G	Northeast	Jan '15	1,200,000	21,000	1.75%
H	Northwest	Dec '13	2,000,000	60,000	3.00%

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 3

Witness: John P. Malloy

- Q-3. Refer to the Application, paragraph 11. Explain why only 900,000 of the meters will have remote service switching capabilities.
- A-3. There are technological challenges that prevent remote service switching from being used on all AMS meters. The remote service switch is available from the meter manufacturer (Landis+Gyr) on the most common residential electric meter types, i.e., 200 Amp services and lower, because of current material limitations. Multiple-phase (polyphase) meters like those typically used on commercial and industrial services present technical difficulties because they have more than one current coil to disconnect, and transformer-rated meter forms are not capable of disconnecting the service because the electrical current does not go directly through them. Due to these challenges, Landis+Gyr does not sell any polyphase meters with remote service switching capabilities.

Gas indices perform a monitor-only function relative to the gas meter and cannot connect or disconnect service. The technology exists where gas meters can be simultaneously replaced to enable this function, but safety concerns associated with remote reconnection of a customer's natural gas service outweighed the potential benefits of this functionality.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 4

Witness: John P. Malloy

- Q-4. Refer to the Application, paragraph 13. Provide the weighted-average remaining service life of KU and LG&E's electric meters.
- A-4. The weighted-average remaining service lives of KU and LG&E's electric meters are 15.4 and 17.4 years, respectively, as of February 2018.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 5

Witness: John P. Malloy

- Q-5. Refer to the Application, paragraph 14. State the number and percentage of removed meters the Companies intend to retain and not immediately dispose of, how those meters will be chosen, the purpose of retaining those meters, and the cost associated with retaining the meters.
- A-5. The Companies intend to retain approximately 20,000 electronic meters (about 2% of the meters removed). The Companies will evaluate the meters based on meter make, model, and time in service. The Company will retain the electronic meters in the best condition and the least time in service. The Companies will only retain electronic meters, which have better diagnostic and error messaging capabilities. The retained meters will be used as replacements for (i) meters in un-deployed areas during the AMS deployment period and (ii) opt-out customer requests. The asset inventory cost associated with retaining legacy electric meters is \$389,181.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

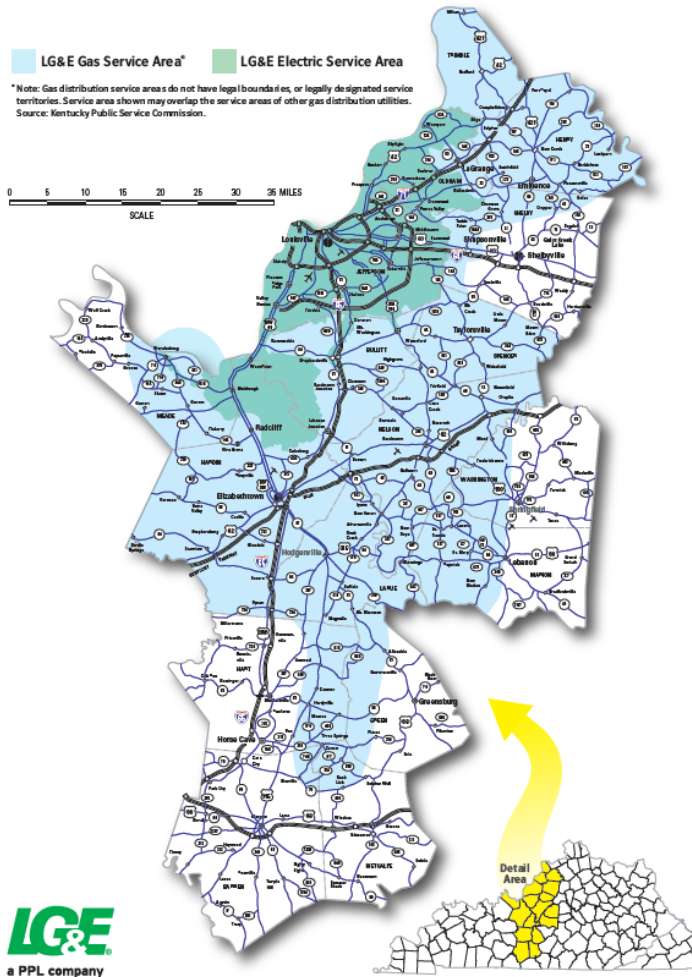
Case No. 2018-00005

Question No. 6

Witness: John P. Malloy

- Q-6. Refer to the Application paragraphs 21 and 22.
- a. Explain whether there is overlap between LG&E electric and gas service territories.
 - b. Explain what costs will be incurred by the Company if a customer of both LG&E electric and gas opts out of AMS.
 - c. If a customer opts out of both the electric and gas meters, explain whether would there be two separate visits to a customer's location to read the meters.
 - d. Since gas meters will not provide the capability for remote connect/disconnect, explain whether opting out of a gas AMS meter will necessitate the need for an additional visit should a customer need to be connected/disconnected.
- A-6.
- a. Yes, within the LG&E service territory there is overlap between LG&E electric and gas service territories, as represented by the below diagram:

LG&E Gas and Electric Service Areas



b. If a customer of both LG&E electric and gas opts out of AMS the company will incur charges for the following items:

- Cost to modify existing software systems.
- Cost to maintain and upgrade existing software systems.
- Costs for software license renewals
- Cost of meter reading handheld and equipment maintenance/replacement.
- Cost of legacy electric meters in inventory.
- Cost to create initial work orders for meter exchange and optimize manual meter read routing.
- Ongoing costs for meter readers, dispatchers, and supervisors, plus transportation costs.
- Costs of manual off-cycle meter reads necessary due to inability to perform Remote Meter Readings Services for non-AMS meters (bill complaints, re-reads, move in/move out reads), plus transportation costs.

- Costs to travel to customer premise, remove existing meter and replace with non-communicating meter, close work orders, plus transportation costs.
 - Cost of additional relays, access points, and supporting infrastructure, assuming an even distribution of lost endpoints throughout the territory.
 - Cost of ongoing maintenance costs associated with additional relays, access points, and supporting infrastructure
 - Costs to update billing system to handle opt-out enrollment, training for staff, and testing.
 - Costs for additional Customer Service Representative time to take calls for opt-out customers, explain tariffs details, and set up account costs.
 - Updates to reporting systems to handle opt-out billing and reporting, training for staff, and testing.
- c. If a customer opts out of both the electric and gas meters, there would be a single visit to a customer's location to read the meters
- d. Because gas meters will not provide the capability for remote connection and disconnection, opting out of a gas AMS meter will not create the need for an otherwise avoidable visit if a customer needs to be connected or disconnected.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 7

Witness: John P. Malloy

- Q-7. Refer to the Application, paragraph 24. The section the Companies are requesting to be waived only applies to fraudulent use by a customer. Explain whether the Companies have a protocol for an improper installation of a meter by the Companies.
- A-7. The Companies use the following protocol to ensure proper installation and functioning of their meters, and will continue to use the applicable elements during and following AMS deployment:
- Field Service techs perform a voltage check on the meter base before installing a new meter or reconnecting an existing meter to ensure the proper voltage is being supplied.
 - After installing the meter, the technician will observe if the meter is registering by either spinning (disc style meter), or with flashing arrows/bars on digital display meters to determine if the amount of load being placed on the meter is appropriate. If high voltage is observed an investigation will be done in an attempt to identify the source of the high voltage.
 - The technician will also check to see if the meter is properly centered within all retaining brackets and sockets to make sure the meter base cover can be replaced without any obstructions from the meter globe itself.
 - The meter base is then closed and sealed.
 - During the manual meter reading, the meter reader will observe the condition of the meter and make a note of any irregularity.
 - Each meter reading will be evaluated and exceptions generated if issues are identified.
 - Each exception will be researched to ensure that the meter reading and the current status of the meter is accurate for the particular account or premise.

AMS will further enable monitoring the quality of installation and ongoing functioning of meters by providing exception reporting for meters either not communicating or not registering usage. The Companies will utilize this exception reporting to generate follow up inspections and troubleshooting where needed.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 8

Witness: John P. Malloy

- Q-8. Refer to the Application, paragraph 27. State whether the Companies intend to test any of the removed meters, pursuant to 807 KAR 5:041, Section 15(3), and, if so, the number and percentage of meters that will be tested, and how these meters will be chosen.
- A-8. Yes, the Companies do intend to test any removed meter that will be retained for possible redeployment within the Companies' service territory. The Companies intend to retain approximately 20,000 electronic meters (about 2% of the meters removed). Note these are not incremental to the retained meters referenced in Question 5. The Companies will evaluate the meters based on meter make, model, and time in service. The Company will retain the electronic meters in good condition and with the least time in service. The Companies will only retain electronic meters, which have better diagnostic and error messaging capabilities.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 9

Witness: John P. Malloy

- Q-9. Refer to the Direct Testimony of John P. Malloy ("Malloy Testimony"), page
- a. Provide any data relied upon by the Companies which would support an expected 20-year lifespan.
 - b. Explain any rate implications if the Commission were to ultimately approve a shorter service life for the AMS meters and gas indices.
- A-9.
- a. Based on experience and discussions with the planned meter vendor, Landis + Gyr, the Companies expect meters and indices deployed during the program to last 20 years on average. See attached.

In addition to the vendor information, the Companies relied upon information from other utilities that have assumed 20-year service lives for AMS meters. See Malloy Testimony, page 21, line 18 to page 24, line 10.

- b. All other things being equal, shorter service lives tend to increase depreciation expense, which in turn tend to increase rates, at least in the short run. If depreciable lives are initially set shorter than actual service lives, depreciation expense will likely be too high in the early years and too low in later years.

From: [Hilton, Tim](#)
To: [Whitehouse, Jonathan](#)
Cc: [Brennan, Paul](#)
Subject: Re: Meter life
Date: Wednesday, March 16, 2016 8:40:31 AM

20 years.

Sent from my iPad

On Mar 16, 2016, at 8:20 AM, Whitehouse, Jonathan <[REDACTED]> wrote:

Paul/Tim,

What is the expected life of the RF Focus AXe meters? Thanks.

Jonathan Whitehouse | Advanced Metering Systems Engineer
LG&E and KU Energy LLC | [REDACTED] | [REDACTED]
[REDACTED] | www.lge-ku.com

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**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 10

Witness: John P. Malloy

Q-10. Refer to Malloy Testimony, page 10.

- a. State whether the electric AMS meters will have a second radio that allows for direct communication to the customer of real-time data (e.g., 8 second).
- b. If so, state whether the Companies will make this data available to customers.
- c. If the Companies were to make real-time data available to their customers, explain what the estimated costs would be to the Companies, and to their customers.

A-10.

- a. The electric AMS meters feature Zigbee communication capability to interact with Home Area Network (HAN) devices. This capability could be used to support future initiatives or independently interact with other customer-procured equipment for nearly real-time monitoring. This functionality is enabled by AMS and typically displayed through in-home devices. Zigbee is a wireless language enabling communication between certain low-power, digital radio devices. See <http://www.zigbee.org/what-is-zigbee/>.
- b. The Companies continue to evaluate the market for in-home devices, but do not currently have any plans to provide for real-time data monitoring. The Companies are considering providing support for customers who procure their own equipment to make use of the available Zigbee communications.
- c. The Companies do not currently have plans to offer in-home devices, and have not completed any financial evaluations regarding such an offering. Informal discussions with other utilities who have offered in-home devices as part of their deployments indicate that the devices are expensive (as much as \$150 per device), have limited usefulness to the customer, and have thus proven not to be cost-effective.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 11

Witness: John P. Malloy

- Q-11. Refer to the Malloy Testimony, page 17. Explain how the Companies determined that 60 percent of non-technical losses would be identified and billed.
- A-11. AMS will significantly enhance the Companies' ability to identify non-technical losses resulting from theft and meter malfunctioning. The Companies' discussions with other utilities indicated that AMS enabled utilities to detect up to 80% of non-technical losses. To be conservative, the Companies' estimated that 60% of these non-technical losses could be identified by AMS technology and data analysis.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 12

Witness: John P. Malloy

Q-12. Refer to Malloy, pages 18-21.

- a. Explain whether the savings shown are due solely to customers accessing and viewing information via ePortal, or whether there are additional savings included arising from third-party access and analysis of the data (with the customer's consent).
- b. If there are no savings from third-party access included, explain whether the Companies foresee allowing energy efficiency vendors to access the customer's data if the customer wants these third parties to have access.
- c. If any savings from third-party access are not included in the savings estimation, estimate what those savings would be.

A-12.

- a. The savings calculated for ePortal are due to active customers having increased access to more granular consumption data, which will enable them to make more informed decisions about their energy usage through visualization of energy conservation-driven behavior changes. The Companies' savings in this area are neutral to whether this visualization is first- or third-person. Based on the Tetra Tech analysis of current AMS Opt-In customers (provided as Appendix A-10 to Exhibit JPM-1), which shows engaged participants are achieving energy savings on the order of 3.8%, the Companies believe that additional savings are possible. These savings could come from a number of areas, including potential third-party access and analysis.
- b. The Companies do foresee enabling customers to provide third-party access if they desire to do so. To facilitate this, the Companies plan to continue offering Green Button Download My Data functionality along with other data export formats, e.g., Comma Separated Value (CSV).
- c. See response to a. Third-party access is not assumed to be incremental.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 13

Witness: John P. Malloy

- Q-13. Refer to the Malloy Testimony, page 20. State whether any commercial or industrial customers currently have access to MyMeter data similar to what is available for the Companies' residential customers.
- A-13. MyMeter data is currently available to small commercial electric customers enrolled in the AMS Opt-In Program. Outside of those customers, the Companies have approximately 1,800 ITRON MV90 meters currently installed and used for customer billing. ITRON MV90 meters are an industry standard solution for large volume commercial and industrial customers. If the ITRON MV90 customers request online access, they can review interval data similar to that proposed for MyMeter.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 14

Witness: John P. Malloy

- Q-14. Refer to the Malloy Testimony, page 28. This page states that customers will be allowed to opt out of AMS deployment "subject to the Companies' operational and safety requirements."
- a. Provide a detailed list of instances in which a customer will not be allowed to opt out, and explain the reasons for not allowing a customer to opt out.
 - b. Identify, by job title or characteristics, the individual(s) responsible for making the determination that customers will not be allowed to opt out.
 - c. Explain what type of electric meter will be used to serve customers electing to opt out of AMS.
 - d. Explain how the decision that customers cannot opt out will be communicated to customers.
- A-14. The Commission has approved the Companies to have the following authority regarding selecting the appropriate metering and meter locations to serve customers:

Company has the right to install any meter or meters it deems in its sole discretion to be necessary or prudent to serve any customer, including without limitation a digital, automated meter reading, automated metering infrastructure, or advanced metering systems meter or meters. When service is supplied by Company at more than one delivery point on the same premises, each delivery point will be metered and billed separately on the rate applicable. Meters include all measuring instruments. Meters will be located outside whenever possible. Otherwise, meters will be located as near as possible to the service entrance and on the ground floor of the building, in a clean, dry, safe and easily accessible place, free from vibration, agreed to by Company.¹

¹ Kentucky Utilities Company, P.S.C. No. 18, Original Sheet No. 98; Louisville Gas and Electric Company, P.S.C. Electric No. 11, Original Sheet No. 98; Louisville Gas and Electric Company, P.S.C. Gas No. 11, Original Sheet No. 98.

This authority is vital to ensure the Companies can safely and reliably provide service to their customers while also ensuring the safety of the Companies' personnel and contractors and providing reasonable protection for the Companies' equipment. The Companies are not proposing to prevent a customer from opting out of the AMS deployment for any reason beyond what is necessary for those purposes and already within the Companies' Commission-approved discretion, but neither are the Companies proposing to curtail that discretion by offering AMS opt-out.

- a. Non-exhaustive examples of instances where a customer may not be allowed to opt out would include issuing threats to Companies' meter reading or field service staff or somehow preventing Companies from regularly and reliably reading meters.
- b. The primary groups that currently determine what metering is appropriate are Meter Reading and Field Services. The Companies presently expect that the same groups will determine if customers will not be permitted to opt out.
- c. Customers electing to opt out of AMS will have meters similar to what is installed today, i.e., electronic electric meters that do not have two-way communication ability.
- d. Each customer who cannot opt out will receive a telephone call (if a phone number is available) and a certified letter. We will work with the customer to determine if the issue preventing opt-out can be resolved. In cases where safety or access issues are resolved, we will accommodate the customer's desire to opt-out of AMS.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 15

Witness: David E. Huff

- Q15. Refer to the Malloy Testimony, pages 30-31. Explain whether the AMS meters installed as part of the Companies' Demand-Side Management AMS offering have remote service switching capabilities installed.
- A-15. The AMS meters currently installed as part of the Companies' Demand-Side Management AMS Customer Offering do not have remote service switching capabilities installed. The meters the Companies ordered most recently for the AMS Customer Offering do have such switches installed, but they are not enabled. None of those meters has yet been installed.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 16

Witness: John P. Malloy

Q-16. Refer to Exhibit JPM-1, page 16 of 64.

- a. Describe what alternatives to the Companies' build-out of their own communication network were considered versus use of an existing or other third-party network.
- b. Explain whether the costs and benefits of each alternative were quantified.
- c. State whether the upgrade and maintenance costs of the communication network have been estimated and included in the cost of the AMS program.
- d. Explain how the operational communications systems are designed to lower the incremental cost of adding future functionality.

A-16.

- a. The Companies are using a combination of private and commercial networks to support AMS. The backhaul from the collectors will be accomplished through a combination of third-party cellular networks, the Companies' fiber network, and third-party fiber networks. For the portions of the network from the collector to the meter, beyond utilizing existing public cellular networks, the Companies are not aware of other existing third-party private networks available for supporting the communication needs of the AMS program. The RF Mesh network buildout was ultimately selected because it provides self-identifying and self-healing communication routes. Exclusively utilizing public cellular networks was not desirable due to ongoing monthly fees and the possibility that commercial cellular technology could change sufficiently to render the meters' communications equipment obsolete prior to the end of the meters' useful life.
- b. The costs and benefits of alternative networks were not quantified.
- c. Yes, the upgrade and maintenance costs of the communication network have been estimated and included in the cost of the AMS program.
- d. The proposed RF Mesh communication network is designed with surplus capacity such that once it is deployed it can handle future customer growth. That capacity also allows

the network to be used for other device types, such as those used for system monitoring, e.g., line sensors providing pertinent distribution data for engineering purposes.

Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018

Case No. 2018-00005

Question No. 17

Witness: John P. Malloy

Q-17. Refer to Exhibit JPM-1, page 17 of 64, which states "in approximately 1,500 instances, LG&E will either replace the index or the entire gas meter because they have an odometer-style index that is not compatible with the AMS gas index module."

- a. Explain whether this sentence means that LG&E only has approximately 1,500 gas meters with odometer-type indices in service, or that LG&E will need to replace approximately 1,500 gas meters.
- b. Refer to LG&E's response to Commission Staff's Second Request for Information in Case No. 2016-00371, Item 63.a.² This response states that LG&E has 46,743 incompatible gas meter indices. Explain how many gas indices LG&E anticipates it will replace in conjunction with its current AMS proposal, and how many gas meters LG&E anticipates will need to be replaced.

A-17.

- a. The Companies need to update and correct the referenced statement to be "in approximately 18,000 instances, LG&E will either replace the index or the entire gas meter because they have an odometer-style index that is not compatible with the AMS gas index module." This sentence means that LG&E has approximately 18,000 gas meters with odometer-type indices in service that will either require an index or full gas meter replacement in order to be made compatible with AMS.

The Companies plan to replace 46,743 incompatible gas meter indices in conjunction with its current AMS proposal. This number includes the approximately 18,000 odometer style mentioned above as well as 29,000 gas automated meter reading (AMR) indices. The Companies will also replace any gas index that may be damaged during the AMS module installation. The Companies do not anticipate needing to replace any gas meters in conjunction with the AMS project.

² 2016-00371, *Application of Louisville Gas and Electric company for an Adjustment of Its Electric and Gas Rates and for Certificates of Public Convenience and Necessity* (filed Jan. 25, 2017), Response of Louisville Gas and Electric Company to Commission Staff's Second Request for Information, Item 63.a.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 18

Witness: John P. Malloy

- Q-18. Refer to Exhibit JPM-1, page 17 of 64, which states "energy consumption data can be transmitted back to the AMS head-end three to four times a day..." State whether data transmission four times per day will be the upper limit. If not, provide the maximum number of times per day data will be transmitted.
- A-18. The Companies' current plans remain to transmit the interval consumption data every 4 hours (6 times per day). There may be operational reasons discovered to increase that frequency once the AMS program begins, e.g., increased availability of data for customer review or for engineering purposes.

Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018

Case No. 2018-00005

Question No. 19

Witness: John P. Malloy

Q-19. Refer to Exhibit JPM-1, page 18 of 64.

- a. Provide details of, and plans for, Zigbee communication through in-home devices.
- b. Explain what types of in-home devices are available commercially to the Companies' customers.
- c. Do studies exist or has there been market research to discuss whether customers want real-time access to data and integration with appliances through the deployment of home area networks (HANs)?

A-19.

- a. The Companies have no plans to deploy in-home devices and thus do not plan to use the ZigBee communication capabilities at this time. The Companies are supportive of enabling customers that procure their own equipment to make use of the available Zigbee communications.
- b. There is an ever-expanding market of commercially available in-home devices that include smart picture frames, thermostats, gateways, and more. Example webpages for such devices are below:

<https://www.ceiva.com/homeview/index.jsp>

https://www.ebay.com/b/ZigBee-Programmable-Thermostats/115949/bn_81003285

<https://rainforestautomation.com/rfa-z114-eagle-200/>

- c. The Companies have not performed any market research in the area of customers desiring real-time access to data and integration with appliances through the deployment of home area networks (HANs) since the Responsive Pricing Pilot in 2008-2010 and the Residential Smart Meters Study in 2012. See attached.

Residential Smart Meters Study



Prepared by:

Bellomy Research, Inc.

January 17, 2012





Agenda



- **Background**
- **Objectives**
- **Methodology**
- **Conclusion/Implications**
- **Detailed Findings**



Background



Background:

LG&E and KU Services Company initiated a Smart Meter Pilot project with 100 customers in 2007. There are currently about 70 customers still participating in the program. Although LG&E/KU gained learning from the Pilot study, the utility would now like to conduct a survey among a broader customer base to gain more in-depth learning on Smart Meter awareness and potential participation. In addition, LG&E/KU is considering four rate options that they would like to understand consumer acceptance of: Time of Use, Critical Peak Pricing, Peak Time Rebate, and Inclining Block.



Objectives



Objectives:

The overall objectives of this study are to understand how much LG&E/KU Residential customers understand about Smart Meters and how willing they would be to participate in a Smart Meter program if offered by the utility. Specifically, the study will evaluate:

- Overall awareness of Smart Meters
- Likelihood to participate in a Smart Meter program
- Appeal of potential rate concepts offered in a Smart Meter program
- Interface tools that would be most important to participation
- Customer attitudes that could impact participation

Results from the study will be used to develop an initial Smart Meter offering, although further research will be necessary to fine-tune the program.



Methodology



Interviewing for this research was conducted via the Internet utilizing sample provided by LG&E/KU. The survey was approximately 15 minutes in length.

BRI sent email invitations to Residential customers requesting their participation in the study. The email invitation contained a survey link allowing them to directly access the survey online 24/7.

Sample provided by LG&E/KU contained Residential customers with an email address. These customers were further screened to ensure that the person who is the utility decision-maker was interviewed.

The data collection period was from 12/5/11 through 12/16/11.

Statistical testing was conducted at the 95% confidence level and significant differences are noted.



