**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 CERTIFICATES OF PUBLIC CONVENIENCE AND NECESSITY FOR FULL DEPLOYMENT OF ADVANCED METERING SYSTEMS** | **)**<br>**)**<br>**)**<br>**)**<br>**)**<br>**)**<br>**)** | **CASE NO. 2018-00005** |

**RESPONSE OF**
**LOUISVILLE GAS AND ELECTRIC COMPANY**
**AND**
**KENTUCKY UTILITIES COMPANY**
**TO COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION**
**DATED APRIL 26, 2018**

**FILED: MAY 11, 2018**

**VERIFICATION**

**COMMONWEALTH OF KENTUCKY )**
**) SS:**
**COUNTY OF JEFFERSON )**

The undersigned, **David E. Huff**, being duly sworn, deposes and says that he is Director of Customer Energy Efficiency & Emerging Technologies for LG&E and KU Services Company, and that he has personal knowledge of the matters set forth in the responses for which he is identified as the witness, and that the answers contained therein are true and correct to the best of his information, knowledge and belief.

**David E. Huff**

Subscribed and sworn to before me, a Notary Public in and before said County and State, this 11th day of May 2018.

(SEAL)
Notary Public

My Commission Expires:

SUSAN M. HUG NOTARY PUBLIC ID # 581907 COMMISSION EXPIRES 6/26/2021 STATE AT LARGE - KENTUCKY

**VERIFICATION**

**COMMONWEALTH OF KENTUCKY )**
**) SS:**
**COUNTY OF JEFFERSON )**

The undersigned, **John P. Malloy**, being duly sworn, deposes and says that he is Vice President – Gas Distribution for Louisville Gas and Electric Company and an employee of LG&E and KU Services Company, and that he has personal knowledge of the matters set forth in the responses for which he is identified as the witness, and the answers contained therein are true and correct to the best of his information, knowledge and belief.

**John P. Malloy**

Subscribed and sworn to before me, a Notary Public in and before said County and State, this 11th day of May 2018.

Susan M. Hug (SEAL)
Notary Public

My Commission Expires:

SUSAN M. HUG NOTARY PUBLIC ID # 581907 COMMISSION EXPIRES 6/26/2021 STATE AT LARGE - KENTUCKY

**Louisville Gas and Electric Company and Kentucky Utilities Company**
**Response to Commission Staff's Second Request for Information**
**Dated April 26, 2018**

**Case No. 2018-00005**

**Question No. 1**

**Witness: John P. Malloy**

Q-1. Refer to the response to the Commission Staff's First Request for Information ("Staff's First Request"), Item 2. For each utility shown in the response, explain if that utility: operates in a state that has legislation or policies in effect allowing customers to opt-out; operates in a state that has no legislation or policies regarding opt outs; or, operates in a state that has legislation or policies barring customers from opting out.

A-1.

| Utility | Location | Legislation or Policies re Opt-Out |
|---|---|---|
| A | Pennsylvania | Bars opt-outs[1] |
| B | Florida | Allows, but does not require, opt-outs[2] |
| C | Texas, Arkansas, Louisiana, Minnesota, Mississippi, Oklahoma | Texas requires opt-outs to be offered[3] Arkansas,[4] Louisiana,[5] Minnesota, Mississippi,[6] and Oklahoma allow,[7] but do not require, opt-outs |
| D | California | Has required opt-outs to be offered[8] |
| E | California | Has required opt-outs to be offered |
| F | California | Has required opt-outs to be offered |
| G | Maryland | Has required opt-outs to be offered[9] |
| H | British Columbia | Has required opt-outs to be offered[10] |

[1] *See* http://www.puc.pa.gov/General/consumer_ed/pdf/13_Smart%20Meters.pdf. Pennsylvania customers cannot opt out, so the number of customers