Methodology



Quotas were set to 500 total; balanced by utility and for three age groups in order to ensure the results were representative of the LG&E/KU population. Given much lower internet penetration among the 65+ group some completes were shifted to younger households, which also aligns better with potential Smart Meter technology usage.

Due to this being an internet study (and only customers providing email addresses were included), it should be noted that this study is reflective of both the LG&E/KU population and internet usage, and does not necessarily represent the entire LG&E/KU customer base (those without internet access).

The study fell short by 4 completes but remained representative. The final number of completes is as follows:

	LG&E	KU	Total
18-44 years	74	98	172
45-64 years	115	154	269
65+ years	27	28	55
Total	216	280	496



Methodology – Block Design



In order to evaluate the four rate options, a complete block design was used with respondents evaluating all four options. In this design, order is controlled so that each option is rated in each position (1st, 2nd, 3rd, 4th) by an equal number of respondents.

Rate Options Evaluated:

- Time of Use
- Critical Peak Pricing
- Peak Time Rebate
- Inclining Block

Customers were asked to rate each of the options on likelihood to participate, ease of understanding, ease of making changes in energy usage, and motivation to lower usage. All ratings were based on a 5pt scale.

Each rate option included a simplified description, along with a diagram to further aid in describing the concept. (see Appendix)



Methodology – Take Rate

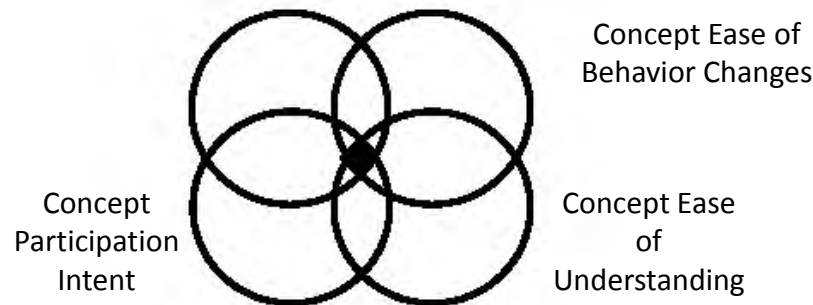


The four rate options were then compared against each other using Bellomy’s “Take Rate” analytical approach, which is ideal when more than two alternatives are being considered and a relative “winner” is desired.

Take Rate is a modified “trial” rate which estimates the percent of respondents who are most committed to a concept idea, providing a more conservative and realistic estimate of customer intent/potential commitment than overall opinion alone.

Take Rate is calculated using the intersection of three to six key variables. Consumers most interested in a concept are identified because they rate the idea high across multiple key measures, not just one. In this case 4 key metrics were intersected:

Take Rate Definition (Top 2 Boxes)





Methodology – Max Diff



Another component of the study was to understand which interface tools would be most important to participation in the Smart Meter program. Eight interface tools were evaluated. The MaxDiff methodology was used to evaluate the 8 tools since it provides the ability to detect more subtle differentiation between preferences as compared to standard rating scales.

In the context of participation in the Smart Meter program, respondents were asked to indicate their most important interface tool *and* their least important interface tool among a subset (3) of the complete list. Respondents completed a series of these simple tasks during which the exposure of attributes was systematically varied to provide level and positional balance.

The results of the MaxDiff analysis are derived preference ratings which add to 100%. Each attribute's preference is ratio-scaled relative to all others. In other words, a tool with a 10% preference rating is exactly twice as preferred as one with a 5% rating.



Methodology – Attitude Analysis



A key component of the study is to understand how customer attitudes drive participation in a Smart Meter program. Each respondent evaluated a randomized series of 19 attributes using a 5pt agreement scale in order to understand customer attitudes regarding energy efficiency, technology, and the desire to control.

Importance of each attribute on likelihood to participate in a Smart Meter program was derived using linear regression, while performance ratings for each attribute were gathered from respondents during the interview.

The attributes were then plotted on a two-dimensional map, plotting Mean Performance vs. Derived Importance for each attribute in order to identify those attributes that have the greatest influence on participation in a Smart Meter program.

- Attributes with positive derived importance to participation: agreement with these attributes drives participation up
- Attributes with negative derived importance to participation: agreement with these attributes drives participation down



Key Conclusions





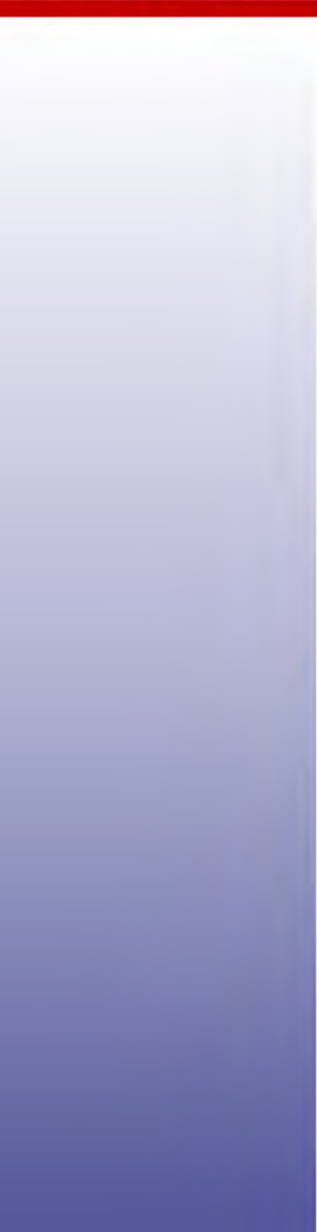
Key Conclusions

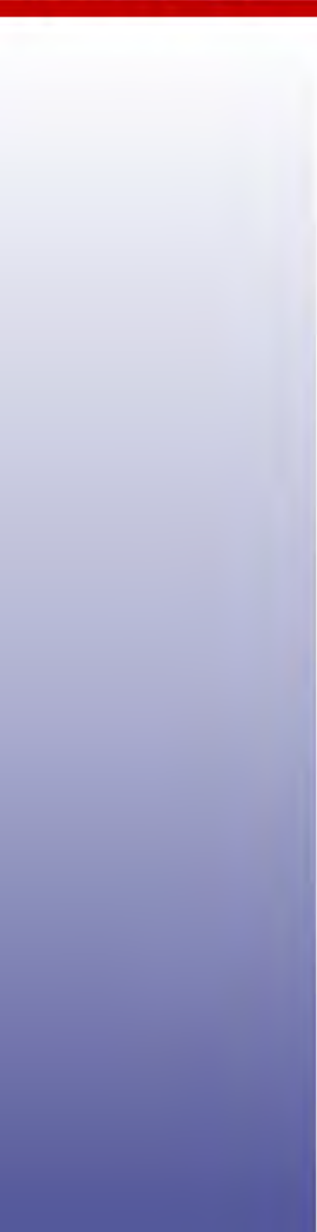




Implications





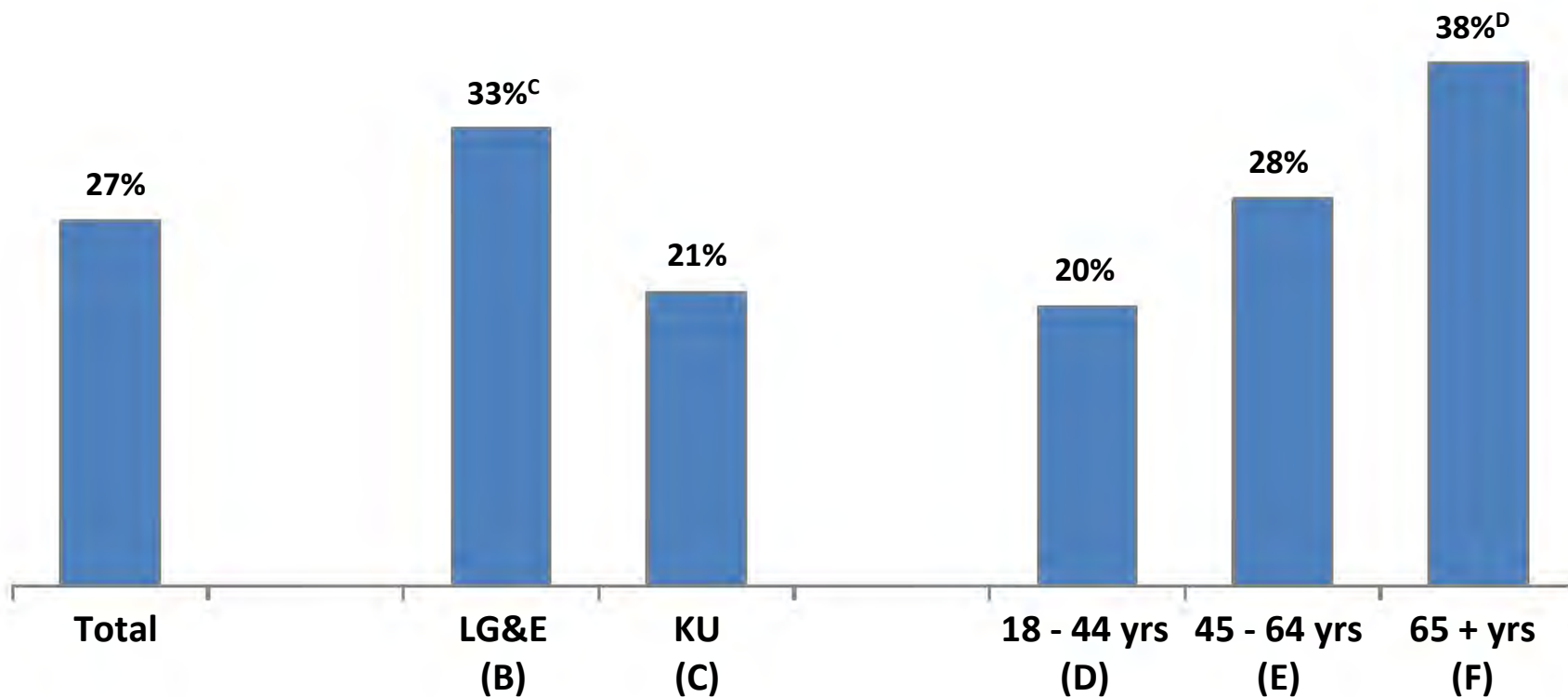




Awareness



Smart Meters Awareness - Unaided (% Yes)

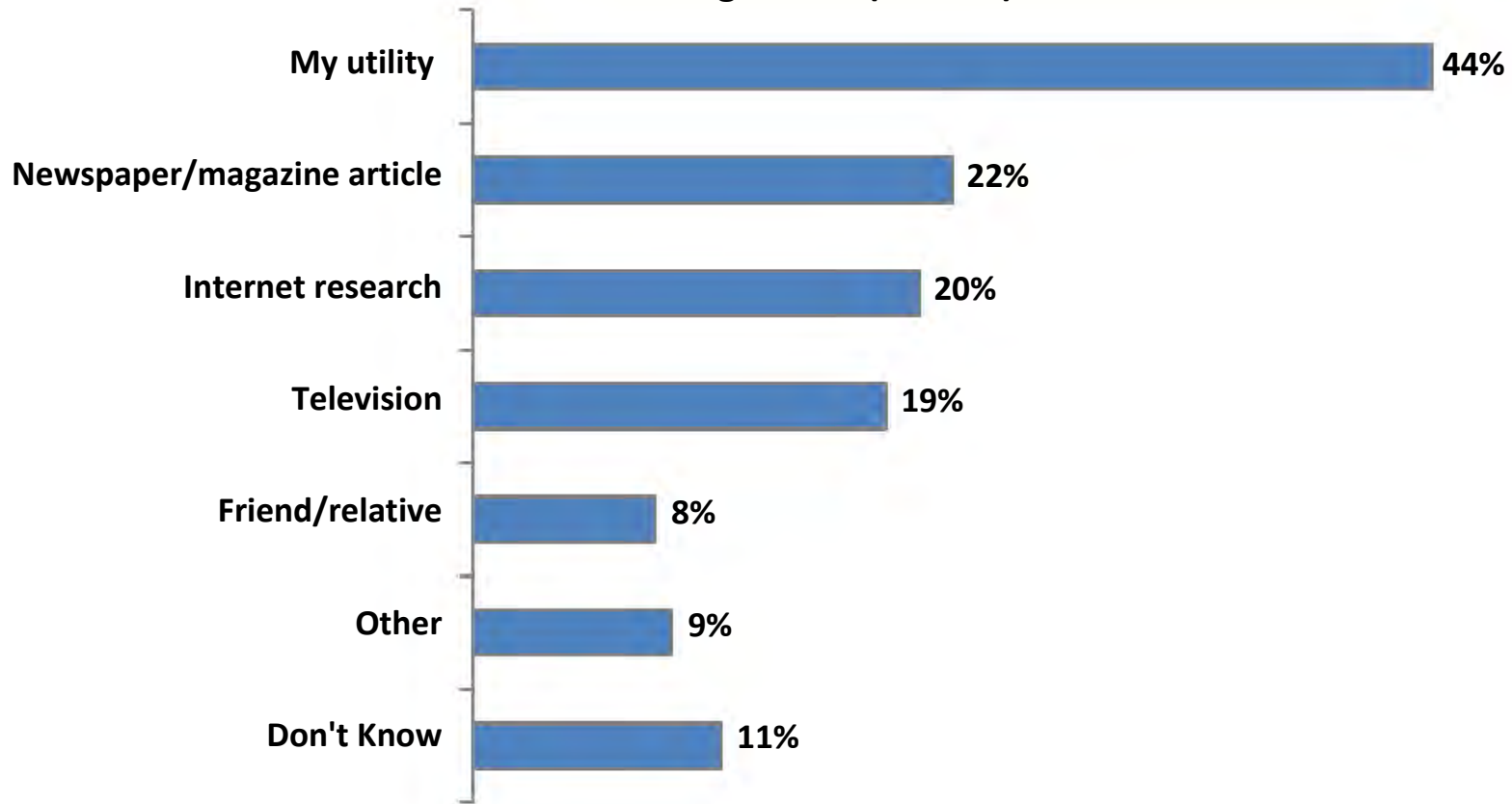




Awareness



How Learned About Smart Meters Among Aware (n = 132)

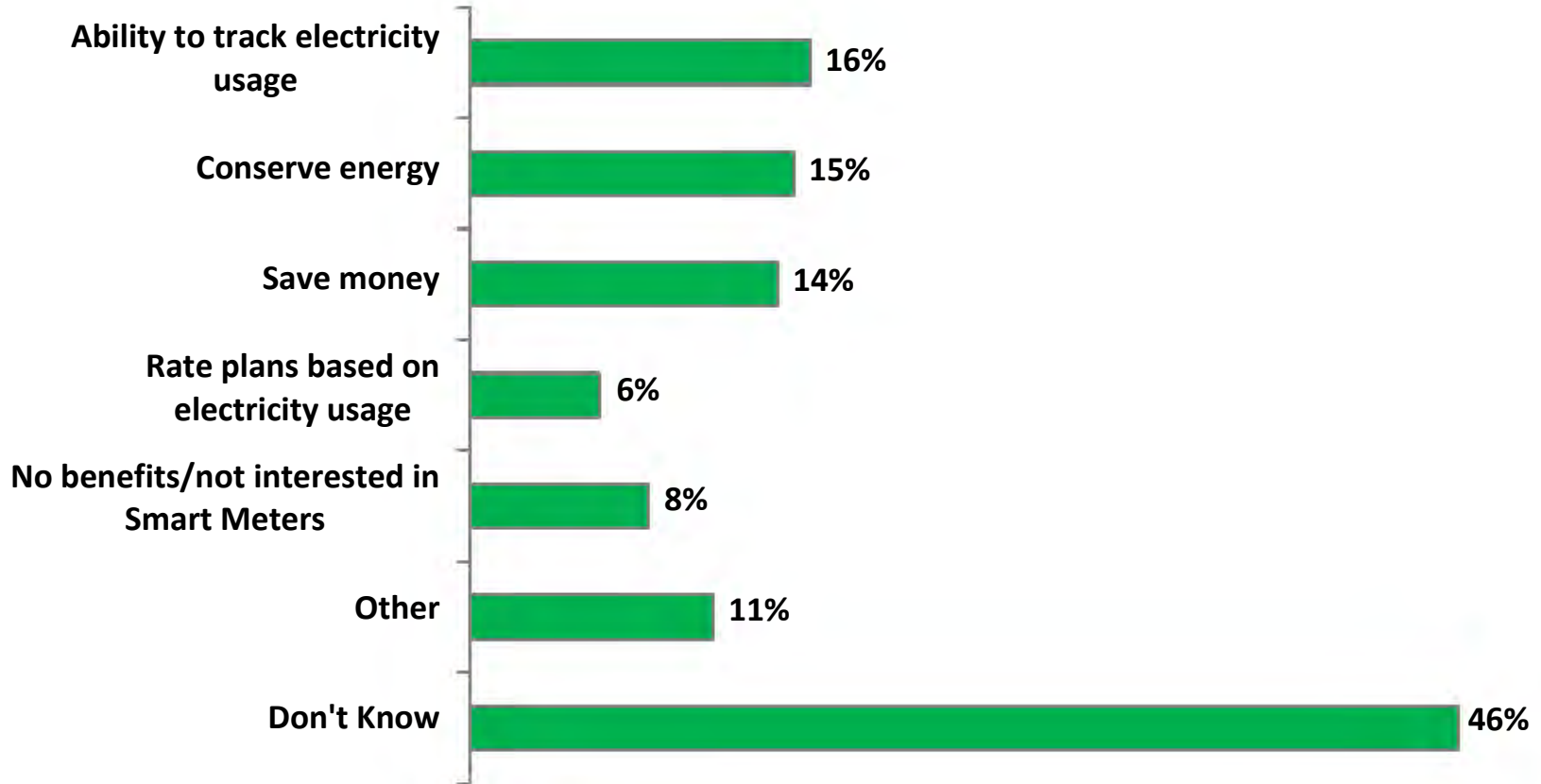




Benefits



**Perceived Benefits/Advantages of Smart Meters
Among Aware (n = 132)**

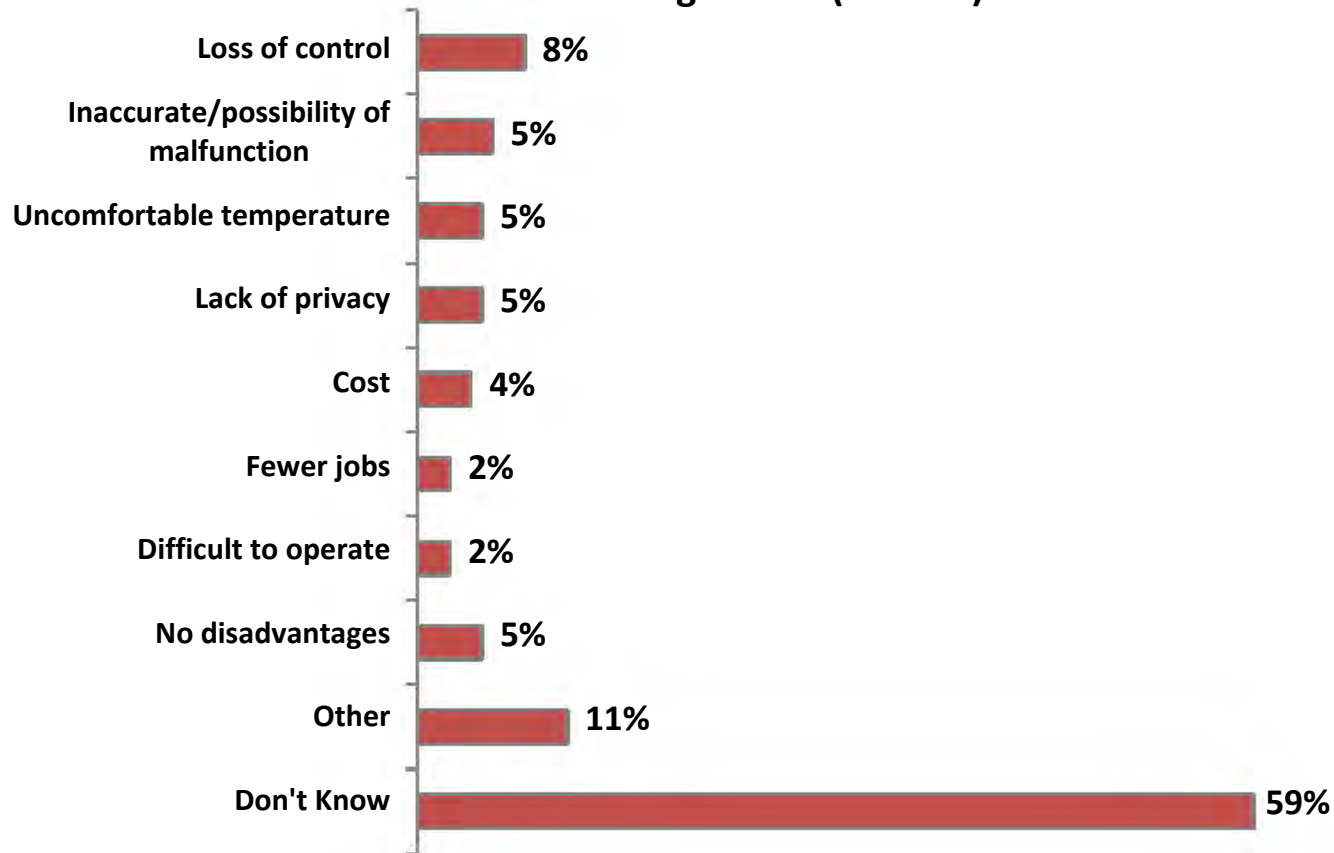




Disadvantages



Perceived Disadvantages of Smart Meters Among Aware (n = 132)

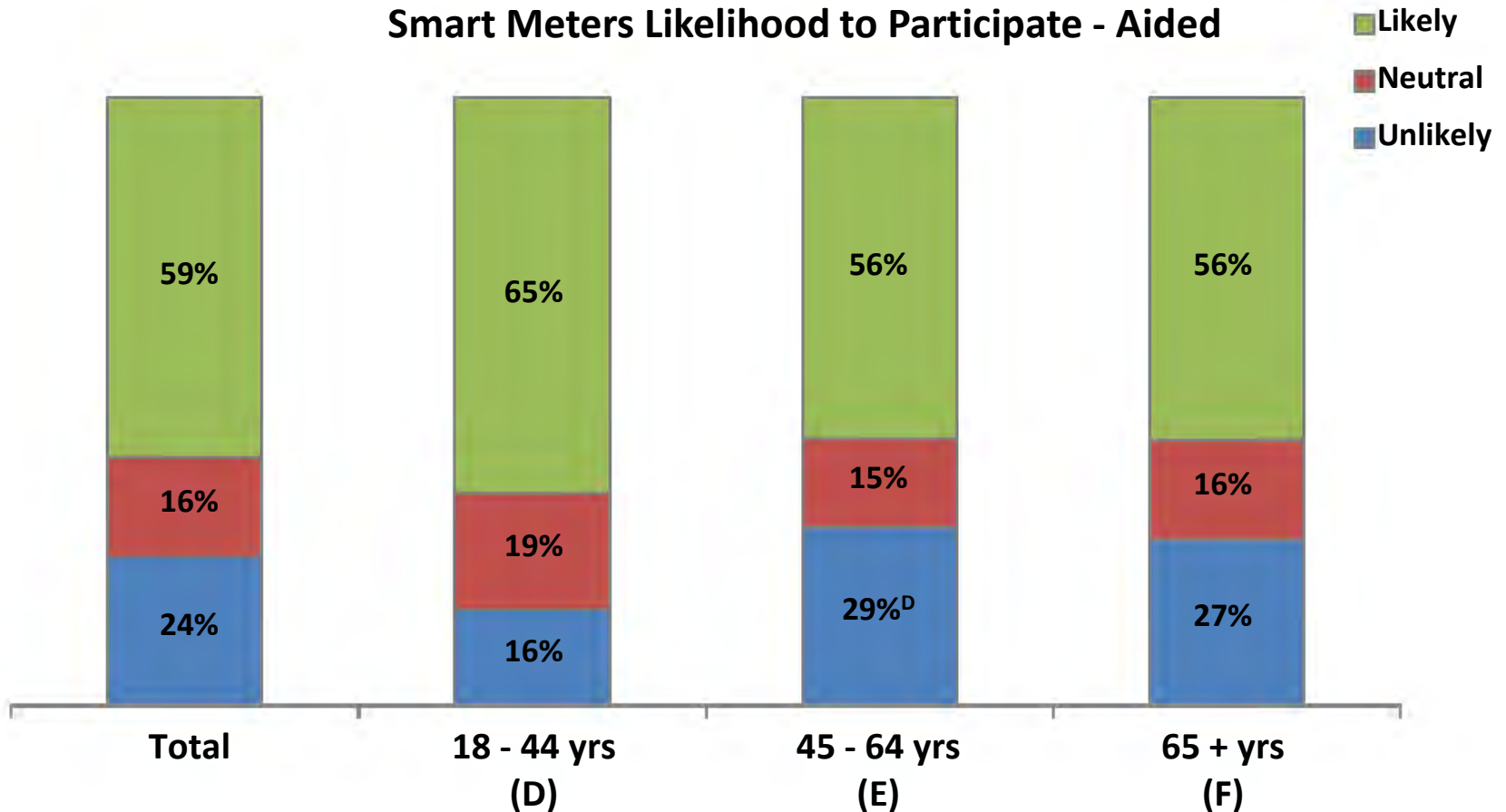




Likelihood to Participate



Smart Meters Likelihood to Participate - Aided



Q8: Based on what you currently know about Smart Meters, how likely would you be to participate in a Smart Meter program if one was offered by [LG&E, Kentucky Utilities]? (5pt scale)



Rate Options



Smart Meters Rate Options

	Time of Use (A)	Critical Peak (B)	Peak Time Rebate (C)	Inclining Block (D)
Likelihood to Participate (T2B)	55.2% ^{BD}	48.6% ^D	70.4% ^{ABD}	37.9%
Ease of Understanding (T2B)	76.4% ^{BD}	72.0% ^D	74.2% ^D	60.5%
Ease of Making Usage Changes (T2B)	52.8% ^{BD}	48.2% ^D	64.1% ^{ABD}	36.5%
Motivation to Lower Usage/Save Money (T2B)	59.1% ^{BD}	54.0% ^D	72.4% ^{ABD}	43.4%
Take Rate*	42.9% ^{BD}	37.7% ^D	55.0% ^{ABD}	25.4%

Q9a: How likely would you be to participate in the [INSERT OPTION] Smart Meter program? (5pt scale)

Q9b: How easy is it to understand the [INSERT OPTION] Smart Meter program? (5pt scale)

Q9c: How easy would it be to make changes to your energy usage with the [INSERT OPTION] Smart Meter program? (5pt scale)

Q9d: How motivated would you be to lower your energy usage and save money with the [INSERT OPTION] Smart Meter program? (5pt scale)

*Take Rate Definition: Customers rating all four metrics T2B (likelihood to participate, ease of understanding, ease of making changes, motivation)



Rate Options



Smart Meters Rate Options – LG&E vs KU

Take Rate*	Time of Use (A)	Critical Peak (B)	Peak Time Rebate (C)	Inclining Block (D)
Total LG&E/KU	42.9% ^{BD}	37.7% ^D	55.0% ^{ABD}	25.4%
LG&E	48.1% ^D	42.1% ^D	57.9% ^{ABD}	26.4%
KU	38.9% ^D	34.3% ^D	52.9% ^{ABD}	24.6%

*Take Rate Definition: Customers rating all four metrics T2B (likelihood to participate, ease of understanding, ease of making changes, motivation)



Rate Options



Smart Meters Rate Options – By Age Group

Take Rate*	Time of Use (A)	Critical Peak (B)	Peak Time Rebate (C)	Inclining Block (D)
Total LG&E/KU	42.9% ^{BD}	37.7% ^D	55.0% ^{ABD}	25.4%
Age 18-44	42.3% ^D	36.6% ^D	55.2% ^{ABD}	25.5%
Age 45-64	41.6% ^D	37.2% ^D	55.0% ^{ABD}	24.2%
Age 65+	51.0% ^D	43.7%	54.6% ^D	30.7%

*Take Rate Definition: Customers rating all four metrics T2B (likelihood to participate, ease of understanding, ease of making changes, motivation)



Tools and Features



MaxDiff Preference Score

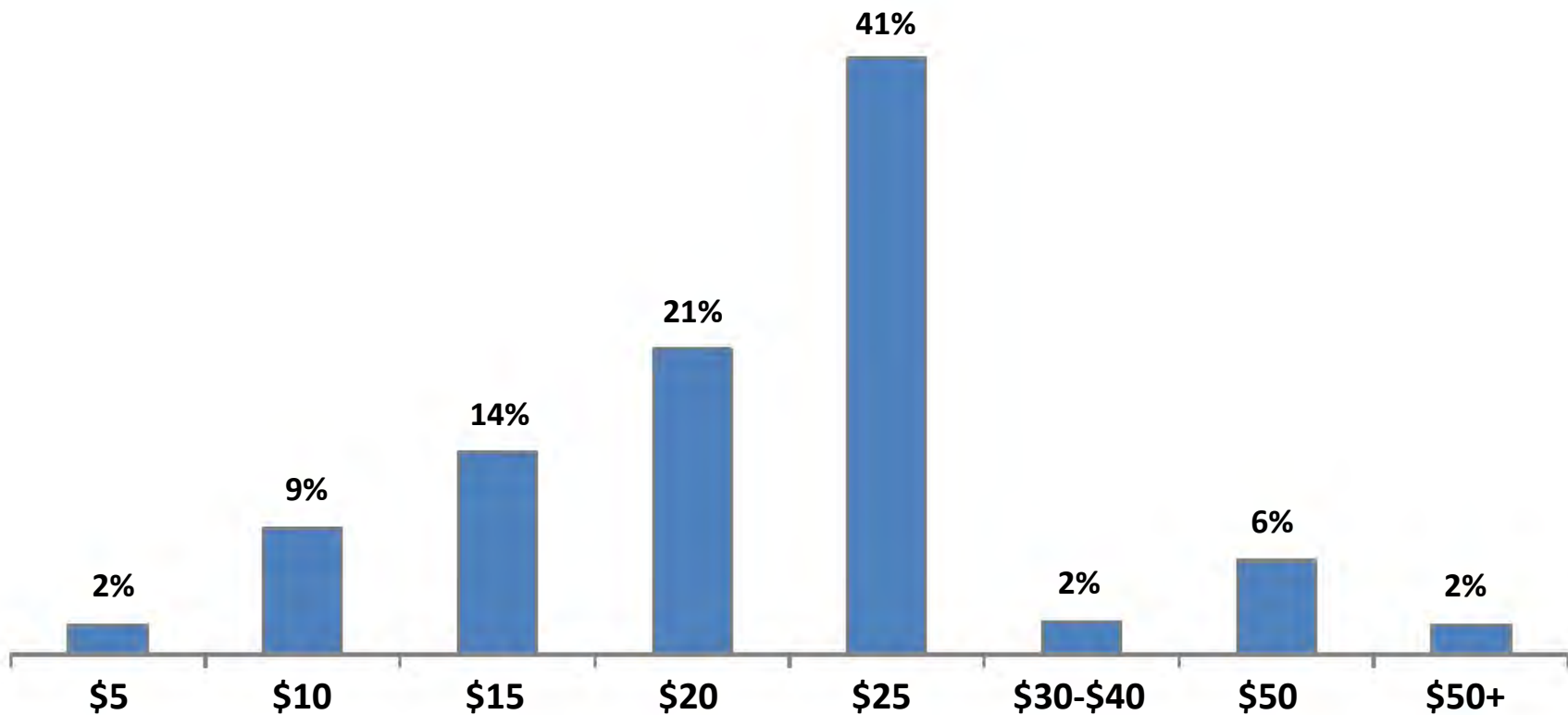
Smart Meter Features	Total LG&E/KU (n = 495)	Age 18-44 (n = 172)	Age 45-64 (n = 268)	Age 65+ (n = 55)
Track your electricity usage on an in-home display or energy monitor	20.18	18.09	21.37	20.91
Track your electricity usage on-line	16.96	16.35	17.16	17.92
Receive Email alerts about when higher rates would start to apply	13.16	10.35	13.89	18.36
Ability to adjust your thermostat on-line	10.89	9.43	12.06	9.82
Receive Email alerts about your electricity usage	10.79	7.11	12.16	15.63
Ability to adjust your thermostat using a Smartphone app	9.94	12.81	8.71	6.93
Track your electricity usage using a Smartphone app	9.19	14.07	7.02	4.45
Receive text message alerts on your Smartphone about when higher rates would start to apply	8.89	11.78	7.63	5.97



Monthly Savings



Monthly Savings Desired to Change Behavior



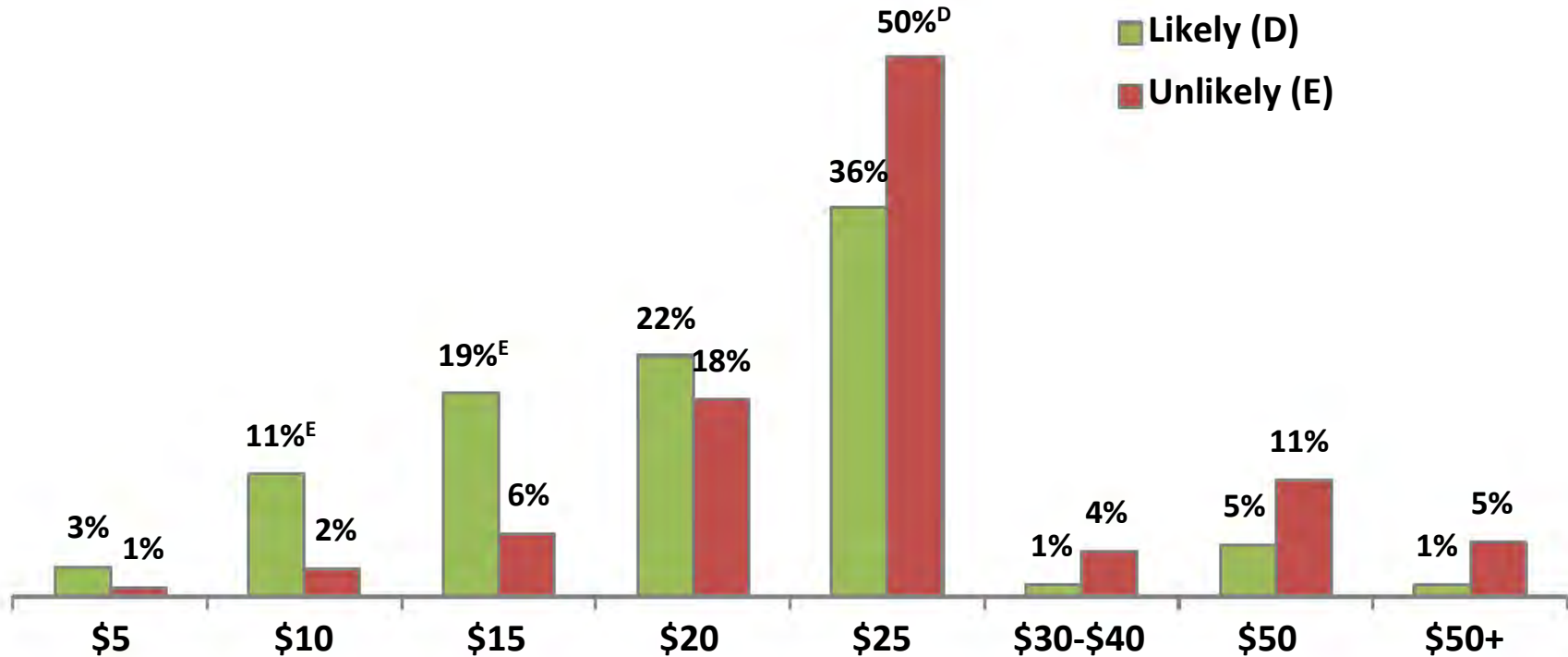
Q11: How much would you need to save on your monthly electric bill in order to change your behavior, such as adjusting your thermostat to sometimes less-comfortable settings, changing the time of day you use appliances, etc.?



Monthly Savings



Monthly Savings Desired to Change Behavior Likely vs Unlikely to Participate*

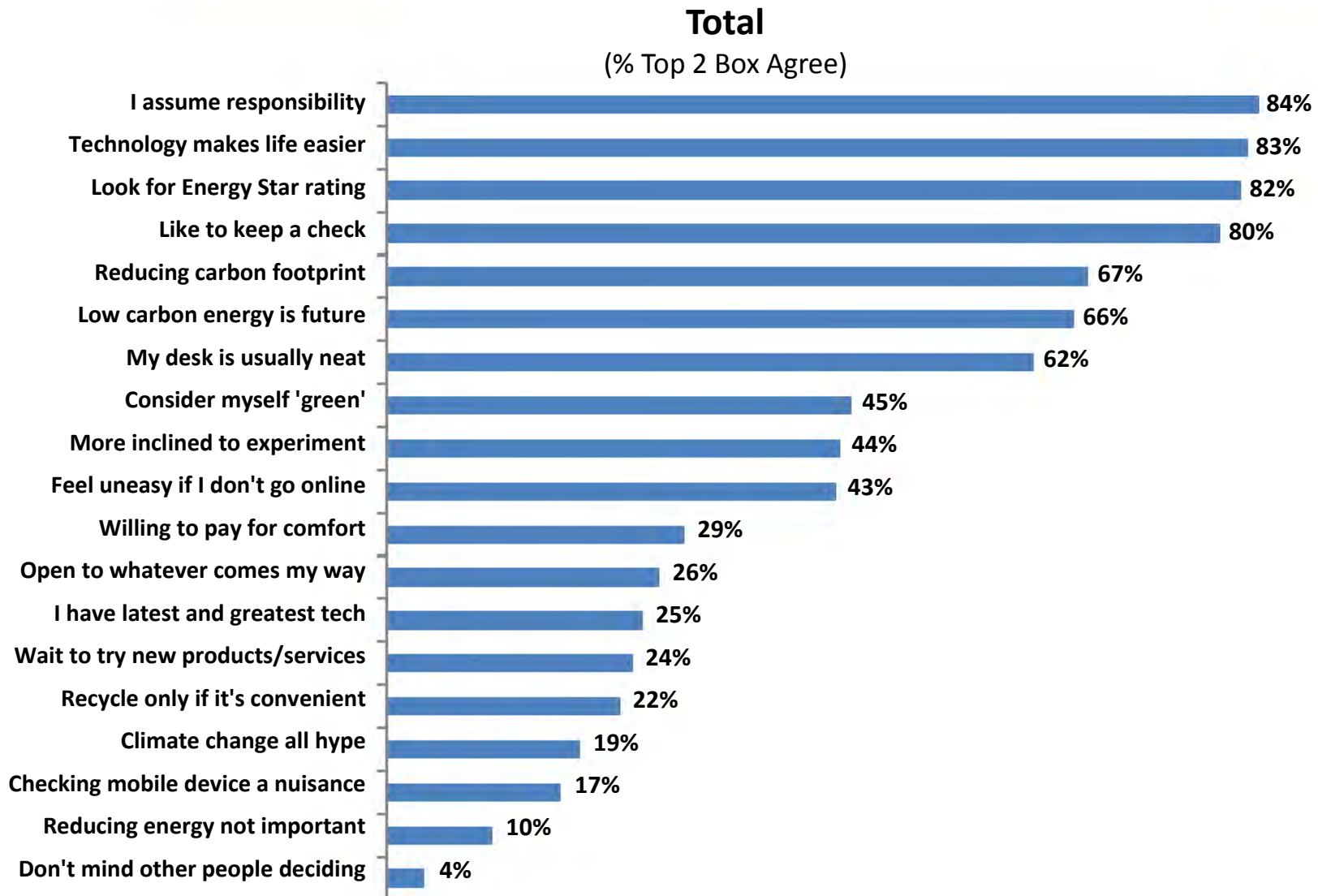


Q11: How much would you need to save on your monthly electric bill in order to change your behavior, such as adjusting your thermostat to sometimes less-comfortable settings, changing the time of day you use appliances, etc.?

*Q8: Based on what you currently know about Smart Meters, how likely would you be to participate in a Smart Meter program if one was offered by [LG&E, Kentucky Utilities]? (5pt scale)



Attitudes





Attitudes

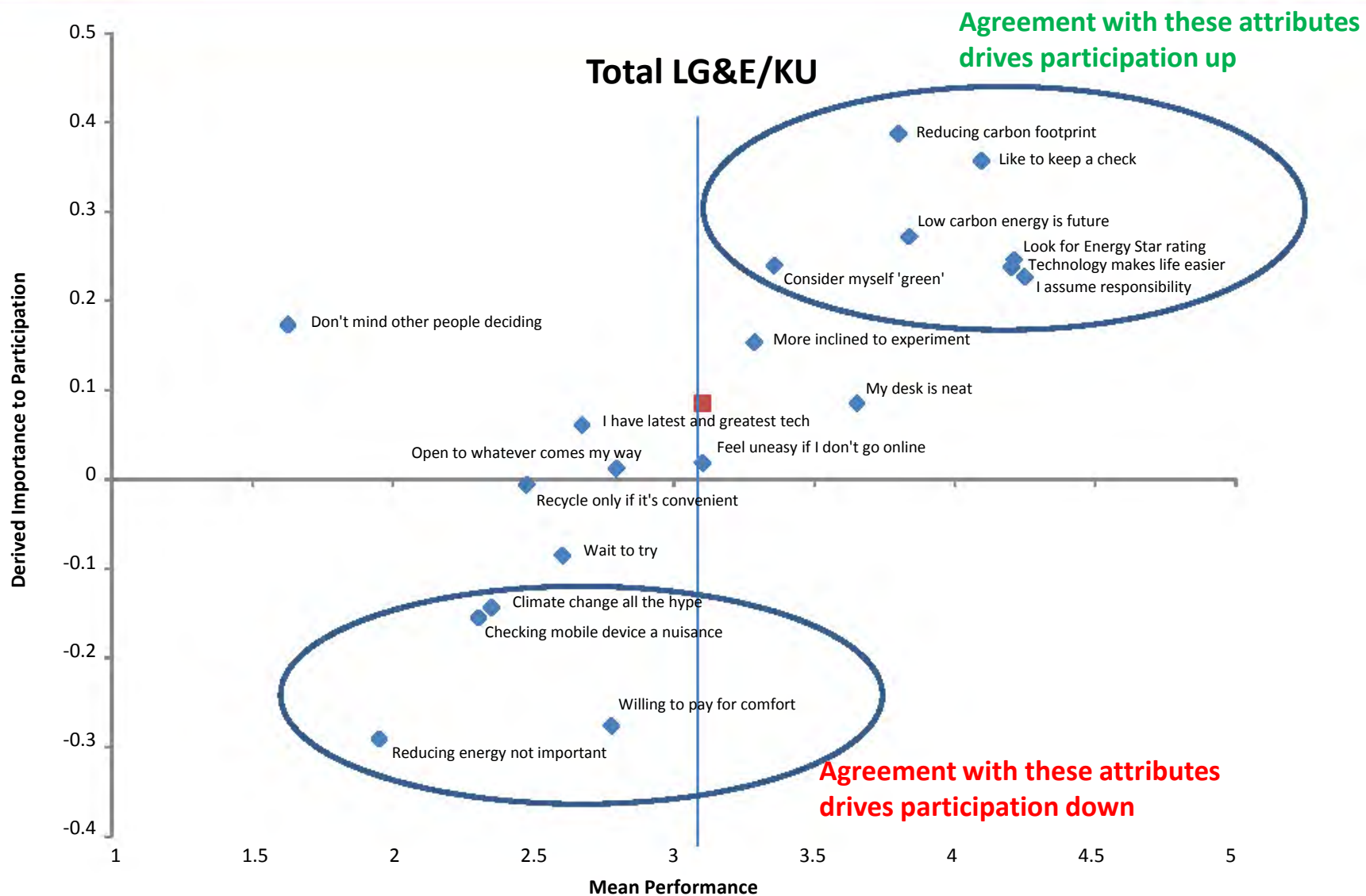


% T2B Agree – By Age Group	Total	18 – 44 yrs (D)	45 – 64 yrs (E)	65+ yrs (F)
I assume responsibility	84%	86%	81%	91% ^E
Technology makes life easier	83%	81%	83%	85%
Look for Energy Star rating	82%	80%	83%	87%
Like to keep a check	80%	87% ^E	74%	89% ^E
Reducing carbon footprint	67%	72%	64%	71%
Low carbon energy is future	66%	69%	64%	65%
My desk is usually neat	62%	67%	60%	58%
Consider myself 'green'	45%	42%	46%	45%
More inclined to experiment	44%	50%	41%	38%
Feel uneasy if I don't go online	43%	48%	38%	53% ^E
Willing to pay for comfort	29%	25%	29%	38%
Open to whatever comes my way	26%	24%	26%	33%
I have latest and greatest tech	25%	37% ^{EF}	17%	20%
Wait to try new products/services	24%	20%	26%	24%
Recycle only if it's convenient	22%	28% ^{EF}	20%	16%
Climate change all hype	19%	16%	21%	15%
Checking mobile device a nuisance	17%	9%	22% ^D	13%
Reducing energy not important	10%	11%	10%	5%
Don't mind other people deciding	4%	2%	4%	5%

Q12: How much do you agree or disagree with each of the following statements? (5pt scale)

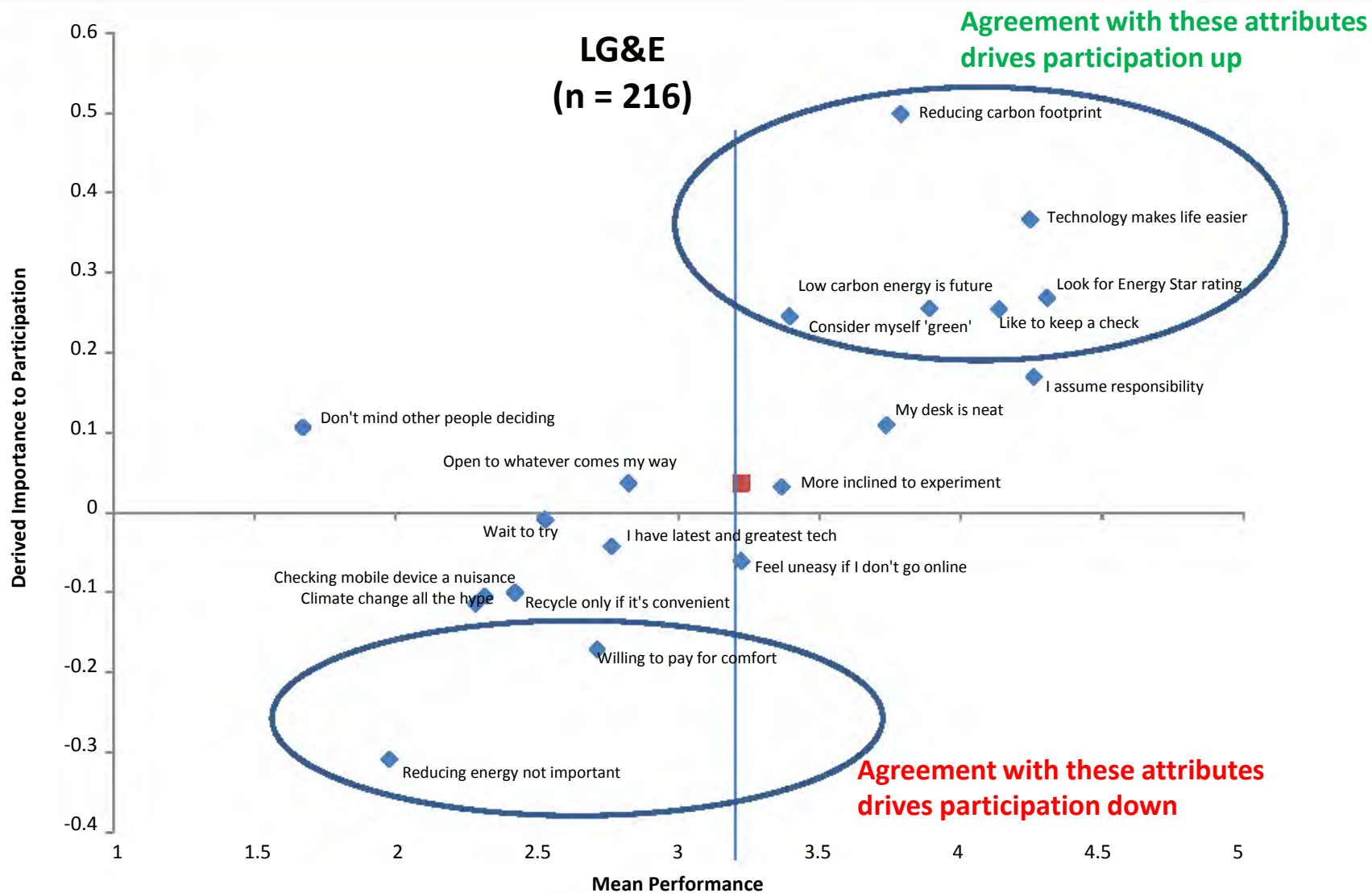


Attitudes and Participation



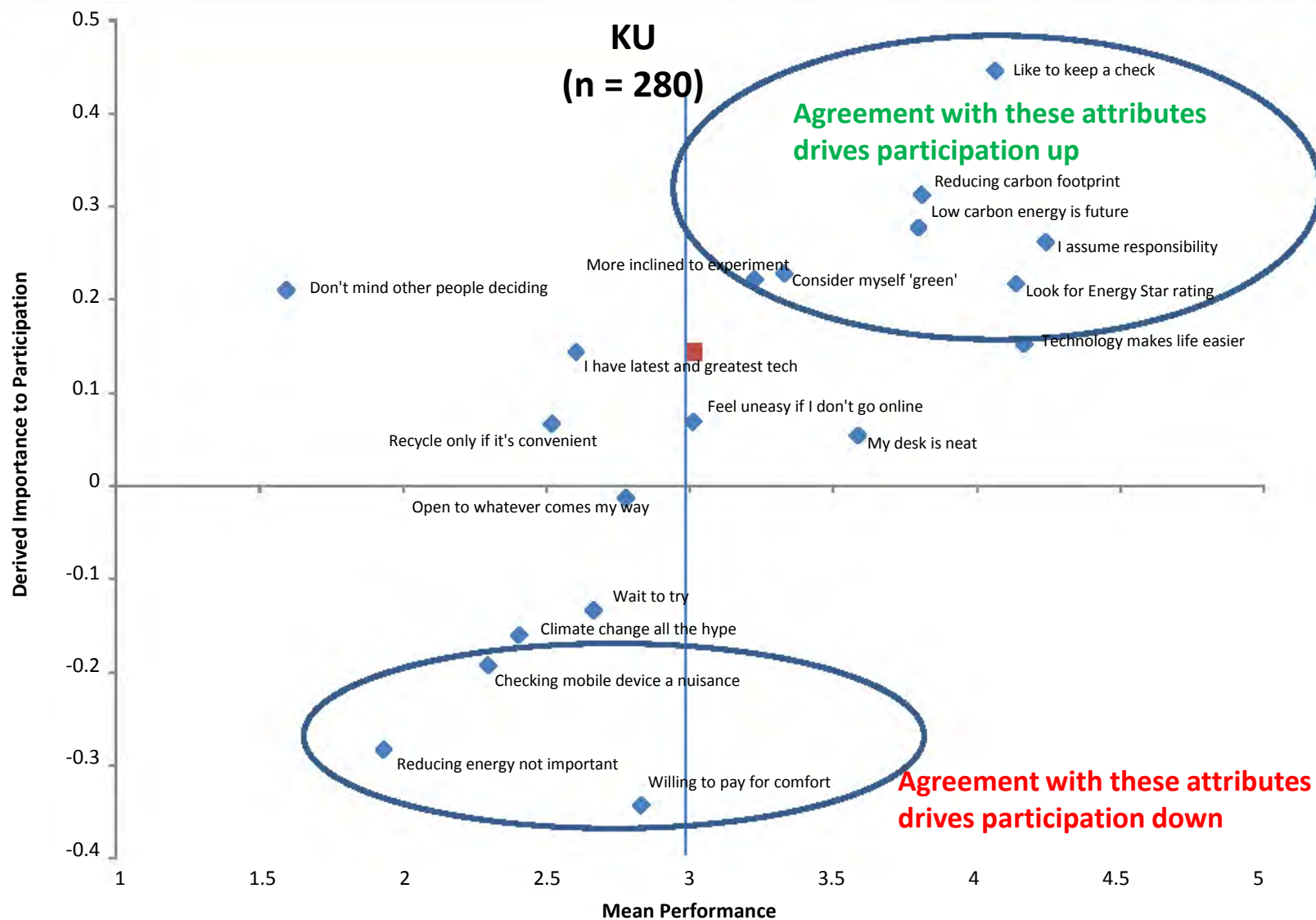


Attitudes and Participation



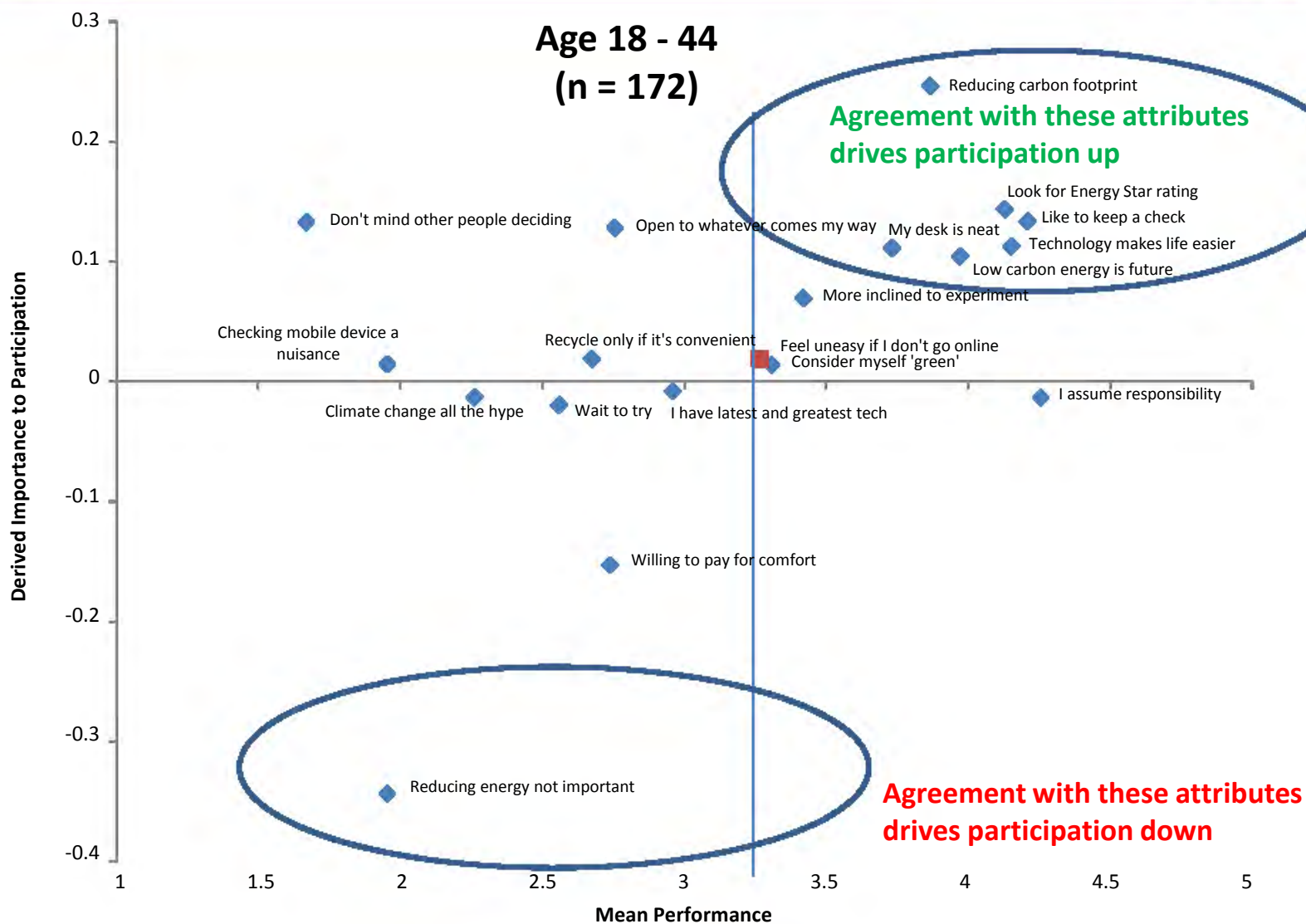


Attitudes and Participation



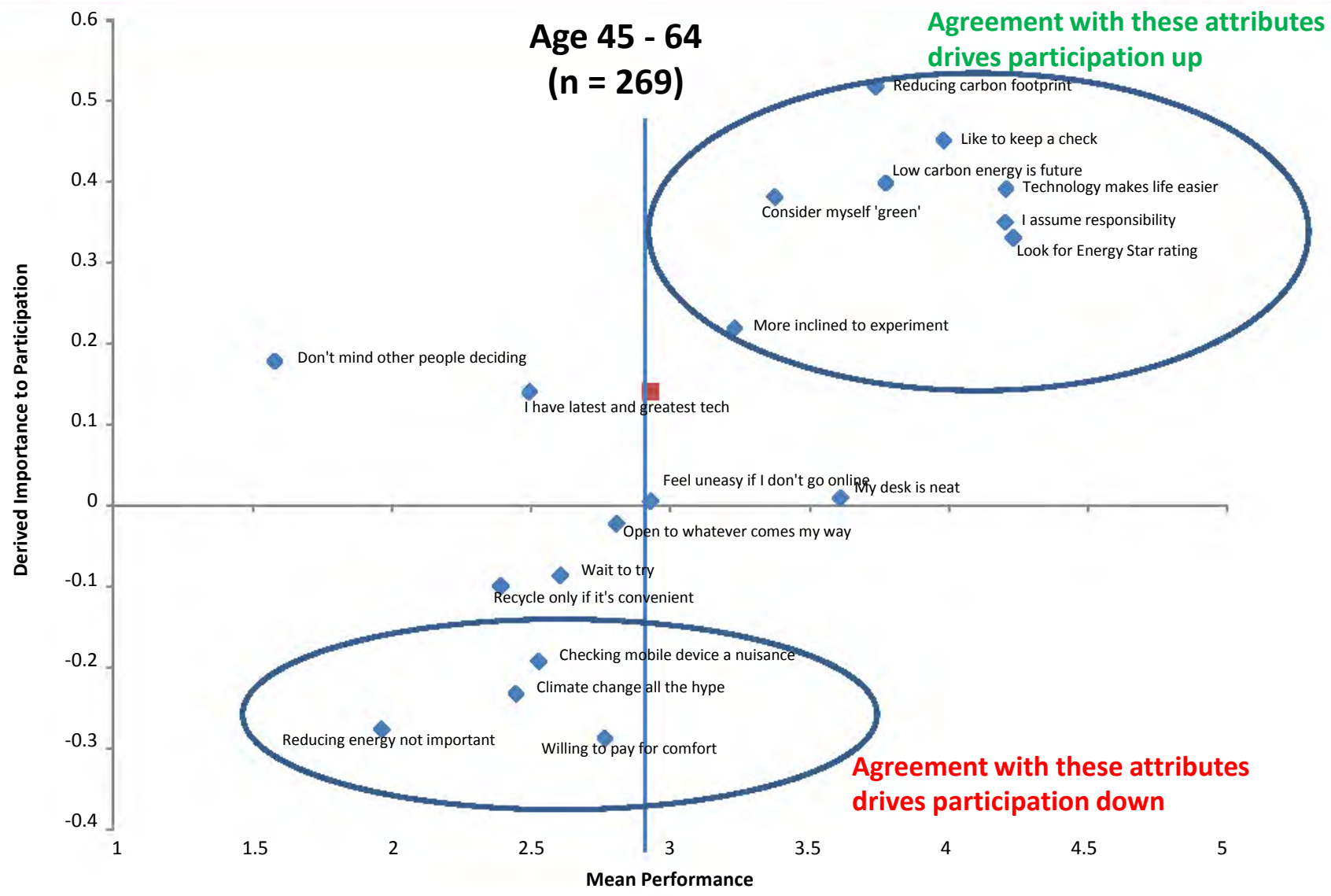


Attitudes and Participation



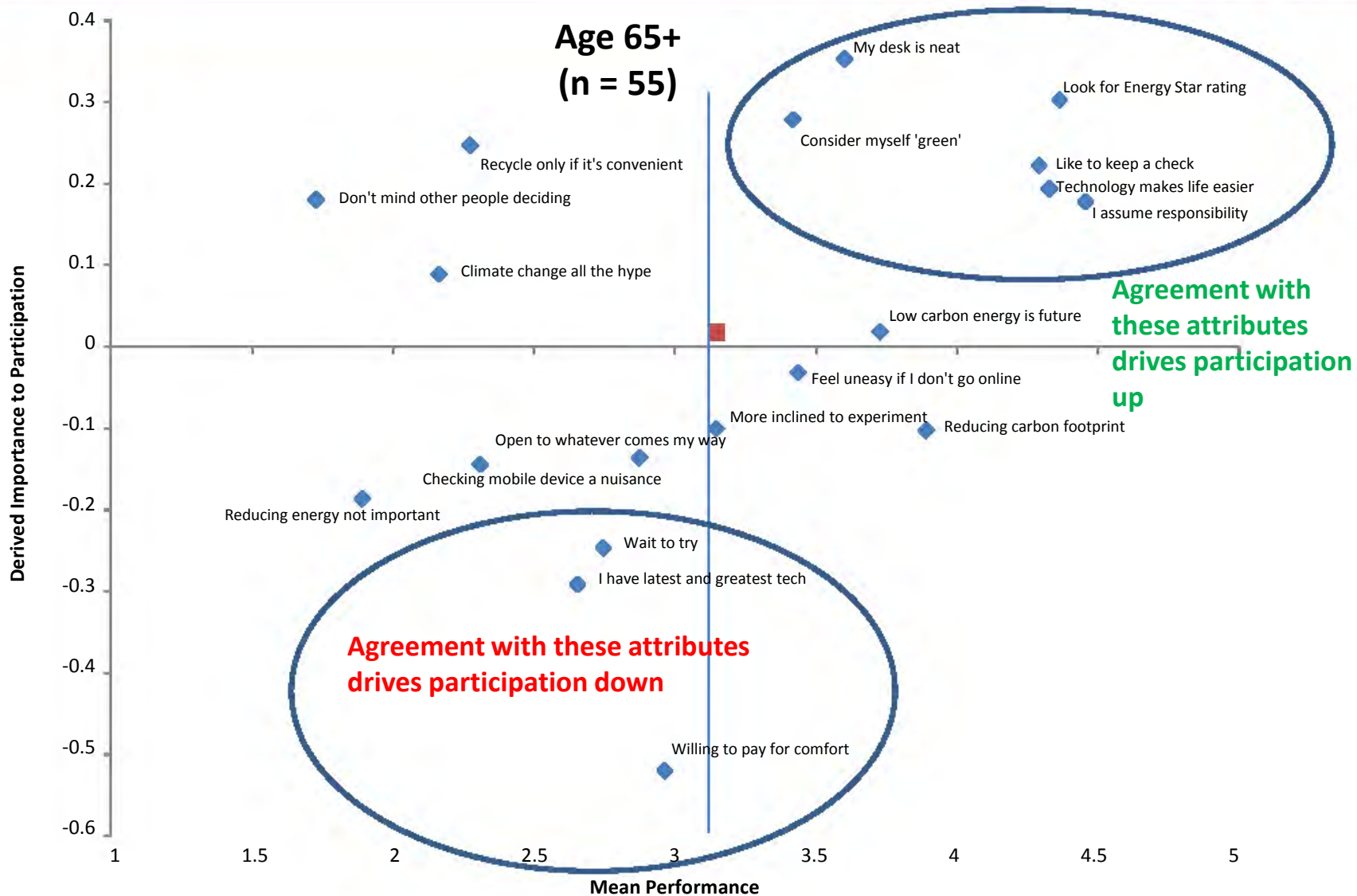


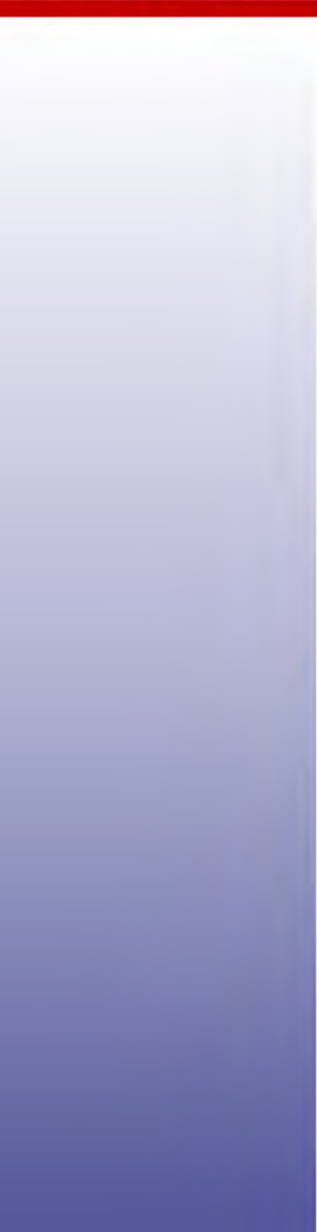
Attitudes and Participation





Attitudes and Participation



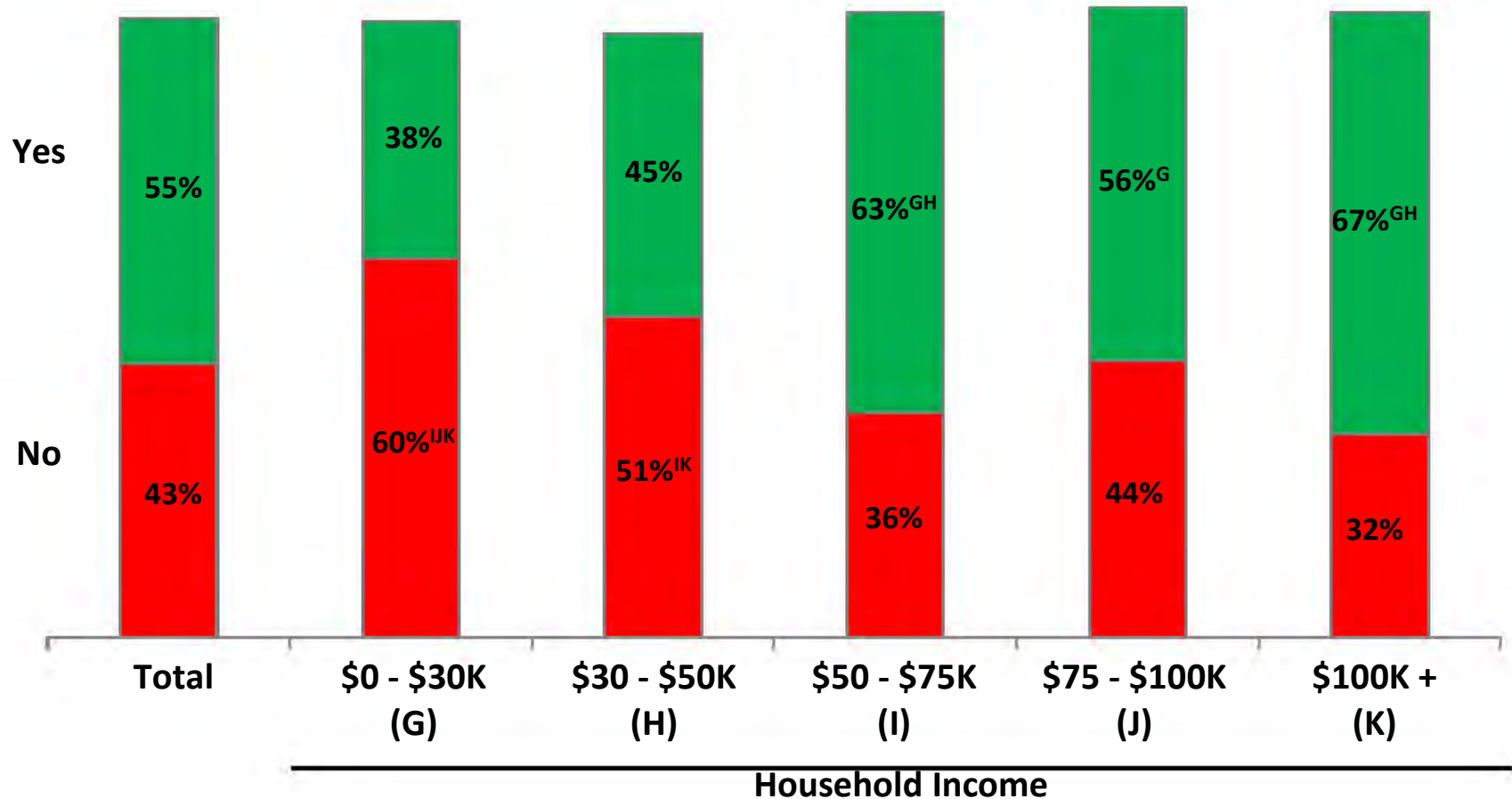




Programmable Thermostat



Programmable Thermostat in Residence



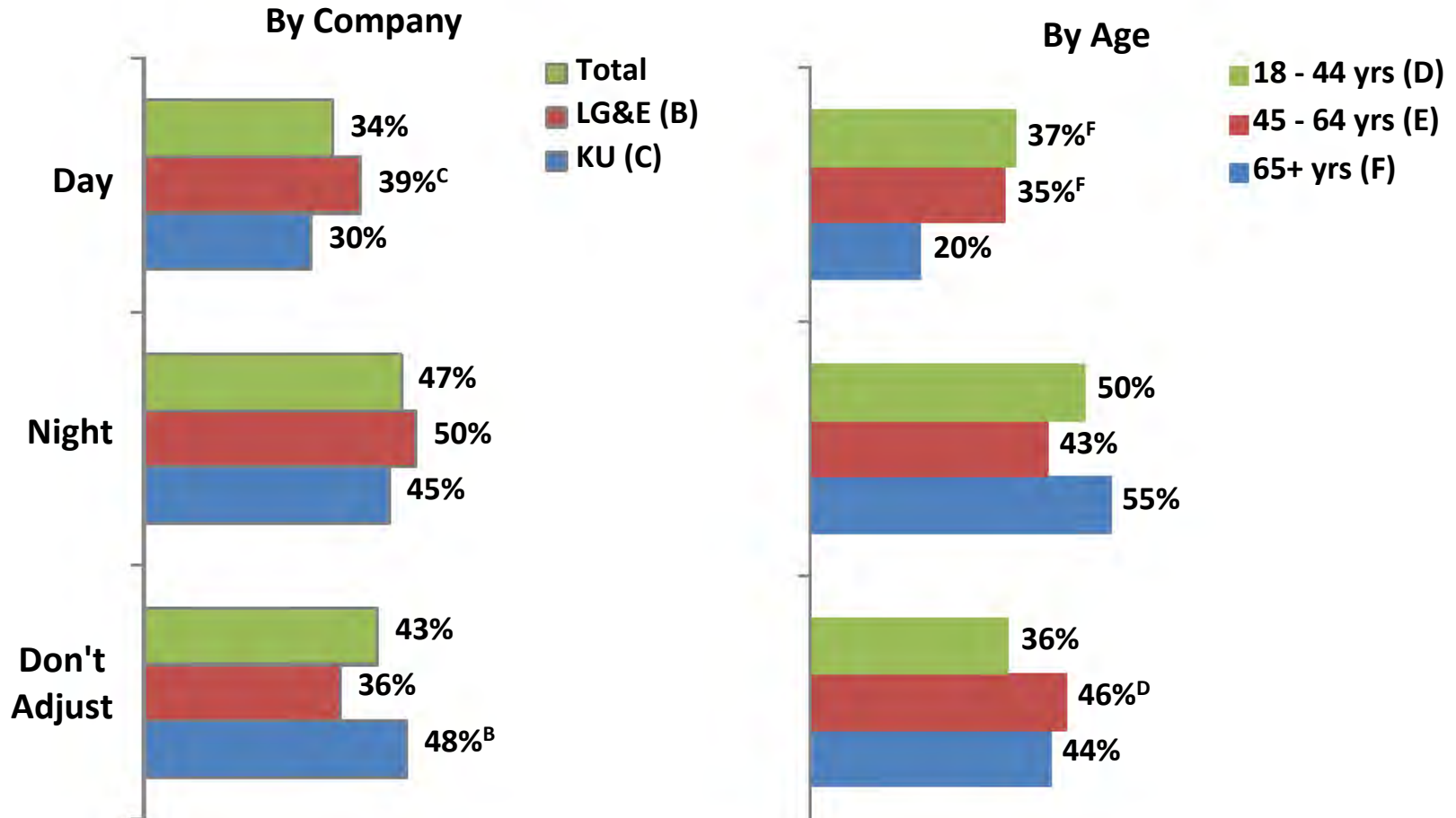
Q4: Is the thermostat in your residence programmable?



Thermostat Adjustment



When Adjust Thermostat on Weekdays



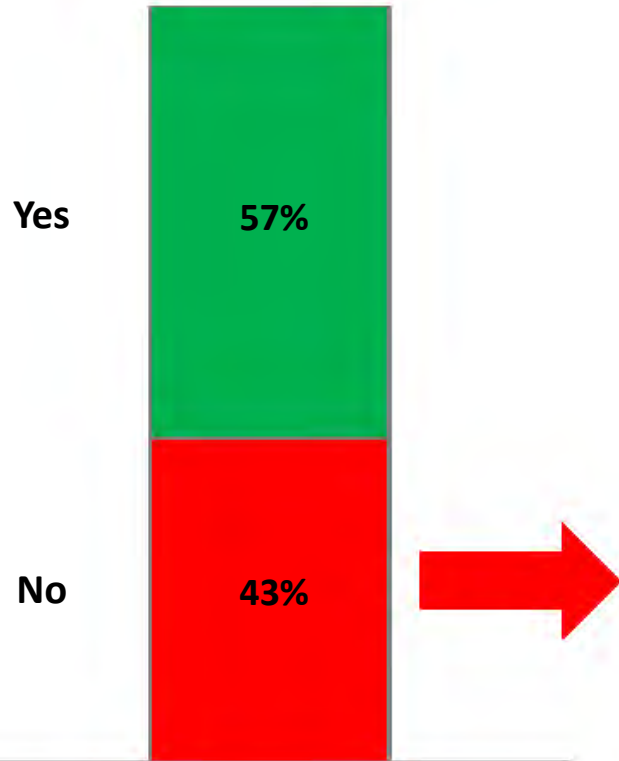
Q2: Thinking about the weekdays (Monday through Friday), when do you or others in your household usually adjust your thermostat (either manually or programmed), if at all? Select all that apply.



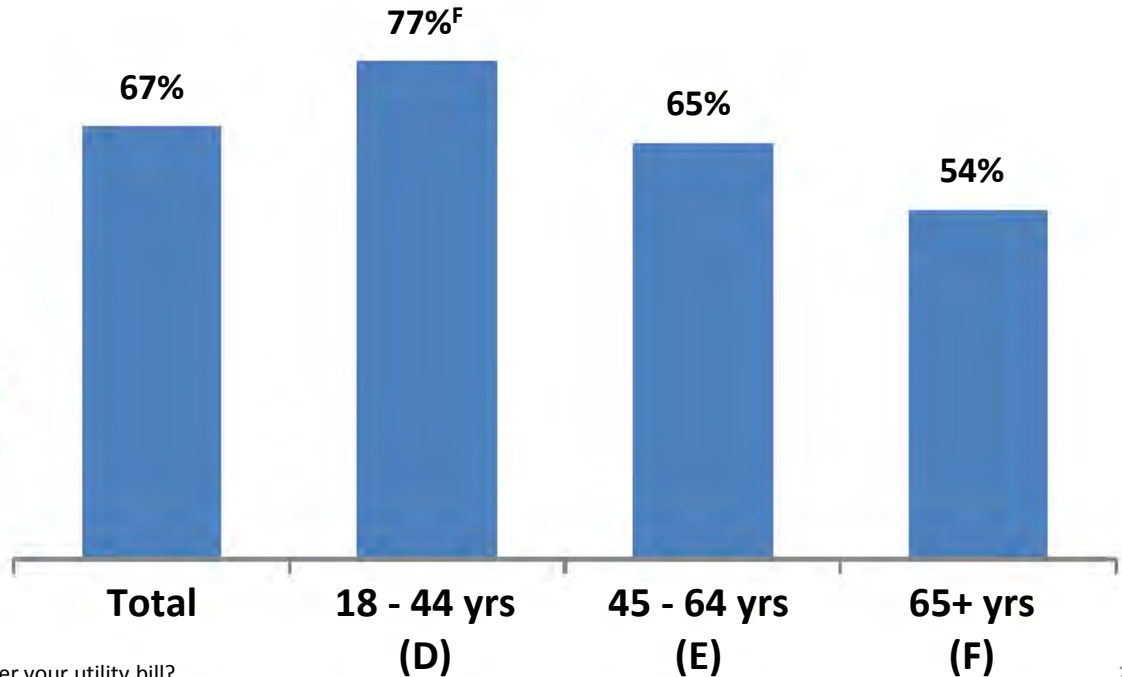
Thermostat Adjustment



Adjust Thermostat
on Weekdays



Willing to Adjust – By Age
(% Yes)



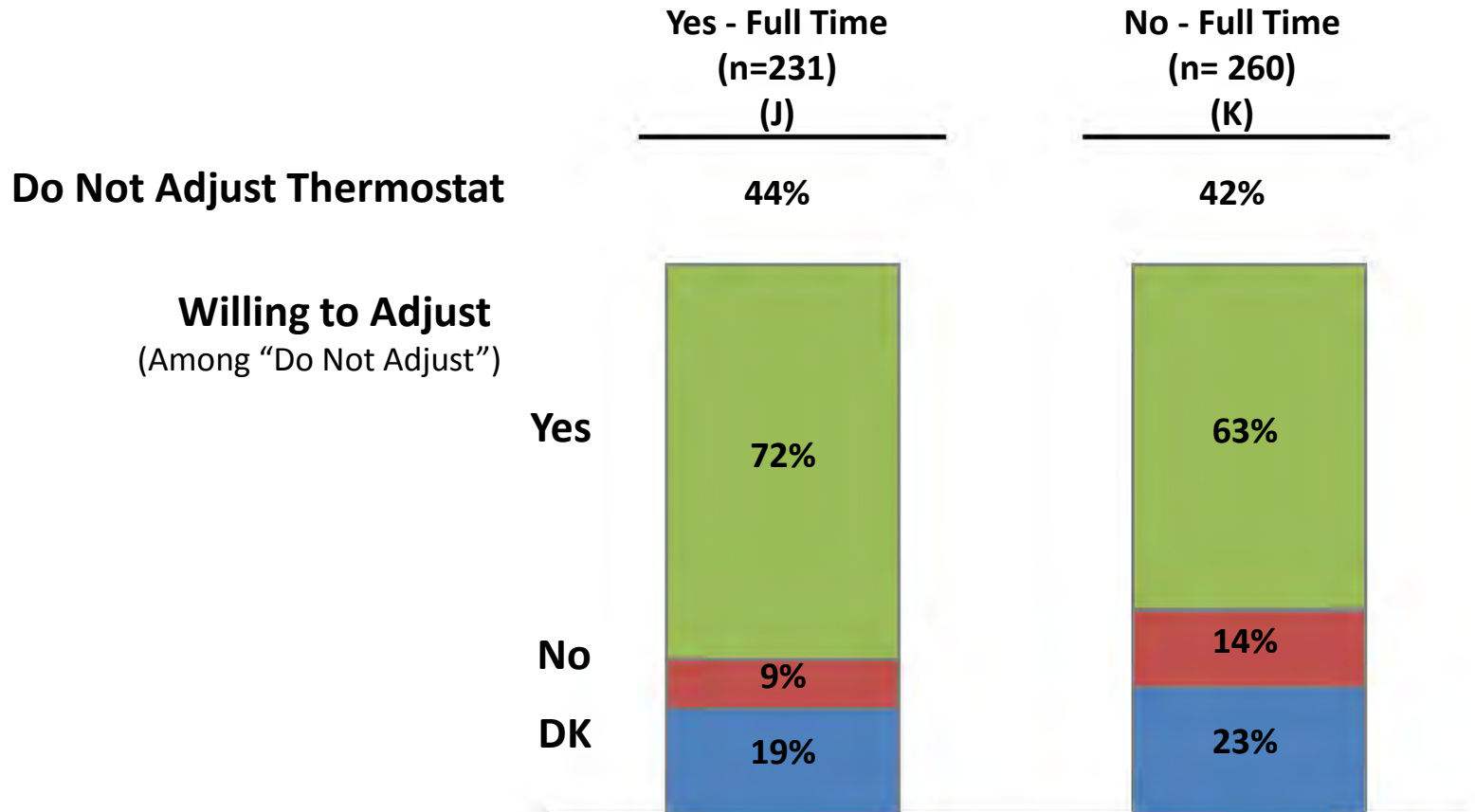
Q3: Would you be willing to adjust your thermostat daily if it would lower your utility bill?



Thermostat Adjustment



Thermostat Adjustment - All Adults Employed Full Time

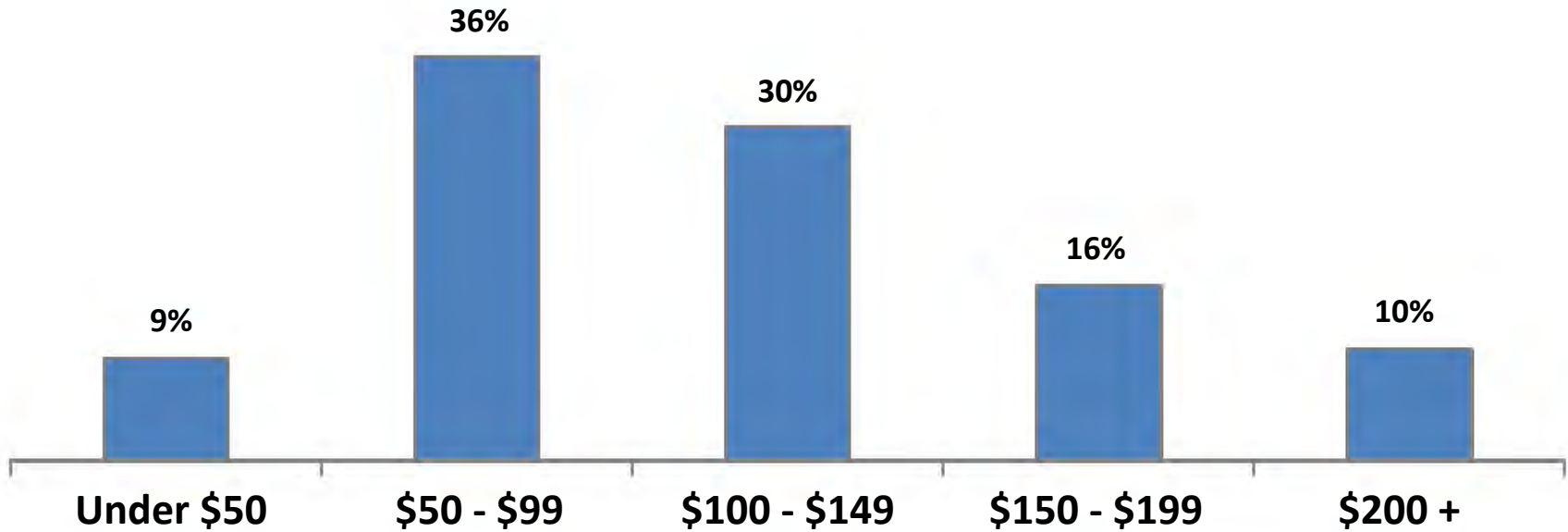




Utility Bill



**Most Recent Utility Bill
 (% of LG&E/KU Customers)**



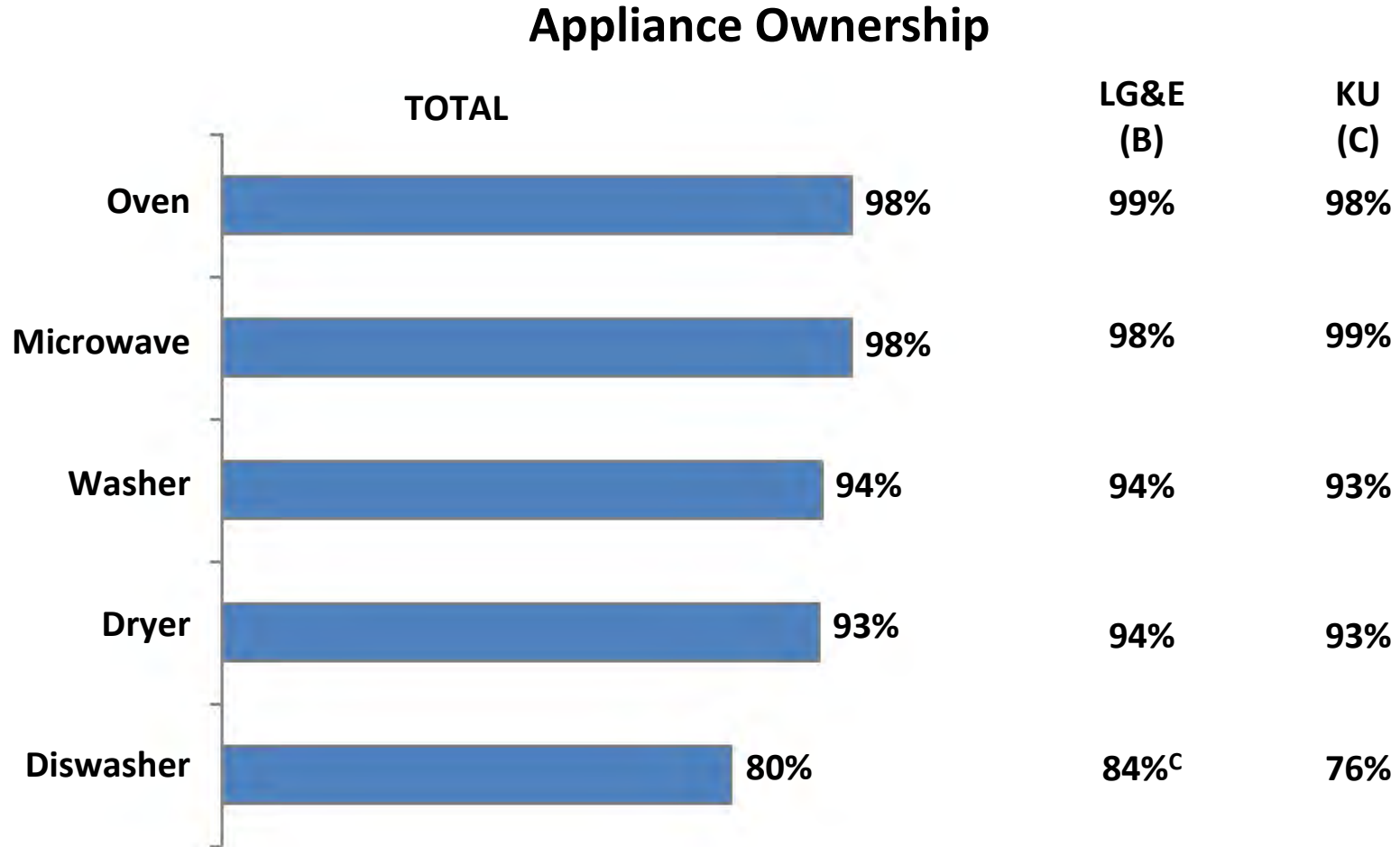
LG&E (B)	4%	31%	31%	22% ^C	12%
KU (C)	13% ^B	40% ^B	29%	10%	8%

QS4a: Approximately, how much was your most recent [LG&E or Kentucky Utilities] bill (excluding any past due amounts)? Please round to the nearest whole dollar.





Appliance Ownership



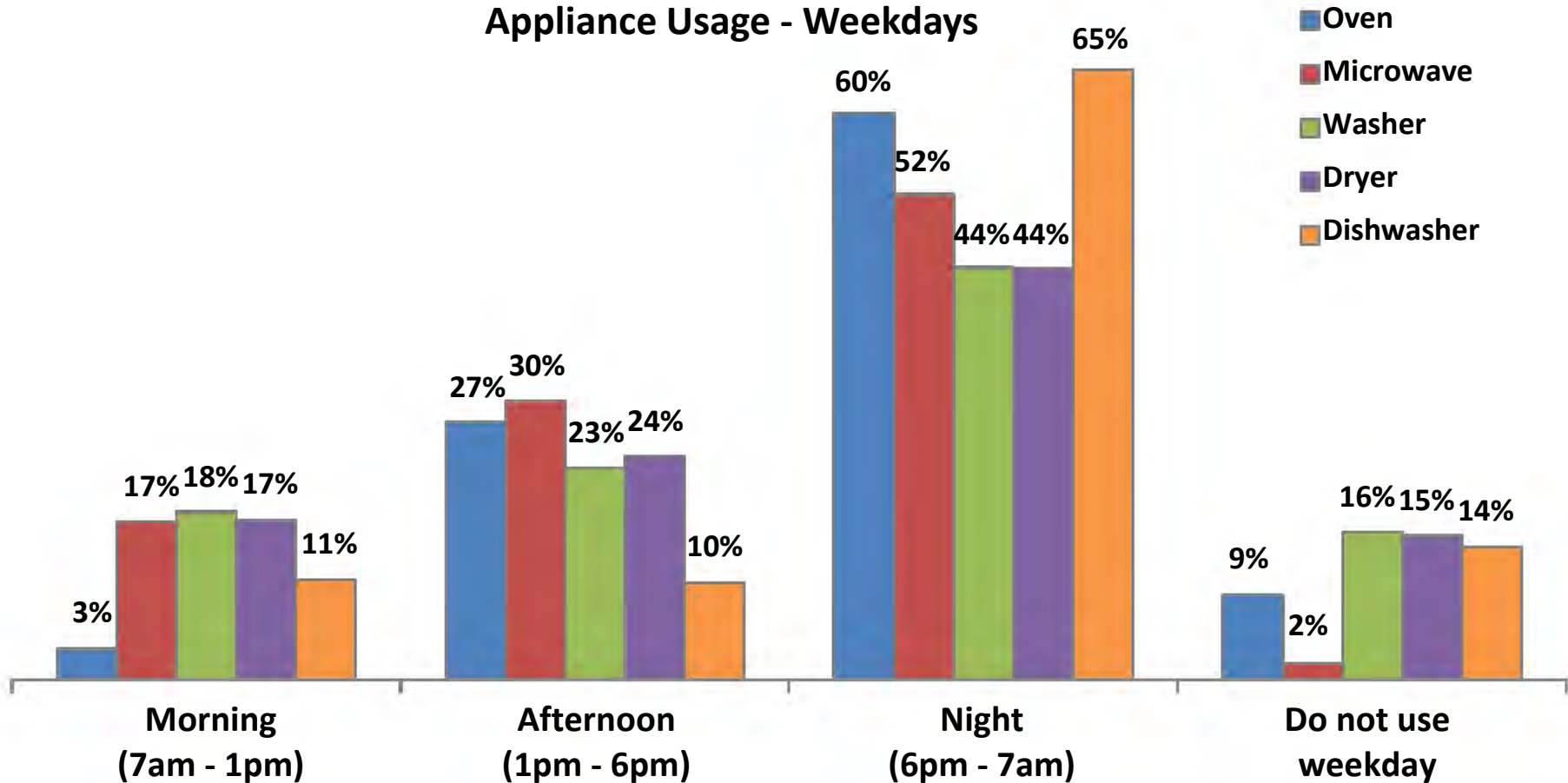
Q1: Which of the following appliances do you have in your residence?



Appliance Usage



Appliance Usage - Weekdays

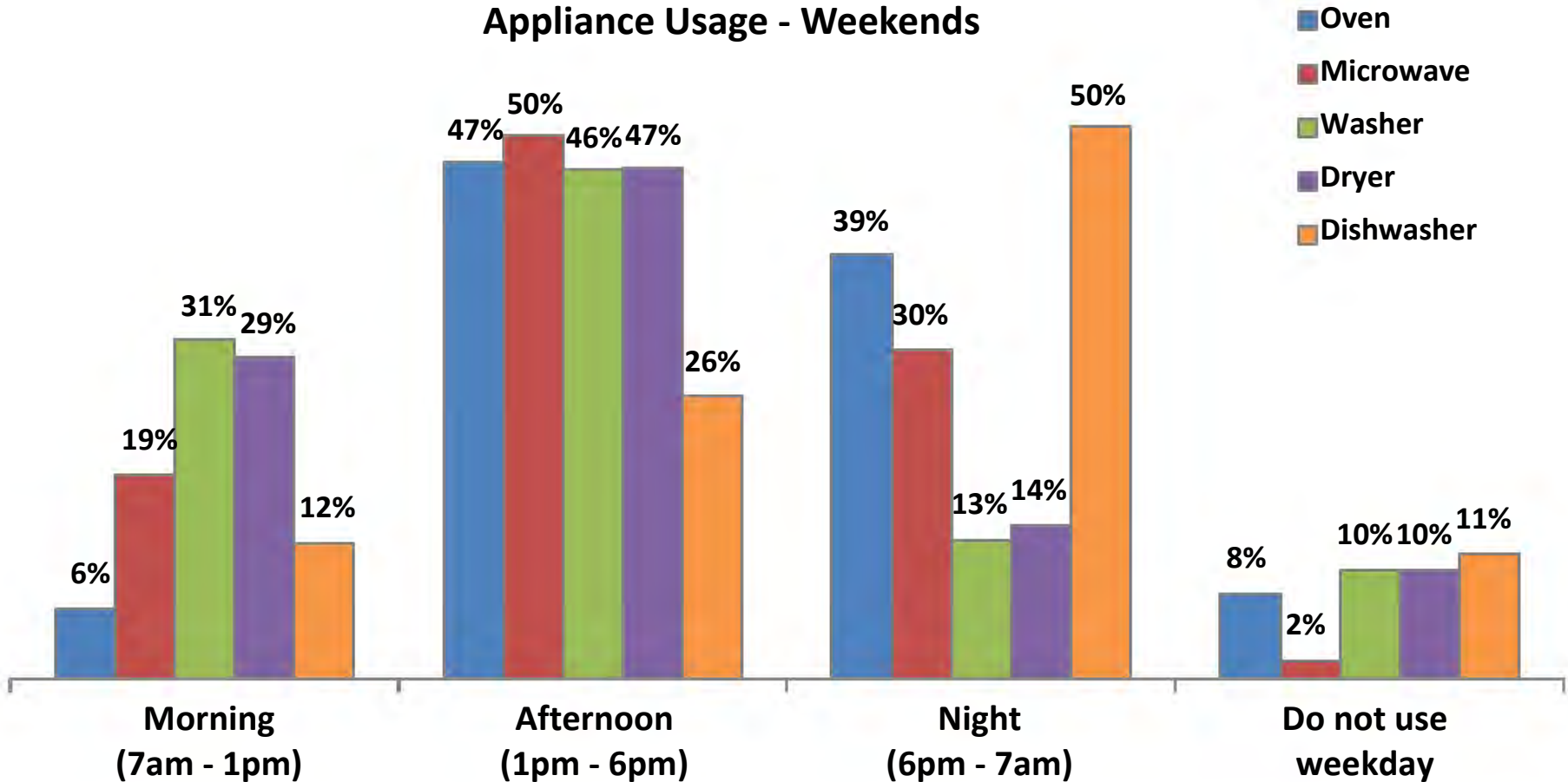




Appliance Usage



Appliance Usage - Weekends





Appliance Usage

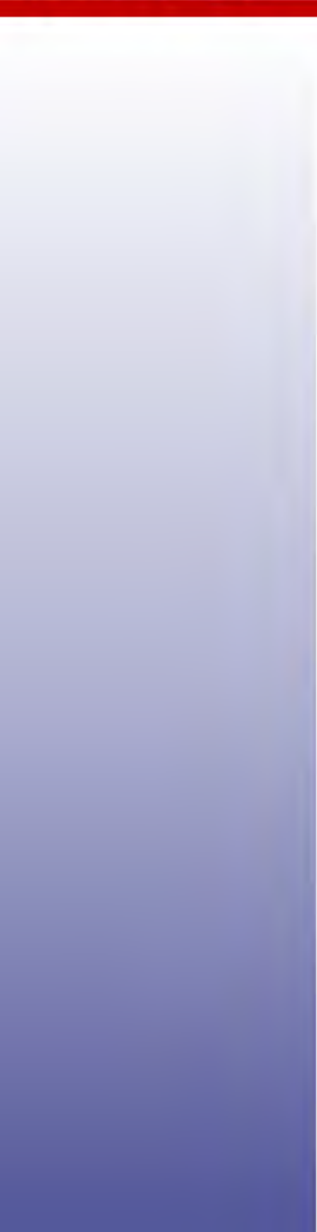


During the week, appliance usage is heaviest at night for younger households (18-64 years), but tends to shift to the afternoon on weekends.

	Washer			Dryer			Oven			Dishwasher			Microwave		
Weekdays	18-44 (D)	45-64 (E)	65+ (F)	18-44 (D)	45-64 (E)	65+ (F)	18-44 (D)	45-64 (E)	65+ (F)	18-44 (D)	45-64 (E)	65+ (F)	18-44 (D)	45-64 (E)	65+ (F)
Morning (7am-1pm)	9	16 ^D	54 ^{DE}	8	17 ^D	48 ^{DE}	2	4	4	5	13 ^D	13	10	20 ^D	22
Afternoon (1pm-6pm)	18	25	28	18	25	34 ^D	22	28	42 ^D	11	9	17	28	28	42
Night (6pm-7am)	56 ^{EF}	42 ^F	14	56 ^{EF}	42 ^F	14	72 ^{EF}	57 ^F	38	71	63	57	60 ^F	50 ^F	35
Do Not Use Weekday	18 ^F	16 ^F	4	18 ^F	16 ^F	4	4	11 ^D	16 ^D	14	15	13	2	2	2
Weekends	18-44 (D)	45-64 (E)	65+ (F)	18-44 (D)	45-64 (E)	65+ (F)	18-44 (D)	45-64 (E)	65+ (F)	18-44 (D)	45-64 (E)	65+ (F)	18-44 (D)	45-64 (E)	65+ (F)
Morning (7am-1pm)	27	33	32	26	31	32	5	7	5	12	13	9	9	25 ^D	18
Afternoon (1pm-6pm)	56 ^{EF}	45 ^F	22	56 ^{EF}	46 ^F	20	50	47	38	37 ^{EF}	20	19	60 ^{EF}	45	44
Night (6pm-7am)	15 ^F	13	6	16	14	8	41	36	45	44	55 ^D	49	30	29	36
Do Not Use Weekend	3	9 ^D	40 ^{DE}	3	9 ^D	40 ^{DE}	3	10 ^D	11	8	11	23 ^D	1	2	2

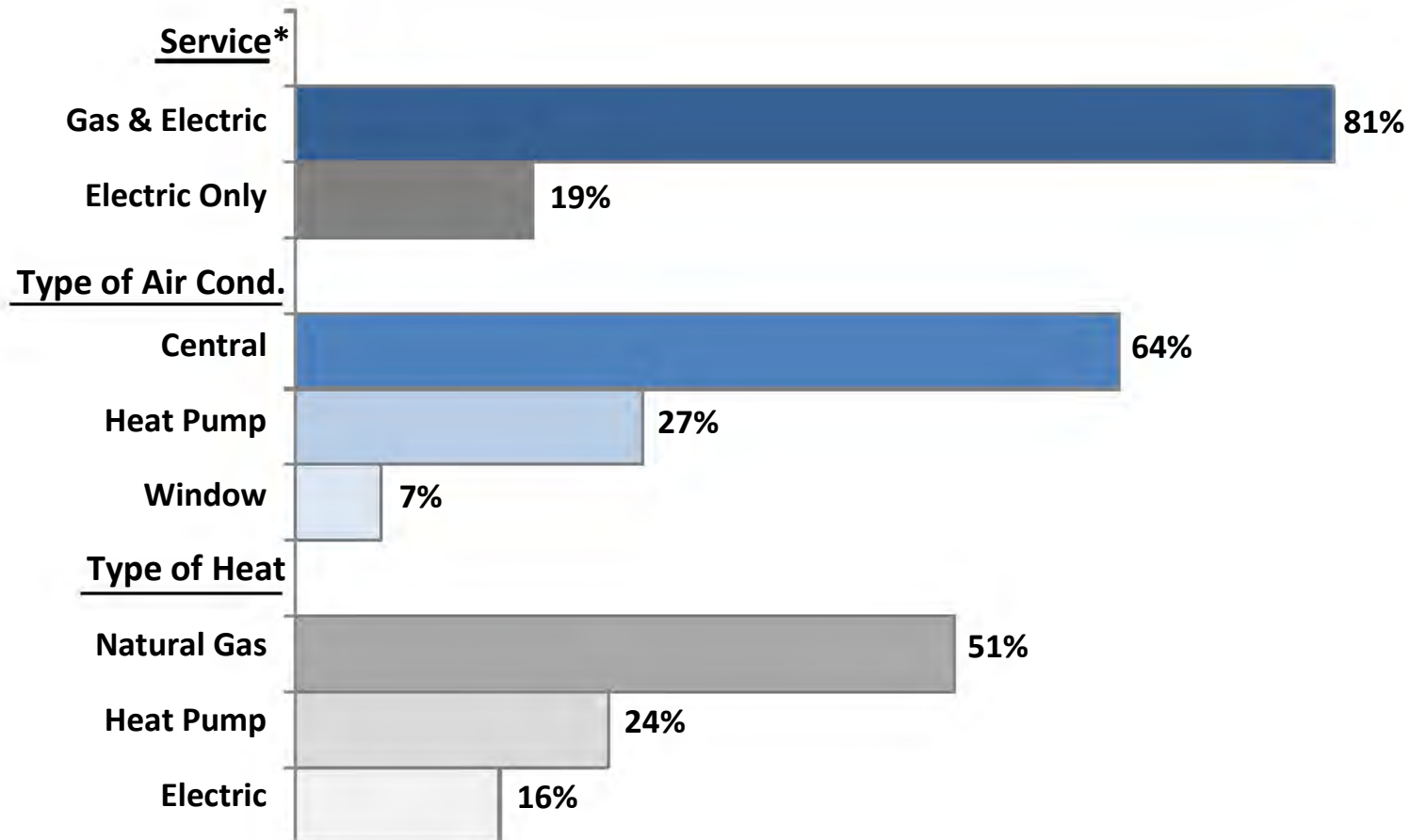
Q1a: When do you most often use your appliances during the weekdays?

Q1b: When do you most often use your appliances on the weekend?





Residence Profile



* Asked among LG&E customers only

Q13: Are you an LG&E customer for electric service only, or for both gas and electric service?

Q14: What is the primary type of air conditioning used in your residence, if any?

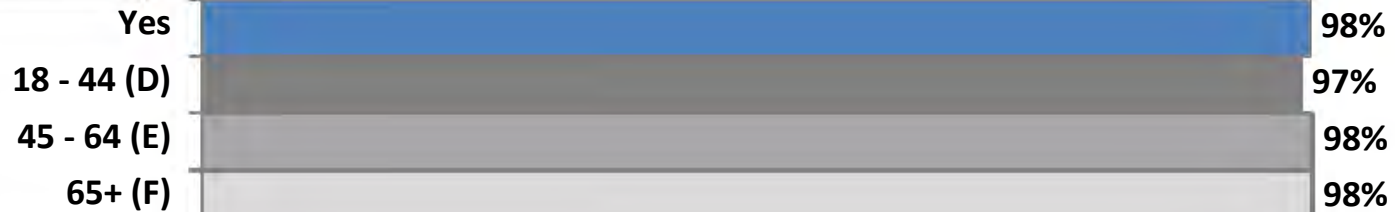
Q15: What is the primary type of heating used in your residence?



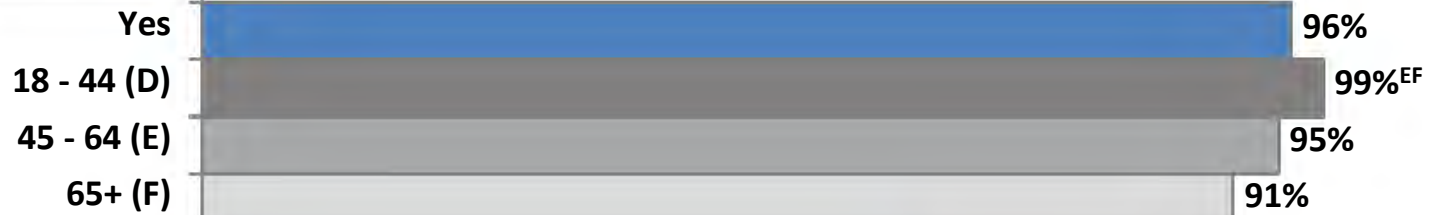
Residence Profile



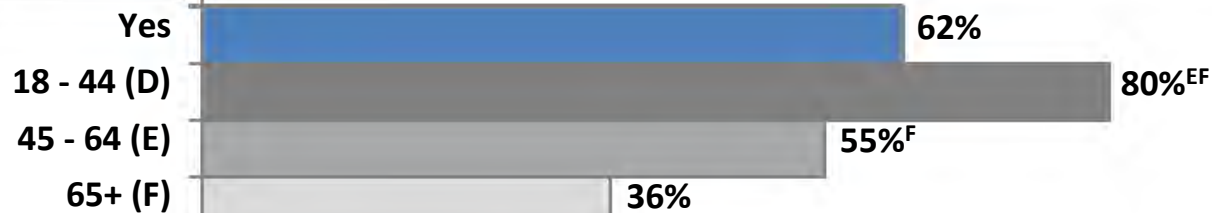
Access to Internet at Residence



Own Cell Phone



Smartphone*



* Asked among "Yes" to Q17 - Own a Cell Phone?

Q16: Do you have access to the internet at your residence?

Q17: Do you own a cell phone?

Q18: Is your cell phone a Smartphone? That is, a phone that allows you to download and run applications or apps, and includes other advanced features.



Demographic Profile

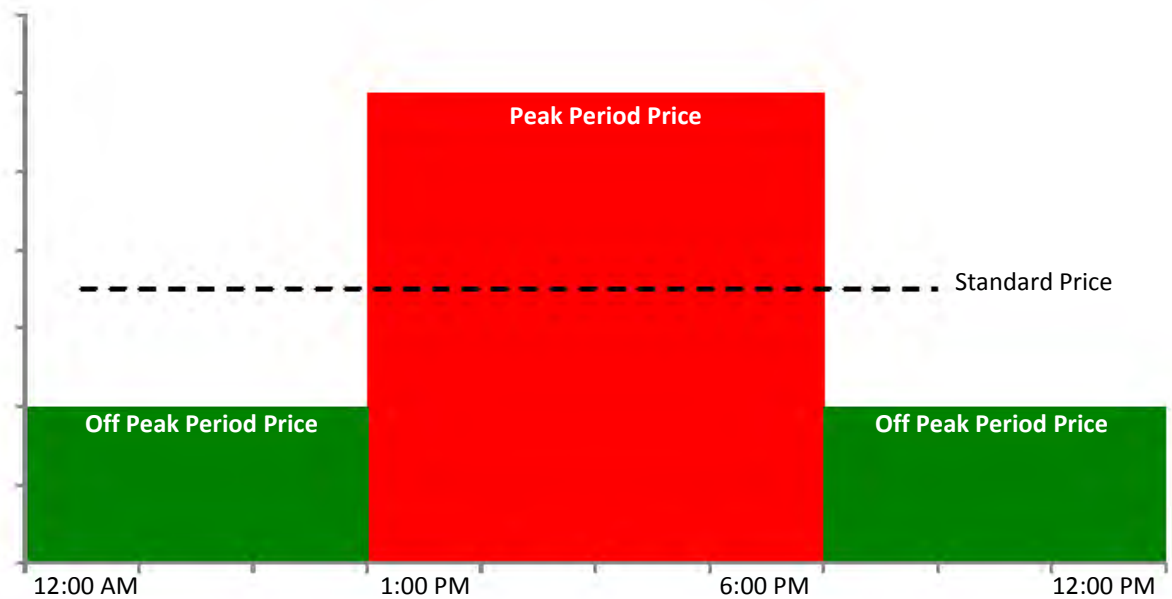


Education		Number of Children Under 18		Income	
1 st through 8 th grade	0.4%	0	66.7%	Under \$10,000	2.2%
Some high school	0.6%	1	12.5%	\$10,000 - \$20,000	6.7%
High school grad or equivalent	8.1%	2	11.1%	Over \$20,000 - \$30,000	7.3%
Some college or technical school	30.7%	3 or more	7.1%	Over \$30,000 - \$40,000	9.9%
College graduate	32.7%	Prefer not to answer	2.6%	Over \$40,000 - \$50,000	13.5%
Grad/post-grad school	26.6%	Employed Full-Time Outside Home		Over \$50,000 - \$75,000	20.4%
Prefer not to answer	1.0%	Yes	46.6%	Over \$75,000 - \$100,000	14.7%
Number of People in Household		No	52.4%	Over \$100,000 - \$150,000	12.5%
1	23.4%	Prefer not to answer	1.0%	Over \$150,000 - \$200,000	5.4%
2	37.7%	Sex		Over \$200,000	2.8%
3 or 4	28.8%	Male	48.6%	Prefer not to answer	4.6%
5 or more	9.3%	Female	49.2%		
Prefer not to answer	0.8%	Prefer not to answer	2.2%		



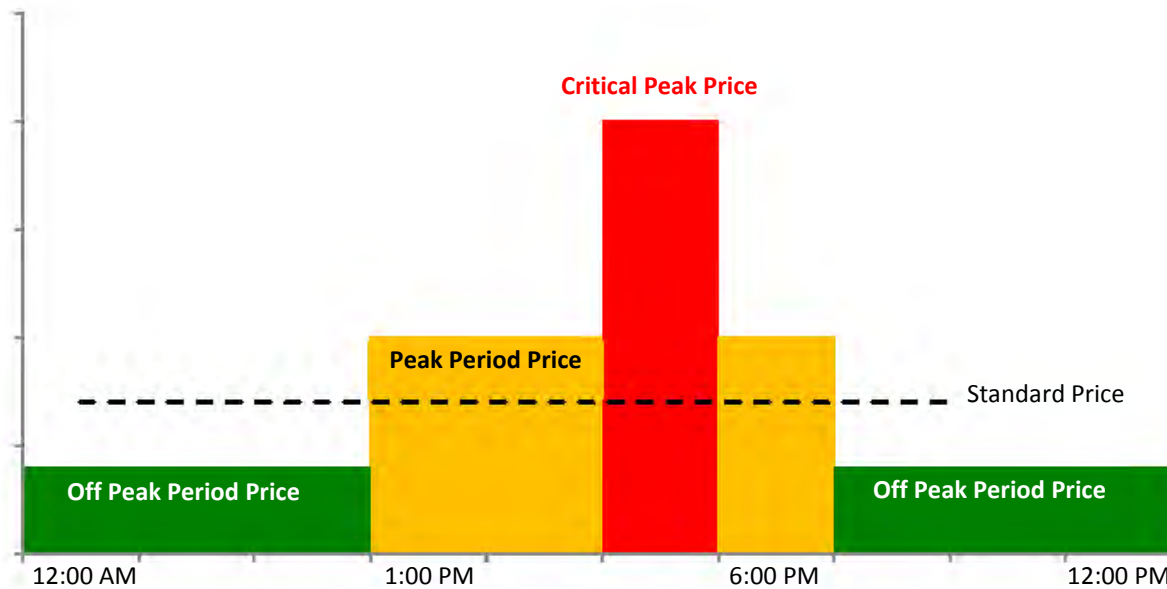


Rate Option Definitions



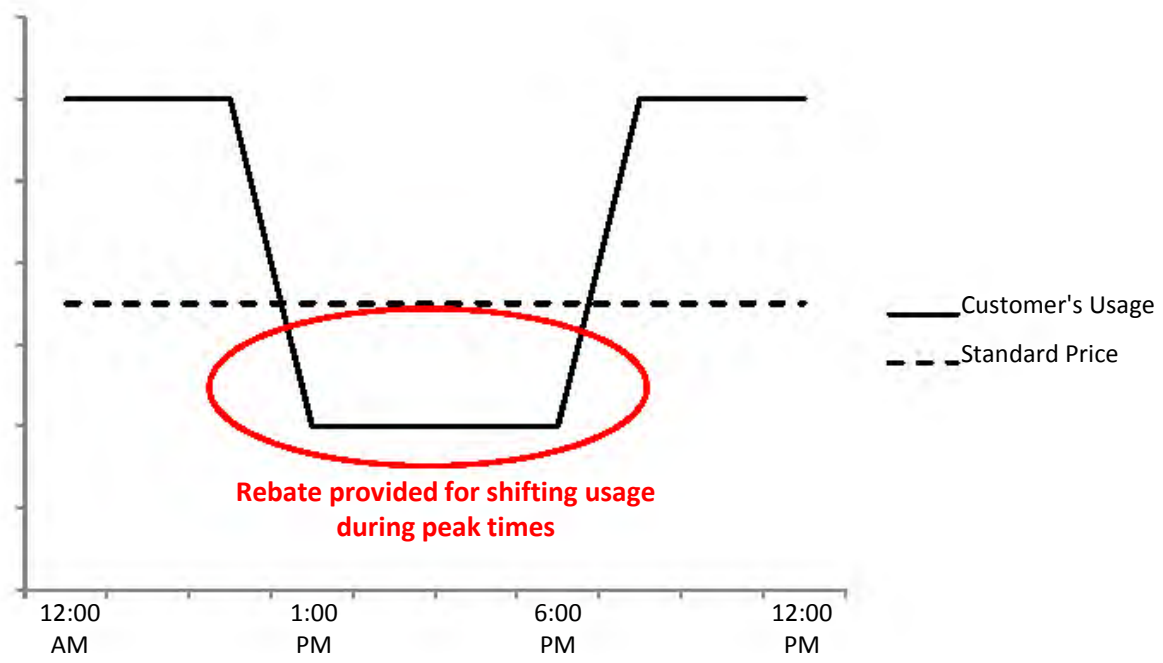


Rate Option Definitions



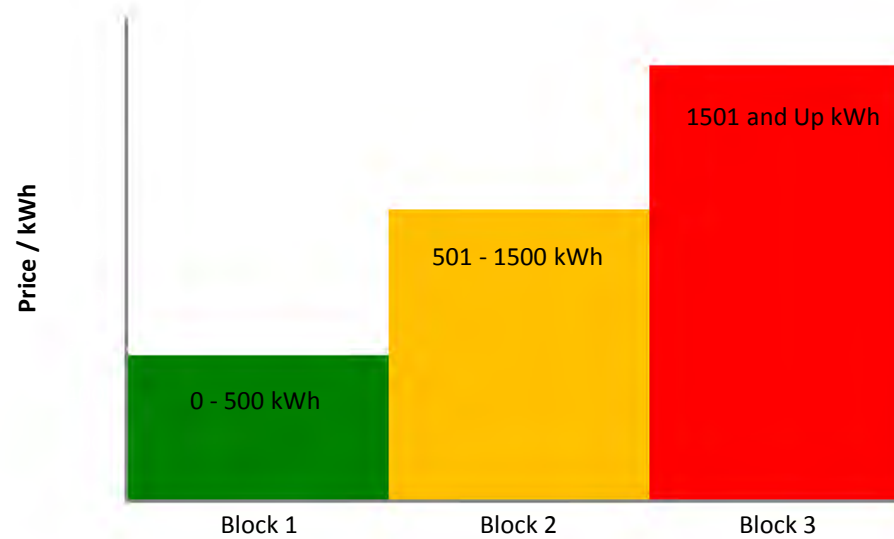


Rate Option Definitions





Rate Option Definitions



**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 20

Witness: John P. Malloy

- Q-20. Refer to Exhibit JPM-1, page 21 of 64, section 5.5.3.2. Explain what is meant by “certain enhanced data analytics algorithms.”
- A-20. The Meter Data Management System will introduce new data validation and processing tools to analyze the quality of the incoming interval data and flag anomalous data for investigation of potential tampering or other metering errors.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 21

Witness: John P. Malloy

- Q-21. Refer to JPM-1, page 22, section 5.5.3.3, which states, "Due to increased volume of information associated with AMS data, the capacity to support data warehouse functionality will need to be augmented accordingly." Explain whether there has been any detailed assessment of the extent to which the Data Warehouse will need to be augmented.
- A-21. The Companies have completed a preliminary analysis of hardware storage capacity requirements and data warehouse augmentation to support the increased volume of information associated with AMS data. The detailed assessment of capacity requirements and data warehouse augmentation will be completed during the early phases of the AMS deployment project. The Companies have included the estimated costs in the submitted business case for AMS.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 22

Witness: John P. Malloy

Q-22. Refer to Exhibit JPM-1, page 22 of 64, section 5.5.3.3.

- a. Explain whether aggregated meter data will be shared with any third party.
- b. If the answer to part a. above is yes, explain under what circumstances the meter data will be shared.

A-22.

- a. Yes, aggregated meter data will be shared with third parties.
- b. Aggregated meter data could be shared for regulatory reports, intervenor data requests, government research, energy-efficiency agency requests, AMS-related requests for proposals, and surveys with other utility companies.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 23

Witness: John P. Malloy

- Q-23. Refer to Exhibit JPM-1, pages 22-23 of 64, section Green Button Download My Data. Explain whether the Companies considered providing Green Button Connect My Data as well as Green Button Download to customers.
- A-23. The Companies have considered providing Green Button 'Connect My Data' as well as Green Button 'Download My Data' to customers, but there is not enough evidence that any incremental benefit of this functionality would exceed the cost to be able to commit to providing it at this time. The Companies noted in the AMS Business Case that the ability to implement Green Button's 'Connect My Data' standard is a benefit of full AMS deployment the Companies will explore. After AMS is deployed and customers become familiar with the data made available by AMS, the Companies will be better able to perform market research on the interest in Green Button 'Connect My Data.'

The Companies have already implemented the Green Button 'Download My Data' standard along with many utilities around the country to provide a standardized format of AMS interval data for use by customers. In addition to the Green Button standard, customers may also export the data in .CSV format, enabling a straightforward path to view the information in readily available software like Microsoft Excel and to transmit that data to any energy-use analysis services customers choose. In so doing, the Companies seek to enable customer choice and understanding by giving them the tools and data to work with whichever providers they desire.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 24

Witness: John P. Malloy

Q-24. Refer to Exhibit JPM-1, page 42 of 64, section 7.1 .5.

- a. Provide the calculation of the \$402 million recovery of non-technical losses over 20 years. Include any necessary work papers.
- b. Provide the warranty period for AMS meters.

A-24.

a.

<u>Calculation</u>	<u>Assumptions</u>
Electric revenue projections	Revenue of in-scope electric customers
× In-scope meters as % of total (after opt-out)	99.2%
× Non-technical line losses (% of revenues)	2%
× % of non-technical losses detected with AMS analytics	60%
× % recovery of non-technical losses detected	60%
× % of benefits gained from deployed meters	Based on deployment*
= Benefit from recovery of non-technical losses	

* Percent is determined from a combination of the number of meters installed and the status of the Meter Data Management System development.

Year	Benefits (\$M)
2018	\$ -
2019	4.2
2020	9.5
2021	15.7
2022	16.3
2023	16.7
2024	17.0
2025	17.3
2026	17.7
2027	18.0
2028	18.4
2029	18.8
2030	19.1
2031	19.5
2032	19.9
2033	20.3
2034	20.7
2035	21.1
2036	21.5
2037	22.0
2038	22.4
2039	22.9
2040	23.3
	<u>\$ 402.3</u>

- b. The warranty for AMS electric meters is 5 years, and the Companies expect to obtain a 20-year gas module warranty through ongoing contract negotiations.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 25

Witness: John P. Malloy

- Q-25. Refer to Exhibit JPM-1, page 53 of 64, section 8.1. Explain whether, for LG&E's combination customers, both the electric meter and gas index will be replaced at the same time.
- A-25. The electric meter and AMS gas modules will typically not be replaced at the same time with the gas modules lagging the electric meter. This is consistent with the manufacturer's recommended practice because it allows for the electric meters to build out the mesh network. The gas module will then look for neighboring electric meters and routers to complete its communication link.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 26

Witness: John P. Malloy

Q-26. Refer to Exhibit JPM-1, pages 59-60 of 64, section 9.2.

- a. Describe the pre-installation educational initiatives that were considered by the Companies.
- b. Explain whether there will be targeted education programs for different types of customers.
- c. Provide evidence on the effectiveness of bill inserts (especially in light of customers opting for electronic billing) if any such data exists.

A-26.

- a. The Companies considered and plan to use a multi-channel approach to create awareness of the deployment process. Specific tactics include:
 - i. Notification to public officials and low income agencies prior to deployment in the areas they represent.
 - ii. Outdoor (i.e. billboards) in the deployment area(s).
 - iii. Radio Advertisements
 - iv. LG&E/KU Walk-in Center Events
 - v. Social Media Advertisements
 - vi. Direct Mail – two personally addressed letters sent to the customers prior to installation (30 days and 14 days in advance of installation).
 - vii. Email Notification – customers with a valid email address on file will receive an email notification in addition to the 14 day letter.
 - viii. Automated Telephone Call – schedule for customers with an up-to-date telephone number on file one week prior to installation.
 - ix. Door-hangers – during installation.
- b. Yes. The Companies will provide targeted educational programs for all types of customers. This includes but is not limited to the following categories:
 - i. Always Engaged – high tech lifestyles
 - ii. Selectively Engaged – savings seekers, technology cautious
 - iii. Rarely Engaged – relationship oriented
 - iv. Low Income – needs assistance from multiple sources

- c. Approximately 10% of the Companies’ customers receive an electronic billing statement. Survey results conducted among all residential customers show electronic billing customers most preferred channel of communications is email, while traditional paper bill customers prefer bill inserts, indicating bill inserts likely are more effective for customers who prefer paper bills.

LG&E/KU Residential Customer Satisfaction Study

Electronic Billing Statement Customers Preferred Communication Channel – Email

2014	2015	2016	2017
67.6%	69.0%	67.1%	57.7%

LG&E/KU Residential Customer Satisfaction Study

Traditional Paper Billing Statement Customers Preferred Communication Channel –

Bill Insert

2014	2015	2016	2017
46.4%	44.7%	37.8%	41.9%

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 27

Witness: John P. Malloy

- Q-27. Refer to Exhibit JPM-1, pages 62-63 of 64, section 12. Explain whether the Companies view "customer account information" as distinct from "customer usage information."
- A-27. Yes, the Companies view "customer account information" as distinct from "customer usage information," and take seriously their obligation to protect both.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 28

Witness: John P. Malloy

- Q-28. Referencing Exhibit JPM-1, the Companies refer to Advanced Distribution Management System ("ADMS") and Distributed Energy Resource Management System ("DERMS") as part of the AMS strategy. Provide details of the ADMS and DERMS and their current status.
- a. State whether the Companies have a Volt-Var Optimization strategy.
 - b. State whether the Companies have a DER integration strategy.
- A-28. The Companies received approval to move forward with the ADMS as part of the Companies' 2016 rate proceedings.³ Current planning for the deployment of the ADMS includes three major functionality release phases. Phase 1, which will include PowerFlow (PF), Feeder Load Management (FLM), and Fault Location Analysis (FLA), is scheduled for release in the fourth quarter of 2018. Phase 2 will integrate the ADMS with our Energy Management System (EMS) in second quarter of 2019. Lastly, Phase 3 will introduce the ADMS Suggested Switching Application (SSA) and Fault Location, Isolation, and Service Restoration (FLISR) functionality currently planned for the fourth quarter of 2019.

Widespread penetration of distributed generation would be the primary driver of DERMS investment, business processes, and technology. There is currently little demand for, and deployment of, distributed generation in the Companies' service territories, presumably because it is uneconomical for most customers. The Companies' current plans are to continue monitoring DERMS development and distributed generation deployment in their service areas.

- a. The Companies conducted a Volt-Var Optimization (VVO) pilot project in 2017. The objective of the pilot project was to evaluate the effectiveness of VVO as a technique to achieve demand (kW) and energy (kWh) savings and to gain experience in the operational requirements of a VVO system. Results of the pilot project indicated that kW and kWh reductions were achieved, but due to the Companies' low avoided cost of capacity it was clear that the amount of savings resulting from VVO would not pass

³ See *In the Matter of: Application of Kentucky Utilities Company for an Adjustment of its Electric Rates and for Certificates of Public Convenience and Necessity*, Case No. 2016-00370, (Ky. PSC Nov. 23, 2016); *In the Matter of: Application of Louisville Gas and Electric Company for an Adjustment of its Electric and Gas Rates and for Certificates of Public Convenience and Necessity*, Case No. 2016-00371, (Ky. PSC Nov. 23, 2016).

the cost-benefits requirements of DSM at this time. The pilot project has ended, but the Companies' current plans are to continue evaluating VVO.

- b. The Companies have multiple means to integrate DERs today, including net metering, their qualifying facility tariff provisions (Rates SQF and LQF), and distributed generation special contracts for business solar customers. In addition, the Companies are investing resources to advance technologies that will enable greater DER integration, including the battery-storage pilot project at the E.W. Brown Generating Station.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 29

Witness: John P. Malloy

- Q-29. Refer to Exhibit JPM-1, Appendix A-5, page 8 of 15. For LG&E's combination customers, explain whether LG&E incurs a \$.42 charge to read the electric and a \$.42 charge to read the gas meter, or if it only incurs the charge one time for both meters.
- A-29. LG&E incurs a \$.42 charge to read a customer's electric meter and an additional \$.42 charge to read the gas meter.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 30

Witness: John P. Malloy

- Q-30. Refer to Exhibit JPM-1, Appendix A-5, page 9 of 15. Provide a detailed calculation showing how the \$55.6 million savings were determined.

- A-30. See attached. Savings in reduced meter capital were derived by comparing the Meter Asset 2018 Business Plan calculated both with and without a full deployment of AMS meters.

Meter Assets 2018 BP Without AMS Full Deployment

\$000s	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
LG&E Meter Capital	\$3,440	\$3,906	\$2,679	\$3,789	\$3,872	\$3,958	\$4,045	\$4,134	\$4,225	\$4,317	\$4,412	\$4,510	\$4,609	\$4,710	\$4,814	\$4,920	\$5,028	\$5,138	\$5,252	\$5,367	\$5,485	\$5,606	\$5,729	\$103,944
KU Meter Capital	\$1,492	\$1,506	\$1,564	\$1,611	\$1,646	\$1,683	\$1,720	\$1,757	\$1,796	\$1,836	\$1,876	\$1,917	\$1,959	\$2,003	\$2,047	\$2,092	\$2,138	\$2,185	\$2,233	\$2,282	\$2,332	\$2,383	\$2,436	\$44,492
Total	\$4,932	\$5,412	\$4,243	\$5,400	\$5,519	\$5,640	\$5,764	\$5,891	\$6,021	\$6,153	\$6,288	\$6,427	\$6,568	\$6,713	\$6,860	\$7,011	\$7,166	\$7,323	\$7,484	\$7,649	\$7,817	\$7,989	\$8,165	\$148,436

Meter Assets 2018 BP With AMS Full Deployment

\$000s	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
LG&E Meter Capital	\$3,378	\$3,042	\$2,045	\$2,893	\$2,957	\$3,022	\$3,088	\$3,156	\$3,225	\$3,296	\$3,369	\$3,443	\$3,519	\$3,596	\$3,675	\$3,756	\$3,839	\$3,923	\$4,010	\$4,098	\$4,188	\$4,280	\$4,374	\$80,172
KU Meter Capital	\$1,246	\$354	\$418	\$430	\$440	\$450	\$459	\$470	\$480	\$490	\$501	\$512	\$524	\$535	\$547	\$559	\$571	\$584	\$597	\$610	\$623	\$637	\$651	\$12,687
Total	\$4,624	\$3,396	\$2,463	\$3,323	\$3,396	\$3,471	\$3,548	\$3,626	\$3,705	\$3,787	\$3,870	\$3,955	\$4,042	\$4,131	\$4,222	\$4,315	\$4,410	\$4,507	\$4,606	\$4,707	\$4,811	\$4,917	\$5,025	\$92,859

Variance / Savings

\$000s	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
LG&E Meter Capital	\$62	\$864	\$633	\$896	\$916	\$936	\$957	\$978	\$999	\$1,021	\$1,044	\$1,067	\$1,090	\$1,114	\$1,138	\$1,163	\$1,189	\$1,215	\$1,242	\$1,269	\$1,297	\$1,326	\$1,355	\$23,772
KU Meter Capital	\$246	\$1,152	\$1,146	\$1,180	\$1,206	\$1,233	\$1,260	\$1,288	\$1,316	\$1,345	\$1,375	\$1,405	\$1,436	\$1,467	\$1,500	\$1,533	\$1,566	\$1,601	\$1,636	\$1,672	\$1,709	\$1,747	\$1,785	\$31,805
Total	\$308	\$2,016	\$1,780	\$2,077	\$2,122	\$2,169	\$2,217	\$2,265	\$2,315	\$2,366	\$2,418	\$2,471	\$2,526	\$2,581	\$2,638	\$2,696	\$2,756	\$2,816	\$2,878	\$2,941	\$3,006	\$3,072	\$3,140	\$55,576

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 31

Witness: John P. Malloy

- Q-31. Refer to Exhibit JPM-1, AppendixA-5, page 13 of 15.
- a. State whether the average monthly bills shown are accurate given the rate increases granted in the Companies' 2016 base rate cases, and the interim rate reductions as a result of Case No. 2018-00034.⁴
 - b. This page states that 48 percent of customers used the portal at least once, and that the average energy savings is 3.0 percent. Reconcile these statements, with the Malloy Testimony, page 19, lines 15-18, which state that 70 percent of customers used the portal at least once, and that the energy savings are 3.8 percent.
 - c. Explain why the Companies assumed there would only be 0.5 percent bill savings, when the Tetra Tech study suggested 0.9 percent bill savings.
- A-31.
- a. The average monthly bills referenced are not reflective of the rate increases granted in the Companies' 2016 base rate case, however the average monthly bills used in the calculation of ePortal savings are reflective of those savings (LG&E: \$101.62; KU: \$118.50; ODP: \$141.06). Neither set of average monthly bills reflects interim rate reductions resulting from Case No. 2018-00034.
 - b. Appendix A-5 details the costs and benefits that make up the Companies' analysis of the AMS business case. Page 13 of Appendix A-5 details the Companies' calculation of the ePortal benefit as estimated for full deployment of AMS. Mr. Malloy's testimony, page 19, lines 15-18 is referring to the Tetra Tech analysis of current participants in the AMS Customer Service Offering. This third-party evaluation demonstrates significant savings are possible with AMS and supports the Companies' estimated bill savings quantified as part of the AMS business case.
 - c. As with any opt-in program, there is potential for self-selection bias in that participating customers chose to participate in the program and may differ from the overall population in terms of demographics or attitudes. The Companies endeavored to remain more conservative than the Tetra Tech study to address the potential for this risk.

⁴ Case No. 2018-00034, *Kentucky Industrial Utility Customers, Inc. Complainant V. Kentucky Utilities Company and Louisville Gas and Electric Company Defendants* (Ky. PSC Mar. 28, 2018).

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 32

Witness: John P. Malloy

- Q-32. Refer to Exhibit JPM-1, Appendix A-9, page 20 of 23. Explain whether there is any evidence that suggests customers are willing to shift usage in response to a price signal/peak periods, when that usage shift has nearly no impact on their existing bill in the short-run.
- A-32. The referenced study did not ask participants questions about critical peak or any type of demand pricing. The Companies' 2008-2010 Responsive Pricing Pilot showed that customers were willing to shift consumption away from peak pricing periods, notwithstanding their total consumption tended to be slightly higher as a result of increased usage during the non-peak periods. See attached.



PPL companies

Responsive Pricing and Smart Meter Pilot

Program Update

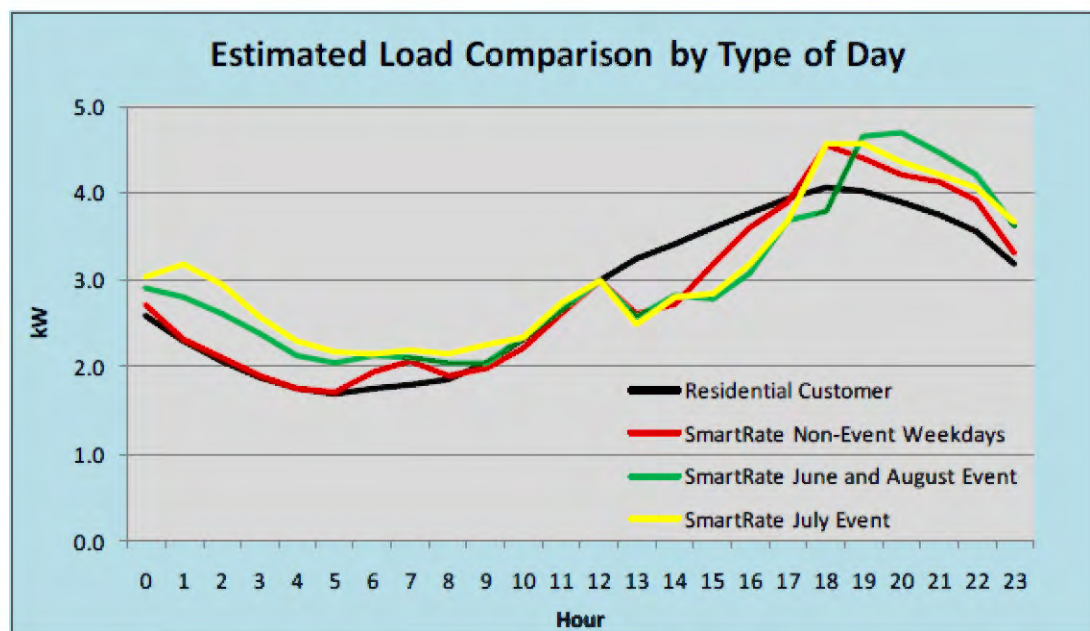
KPSC Case No. 2011-00440 Informal Conference

January 17, 2012



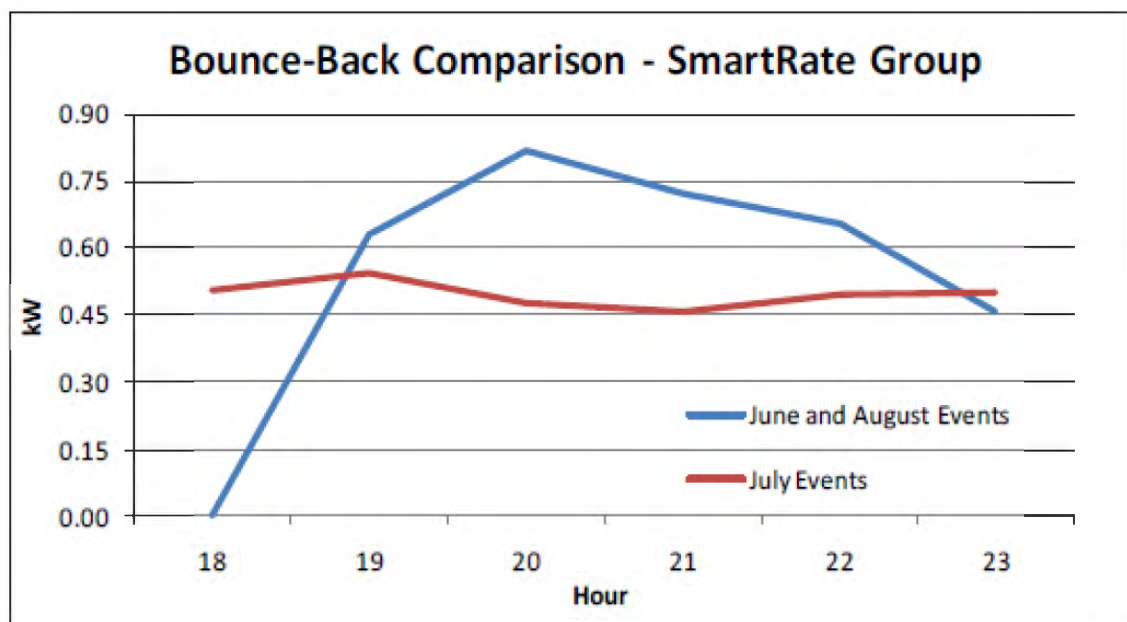
What we learned...

- *Responsive Pricing customers used more energy overall compared to non-Responsive Pricing customers*
- *Program participants consistently shifted load from higher-priced weekday hours to lower-priced off-peak and weekend time periods*



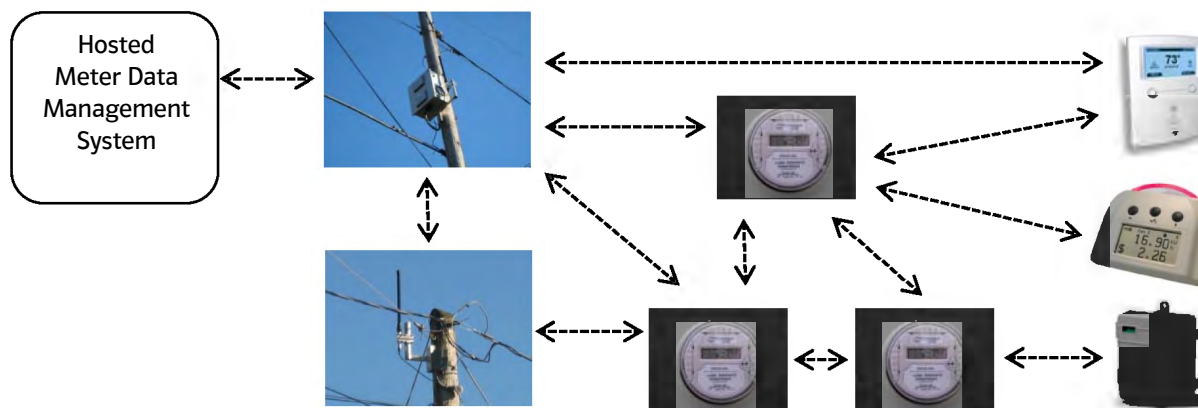
What we learned...

- *CPP events demonstrated demand savings of up to 1 kW per Responsive Pricing participant, but exhibited bounce-back effect of up to 0.8 kW higher than initial peak*



What we learned...

- Smart meter network performance is largely dependent on terrain topography
- Smart technologies and associated industry standards have evolved and developed considerably, since the pilot was deployed
- Meter data management system is considered necessary for a sustainable smart meter deployment and network operations



What has changed . . .

- *Hardware and software employed on the equipment used in the pilot program are out of date and degrading in performance*
- *Smart metering and two-way communications technologies available on the market today feature software and hardware with latest performance and standards upgrades*
- *Today, smart meter vendors rely on utilities to ensure meter data management systems are in place prior to permanent smart meter deployment*
- *Pilot's meter data managements services are hosted; however, the existing smart meter vendor has made the platform obsolete and is no longer supporting it*

What would we do differently...

- *Ensure that a meter data management system is implemented prior to deploying smart meters*
- *Adopt a framework which would allow periodic assessment of smart meters and two-way communications technologies and consequent exchange of dated technologies already deployed*
- *Seek approval on tariff adjustments to ensure program expenditures and revenues are in balance*

What would it take to continue...

- *To maintain...*
 - Annual estimated cost to maintain the existing technology solution is at least \$240,000 and is not economical
 - Hosted services solution availability and term is not guaranteed
- *To revamp...*
 - Substitute scalable meter data management system could cost at least \$500,000 and would require considerable planning and development
 - Simultaneously, existing smart meters, communications equipment and premise devices would need to be replaced with most recent generations of each

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 33

Witness: David E.Huff

- Q-33. Refer to Direct Testimony of David E. Huff ("Huff Testimony"), pages 7-8. The testimony states that "In addition, a participant suggested that consumer data, including anonymous data, may offer the Companies new revenue opportunities. The participant suggested such revenues could be used to offset costs to customers associated with AMS." Explain whether this implies that the Companies are contemplating aggregating and anonymizing customer usage data and selling that data to third parties.
- A-33. The Companies have no current plans to sell aggregated and anonymized customer usage data to third parties.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 34

Witness: David E. Huff

Q-34. Refer to the Huff Testimony, page 17, lines 3-5.

- a. Explain why LG&E and KU will not be able to avoid the costs the set-up charge is designed to recover.
- b. Explain whether LG&E and KU are aware that Duke Energy Kentucky, Inc. ("Duke Kentucky") does not charge its set-up fee as long as a customer notifies Duke Kentucky prior to the meter being installed.

A-34.

- a. The set-up charge includes costs to create initial work orders for meter exchange and optimize manual meter read routing; costs to travel to customer premise, remove existing meter and replace with non-communicating meter, close work orders, plus transportation costs; and costs associated with customer service representatives taking calls for opt-out customers, explaining tariffs details, and setting up the account to be opted out of AMS. At the point that AMS deployment has started in a given area deployment plans will be set, and adjusting those plans to opt a customer out will introduce inefficiency in the meter deployment process, including potentially avoidable truck rolls and customer deployment communications. Additionally, if the customer delays formally opting-out in an effort to avoid the opt-out fee, then multiple communication and installation attempts are likely to follow, resulting in higher than expected costs.
- b. The Companies are aware.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 35

Witness: John P. Malloy

- Q-35. Refer to Exhibit DEH-2, page 52. Explain whether the savings attributed to ePortal are based solely on people changing behavior in response to information from ePortal, or changes enabled by access to data from ePortal.
- A-35. The ePortal savings are based upon behavioral changes from customer access and in response to information from the ePortal.

Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018

Case No. 2018-00005

Question No. 36

Witness: John P. Malloy

- Q-36. Regarding the Companies' distribution grid, explain whether the Companies have determined what the most cost-effective deployment strategy is.
- a. Explain whether the Companies have considered where on the Companies' distribution grid the deployment adds the most value.
 - b. Explain which areas could benefit most, considering short-term and long-term benefits to different customer segments.
- A-36. Yes, the Companies have determined the most cost-effective deployment strategy based on currently available information.
- a. The Companies have preliminarily considered where on the Companies' distribution grid the deployment adds the most value and concluded that full deployment is needed to maximize the benefits possible with AMS.
 - b. The Companies understand the request to pertain to which geographic areas of the Companies' service territory stand to benefit the most from AMS. As the Companies' analysis shows, all customers stand to benefit from AMS in a number of areas ranging from reduced operational costs to energy savings and better identification, attribution, and recovery of non-technical losses. The Companies do not currently possess any information indicating certain geographic areas will benefit more than others when considering short-term and long-term benefits to different customer segments.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 37

Witness: John P. Malloy

- Q-37. Explain whether the Companies anticipate regular analysis of customer AMS data to statistically evaluate energy efficiency outcomes.
- A-37. Yes, the Companies anticipate regular analysis of customer AMS data to statistically evaluate energy efficiency outcomes. The Companies also anticipate that because customers will also have access to their AMS data, they too will be better able to evaluate energy efficiency outcomes.

Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018

Case No. 2018-00005

Question No. 38

Witness: David E. Huff

- Q-38. Explain whether the Companies conducted any in-house analysis of customer AMS pilot 15-minute-interval data to aid in the Companies' better understanding of consumption patterns seasonally and geographically and projections of how this information can be utilized into load forecasting, peak demand estimation, etc.
- A-38. Access to interval data from the AMS Opt-In program augments the data available for general load research and sales analysis endeavors. As with any opt-in program, there is potential for self-selection bias in that participating customers chose to participate in the program and may differ from the overall population in terms of demographics or attitudes. This risk introduces uncertainty as to how representative the results of the analysis are, but the results of any analysis still provides informational value. Full deployment of AMS will eliminate the potential for self-selection bias and increase the types of analysis possible. Specific examples of analysis completed utilizing AMS opt-in data include:
- Snow day behavioral impact analysis. The analysis assessed use per customer on snow days while controlling for weather, as well as the relative change in load profile as compared to non-snow days.
 - Analysis of the number of customers required to approximate a smooth load shape. The analysis studied the number of individual load shapes required to create a smooth aggregate load shape as a result of load shape variability netting out. Several metrics for smoothness were studied.
 - Analysis of the degree to which customers' monthly peaks are coincident to the system peak. The analysis assessed the degree to which individual customer peaks were greater than their load at the time of the class-level peak as well as the frequency of a customer's peak occurring on the same day as the monthly class-level peak load. Additionally, the potential impact on system load was quantified in the extremely unlikely event that all customers' monthly peak occurred simultaneously.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 39

Witness: John P. Malloy

Q-39.

- a. Describe the estimated long-term IT infrastructure required to adequately process and analyze AMI meter data for use in other areas of the Company such as resource planning, distribution system planning, etc.
- b. Explain whether these costs were included in the estimated cost of the AMS system.

A-39.

- a. The long-term IT infrastructure required to adequately process and analyze AMS data in other areas of the Companies will consist of a meter data management system (MDMS), a data warehouse, additional data analytic tools, and interfaces to current and future operating systems. The Companies are currently analyzing different options to adequately process and analyze AMS meter data.
- b. Yes, the costs associated with this long-term IT infrastructure has been included in the estimated cost of the AMS system.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 40

Witness: John P. Malloy

Q-40.

- a. Explain whether the Companies' GIS system will interface with the AMS data.
- b. Explain whether the Companies intend to use this opportunity to improve GIS information on the distribution system with the proposed rollout of the AMS meters.

A-40.

- a. The Companies plan to evaluate the full scope of integration to GIS systems during the project. The Companies have planned for a level of integration of geospatial data (presumably a batch process, but to be determined during the early phases of the project) that will be needed to keep GIS consistent with the AMS meter deployment for critical business processes.
- b. Yes, the Companies will capture the latitudinal and longitudinal information as each AMS meter is placed. That information will initially be stored in the SAP Customer Care System. As the data is accumulated, Companies will then analyze uses for this data in conjunction with GIS and any other applications that could benefit from the data.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 41

Witness: John P. Malloy

- Q-41. Explain whether the Companies' traditional distribution planning using power flow modeling anticipates extracting AMS data in conjunction with GIS data to improve distribution system planning.
- A-41. Yes, the Companies anticipate using AMS data to complement existing efforts to improve distribution system and maintenance planning.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 42

Witness: John P. Malloy

- Q-42. With AMS, each meter is a sensor. Explain whether the Companies evaluated leveraging the sensing capabilities with GIS for business process improvements such as system visualization with AMS data, locational voltage optimization potential, and geospatial tracking of distribution system issues to prepare and or predict future issues.
- A-42. AMS is a foundational system for the Companies and the data provided by AMS will be used for numerous business process improvements, including improved distribution maintenance and outage responses. See Section 7.1.2 (pages 38-39) and Appendix A-5 (pages 10-12) of Exhibit JPM-1 for discussion on these benefits and specific calculation assumptions.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 43

Witness: John P. Malloy

- Q-43. One successful use of AMS is the implementation of pre-payment programs, which have been shown both in Kentucky and nationwide to result in energy usage reductions. Explain whether the Companies considered the deployment of prepayment programs as a tool for addressing affordability concerns for certain customer populations.
- A-43. Yes, AMS is a foundational component to offer customer services such as pre-payment programs, but the Companies currently have no plans to offer a pre-payment program.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 44

Witness: John P. Malloy

- Q-44. Explain what metrics the Companies will use to evaluate the performance and outcomes of the AMS deployment.
- A-44. The performance of the AMS deployment will be measured against specific metrics for safety, customer satisfaction, and delivery against budget and schedule. These metrics will be identified and expanded throughout the course of the project. The outcomes of the AMS deployment will be evaluated against the successful achievement of the quantified operational benefits.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 45

Witness: John P. Malloy

- Q-45. Provide, separately for LG&E and KU, the undepreciated book balances for the Companies' electric meters, and LG&E's gas meters.
- A-45. The undepreciated book balances for LG&E and KU's electric meters are \$16.7 million and \$36.2 million, respectively, and LG&E gas meters are \$41.3 million, all as of February 2018.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 46

Witness: Rick E. Lovekamp

- Q-46. Discuss any updates that may need to be made to the Application, or to any of the exhibits, to reflect potential outcomes of Case No. 2018-00034.
- A-46. The outcome of Case No. 2018-00034 will not impact the Companies' application or exhibits in this proceeding. The Companies submitted a Verified Informational Update Filing on January 30, 2018 in this proceeding that explained how the 2017 Tax Cuts and Job Act ("TCJA") would increase the AMS business case net present value basis. In addition, see the attachments to AG 1-34, which include the financial model the Companies updated to reflect the TCJA.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 47

Witness: John P. Malloy

Q-47. According to a study by the U.S. Department of Energy,⁵ a successful AMI project will plan, implement, measure, and evaluate 14 elements, as listed below. However, when reviewing the project cost categories on page 47 of Exhibit JPM-1, it is difficult to determine if all 14 elements have been incorporated into the cost calculation, leading to questions of whether the cost estimates are under-represented. Indicate whether these elements have been incorporated into the project and the cost calculations.

- a. Equipment
- b. Software
- c. Integration
- d. Warranty
- e. Data Center
- f. Hosting
- g. Analytics
- h. Support
- i. Consumer Engagement
- j. Business Processes
- k. Cyber Security
- l. Training
- n. Disaster Recovery

⁵ *Modern Distribution Grid, Decision Guide Volume III*, U.S. Department of Energy (dated June 28, 2017).

A-47. All elements listed in a. - n. have been incorporated into the cost calculation of the AMS project as filed.

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 48

Witness: John P. Malloy

- Q-48. The application covers both companies jointly and offers no analysis for the individual companies. Fully provide the differences in costs and benefits between LG&E and KU.
- A-48. See attached.

\$000s

LG&E	Total Nominal \$		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
	2018-2022	2018-2040																							
Capital Expenses																									
Meters	\$ 100,206	\$ 107,775	\$ 2,112	\$ 48,311	\$ 49,128	\$ 655	\$ -	\$ -	\$ 143	\$ 385	\$ 401	\$ 410	\$ 419	\$ 428	\$ 438	\$ 447	\$ 457	\$ 467	\$ 478	\$ 488	\$ 499	\$ 510	\$ 521	\$ 532	\$ 544
Network	\$ 8,079	\$ 9,749	\$ 1,958	\$ 6,058	\$ 58	\$ 4	\$ -	\$ 31	\$ 32	\$ 344	\$ 33	\$ 34	\$ 35	\$ 35	\$ 36	\$ 367	\$ 38	\$ 39	\$ 39	\$ 40	\$ 41	\$ 395	\$ 43	\$ 44	\$ 45
IT and Systems	\$ 56,908	\$ 68,147	\$ 12,323	\$ 27,505	\$ 15,997	\$ 1,083	\$ -	\$ -	\$ 469	\$ 114	\$ 3,260	\$ -	\$ -	\$ -	\$ 530	\$ 103	\$ 3,097	\$ -	\$ -	\$ -	\$ 600	\$ 93	\$ 2,973	\$ -	\$ -
Capex total	\$ 165,193	\$ 185,670	\$ 16,393	\$ 81,875	\$ 65,183	\$ 1,742	\$ -	\$ 31	\$ 644	\$ 842	\$ 3,694	\$ 444	\$ 454	\$ 464	\$ 1,004	\$ 917	\$ 3,592	\$ 506	\$ 517	\$ 528	\$ 1,140	\$ 997	\$ 3,537	\$ 576	\$ 589
Operating Expenses																									
Meters	\$ 7,107	\$ 11,147	\$ -	\$ 2,406	\$ 3,973	\$ 560	\$ 168	\$ 173	\$ 178	\$ 183	\$ 189	\$ 194	\$ 200	\$ 206	\$ 212	\$ 219	\$ 225	\$ 232	\$ 239	\$ 246	\$ 253	\$ 261	\$ 269	\$ 277	\$ 285
Network	\$ 917	\$ 6,554	\$ -	\$ 197	\$ 234	\$ 240	\$ 246	\$ 252	\$ 258	\$ 265	\$ 271	\$ 278	\$ 285	\$ 292	\$ 299	\$ 307	\$ 314	\$ 322	\$ 330	\$ 339	\$ 347	\$ 356	\$ 365	\$ 374	\$ 383
IT and Systems	\$ 5,192	\$ 45,931	\$ 57	\$ 594	\$ 1,285	\$ 1,503	\$ 1,753	\$ 1,800	\$ 1,847	\$ 1,896	\$ 1,945	\$ 1,996	\$ 2,048	\$ 2,102	\$ 2,157	\$ 2,214	\$ 2,272	\$ 2,331	\$ 2,393	\$ 2,456	\$ 2,520	\$ 2,586	\$ 2,654	\$ 2,724	\$ 2,796
Opex total	\$ 13,216	\$ 63,632	\$ 57	\$ 3,197	\$ 5,493	\$ 2,303	\$ 2,167	\$ 2,225	\$ 2,283	\$ 2,344	\$ 2,405	\$ 2,468	\$ 2,533	\$ 2,600	\$ 2,669	\$ 2,739	\$ 2,811	\$ 2,886	\$ 2,962	\$ 3,040	\$ 3,120	\$ 3,203	\$ 3,288	\$ 3,375	\$ 3,464
Total Costs	\$ 178,410	\$ 249,302	\$ 16,450	\$ 85,072	\$ 70,676	\$ 4,046	\$ 2,167	\$ 2,256	\$ 2,927	\$ 3,186	\$ 6,099	\$ 2,912	\$ 2,987	\$ 3,064	\$ 3,673	\$ 3,656	\$ 6,403	\$ 3,391	\$ 3,479	\$ 3,568	\$ 4,261	\$ 4,200	\$ 6,825	\$ 3,951	\$ 4,053
Total Benefits	\$ 49,342	\$ 418,590	\$ 946	\$ 5,447	\$ 10,409	\$ 16,087	\$ 16,453	\$ 16,828	\$ 17,199	\$ 17,580	\$ 17,968	\$ 19,026	\$ 18,772	\$ 19,188	\$ 19,613	\$ 20,048	\$ 20,492	\$ 21,607	\$ 21,412	\$ 21,888	\$ 22,375	\$ 22,873	\$ 23,382	\$ 24,562	\$ 24,435
KU																									
Capital Expenses																									
Meters	\$ 87,927	\$ 94,778	\$ 2,422	\$ 29,617	\$ 52,691	\$ 3,197	\$ -	\$ -	\$ 86	\$ 326	\$ 367	\$ 375	\$ 383	\$ 392	\$ 400	\$ 409	\$ 418	\$ 427	\$ 437	\$ 446	\$ 456	\$ 466	\$ 476	\$ 487	\$ 498
Network	\$ 10,430	\$ 12,615	\$ 727	\$ 9,134	\$ 565	\$ 5	\$ -	\$ 39	\$ 40	\$ 443	\$ 50	\$ 45	\$ 46	\$ 47	\$ 48	\$ 472	\$ 57	\$ 51	\$ 52	\$ 53	\$ 54	\$ 506	\$ 66	\$ 58	\$ 59
IT and Systems	\$ 56,484	\$ 70,788	\$ 11,192	\$ 28,030	\$ 16,084	\$ 1,178	\$ -	\$ -	\$ 597	\$ 145	\$ 4,149	\$ -	\$ -	\$ -	\$ 675	\$ 131	\$ 3,942	\$ -	\$ -	\$ -	\$ 764	\$ 118	\$ 3,784	\$ -	\$ -
Capex total	\$ 154,842	\$ 178,181	\$ 14,341	\$ 66,781	\$ 69,340	\$ 4,380	\$ -	\$ 39	\$ 723	\$ 914	\$ 4,566	\$ 420	\$ 429	\$ 438	\$ 1,123	\$ 1,011	\$ 4,417	\$ 478	\$ 489	\$ 499	\$ 1,274	\$ 1,090	\$ 4,326	\$ 545	\$ 557
Operating Expenses																									
Meters	\$ 9,984	\$ 15,126	\$ -	\$ 2,294	\$ 5,799	\$ 1,678	\$ 213	\$ 220	\$ 226	\$ 233	\$ 240	\$ 247	\$ 255	\$ 262	\$ 270	\$ 278	\$ 287	\$ 295	\$ 304	\$ 313	\$ 322	\$ 332	\$ 342	\$ 352	\$ 363
Network	\$ 706	\$ 4,934	\$ -	\$ 170	\$ 174	\$ 179	\$ 183	\$ 188	\$ 193	\$ 198	\$ 203	\$ 208	\$ 213	\$ 219	\$ 224	\$ 230	\$ 236	\$ 242	\$ 248	\$ 254	\$ 261	\$ 268	\$ 275	\$ 282	\$ 289
IT and Systems	\$ 5,911	\$ 54,962	\$ 43	\$ 607	\$ 1,388	\$ 1,764	\$ 2,109	\$ 2,166	\$ 2,223	\$ 2,281	\$ 2,341	\$ 2,403	\$ 2,466	\$ 2,530	\$ 2,597	\$ 2,665	\$ 2,735	\$ 2,807	\$ 2,881	\$ 2,957	\$ 3,035	\$ 3,115	\$ 3,197	\$ 3,282	\$ 3,368
Opex total	\$ 16,602	\$ 75,022	\$ 43	\$ 3,071	\$ 7,362	\$ 3,620	\$ 2,506	\$ 2,574	\$ 2,642	\$ 2,712	\$ 2,784	\$ 2,858	\$ 2,933	\$ 3,011	\$ 3,091	\$ 3,173	\$ 3,258	\$ 3,344	\$ 3,433	\$ 3,525	\$ 3,618	\$ 3,715	\$ 3,814	\$ 3,916	\$ 4,020
Total Costs	\$ 171,443	\$ 253,202	\$ 14,384	\$ 69,852	\$ 76,702	\$ 8,000	\$ 2,506	\$ 2,613	\$ 3,365	\$ 3,626	\$ 7,350	\$ 3,277	\$ 3,362	\$ 3,450	\$ 4,214	\$ 4,185	\$ 7,675	\$ 3,822	\$ 3,922	\$ 4,024	\$ 4,893	\$ 4,805	\$ 8,140	\$ 4,461	\$ 4,577
Total Benefits	\$ 63,566	\$ 566,843	\$ 1,371	\$ 6,062	\$ 12,298	\$ 21,234	\$ 22,600	\$ 23,084	\$ 23,579	\$ 24,084	\$ 24,600	\$ 25,968	\$ 25,667	\$ 26,218	\$ 26,781	\$ 27,356	\$ 27,944	\$ 29,385	\$ 29,158	\$ 29,786	\$ 30,427	\$ 31,082	\$ 31,751	\$ 33,275	\$ 33,134
Project Total																									
Capital Expenses																									
Meters	\$ 188,134	\$ 202,553	\$ 4,535	\$ 77,928	\$ 101,819	\$ 3,852	\$ -	\$ -	\$ 230	\$ 711	\$ 768	\$ 785	\$ 802	\$ 820	\$ 838	\$ 856	\$ 875	\$ 895	\$ 914	\$ 934	\$ 955	\$ 976	\$ 997	\$ 1,019	\$ 1,042
Network	\$ 18,509	\$ 22,364	\$ 2,684	\$ 15,192	\$ 624	\$ 10	\$ -	\$ 70	\$ 71	\$ 786	\$ 83	\$ 79	\$ 80	\$ 82	\$ 84	\$ 839	\$ 95	\$ 89	\$ 91	\$ 93	\$ 95	\$ 901	\$ 109	\$ 102	\$ 104
IT and Systems	\$ 113,392	\$ 138,934	\$ 23,515	\$ 55,535	\$ 32,081	\$ 2,261	\$ -	\$ -	\$ 1,066	\$ 260	\$ 7,409	\$ -	\$ -	\$ -	\$ 1,205	\$ 234	\$ 7,039	\$ -	\$ -	\$ -	\$ 1,364	\$ 210	\$ 6,757	\$ -	\$ -
Capex total	\$ 320,035	\$ 363,851	\$ 30,734	\$ 148,656	\$ 134,523	\$ 6,122	\$ -	\$ 70	\$ 1,367	\$ 1,757	\$ 8,260	\$ 864	\$ 883	\$ 902	\$ 2,126	\$ 1,929	\$ 8,009	\$ 984	\$ 1,006	\$ 1,028	\$ 2,414	\$ 2,087	\$ 7,863	\$ 1,121	\$ 1,146
Operating Expenses																									
Meters	\$ 17,092	\$ 26,273	\$ -	\$ 4,701	\$ 9,772	\$ 2,238	\$ 381	\$ 392	\$ 404	\$ 416	\$ 429	\$ 441	\$ 455	\$ 468	\$ 482	\$ 497	\$ 512	\$ 527	\$ 543	\$ 559	\$ 576	\$ 593	\$ 611	\$ 629	\$ 648
Network	\$ 1,623	\$ 11,488	\$ -	\$ 367	\$ 408	\$ 419	\$ 429	\$ 440	\$ 451	\$ 462	\$ 474	\$ 486	\$ 498	\$ 511	\$ 523	\$ 537	\$ 550	\$ 564	\$ 578	\$ 593	\$ 608	\$ 623	\$ 639	\$ 655	\$ 672
IT and Systems	\$ 11,104	\$ 100,893	\$ 100	\$ 1,201	\$ 2,674	\$ 3,267	\$ 3,862	\$ 3,967	\$ 4,071	\$ 4,177	\$ 4,286	\$ 4,399	\$ 4,514	\$ 4,633	\$ 4,754	\$ 4,879	\$ 5,007	\$ 5,139	\$ 5,274	\$ 5,413	\$ 5,555	\$ 5,701	\$ 5,852	\$ 6,006	\$ 6,164
Opex total	\$ 29,818	\$ 138,654	\$ 100	\$ 6,268	\$ 12,854	\$ 5,924	\$ 4,672	\$ 4,799	\$ 4,925	\$ 5,055	\$ 5,189	\$ 5,326	\$ 5,467	\$ 5,611	\$ 5,760	\$ 5,912	\$ 6,069	\$ 6,230	\$ 6,395	\$ 6,565	\$ 6,739	\$ 6,918	\$ 7,102	\$ 7,290	\$ 7,484
Total Costs	\$ 349,853	\$ 502,505	\$ 30,834	\$ 154,924	\$ 147,377	\$ 12,046	\$ 4,672	\$ 4,869	\$ 6,292	\$ 6,812	\$ 13,449	\$ 6,190	\$ 6,349	\$ 6,513	\$ 7,886	\$ 7,841	\$ 14,078	\$ 7,214	\$ 7,401	\$ 7,592	\$ 9,153	\$ 9,005	\$ 14,965	\$ 8,412	\$ 8,630
Total Benefits	\$ 112,908	\$ 985,433	\$ 2,318	\$ 11,508	\$ 22,707	\$ 37,322	\$ 39,053	\$ 39,912	\$ 40,778	\$ 41,663	\$ 42,568	\$ 44,994	\$ 44,439	\$ 45,406	\$ 46,394	\$ 47,404	\$ 48,436	\$ 50,992	\$ 50,571	\$ 51,674	\$ 52,801	\$ 53,954	\$ 55,133	\$ 57,837	\$ 57,569

**Louisville Gas and Electric Company and Kentucky Utilities Company
Response to Commission Staff's First Request for Information
Dated April 2, 2018**

Case No. 2018-00005

Question No. 49

Witness: John P. Malloy

Q-49. Fully detail all work that has been performed on the AMS project to date, including the total investment made to date.

A-49. The Companies have worked prudently and diligently to quantify the expected costs and benefits of AMS in order to deliver quality business cases for consideration in both the 2016 and current AMS proposals. This work has included engaging a small team for the purpose of building and refining the AMS business cases, planning and preparation for project execution, and completing the work of the AMS Collaborative sessions.

The total investment made through March 2018 is \$4.9 million and reflects the seriousness of the Companies' proposals. This cost is included into the cost calculation of the AMS project as filed.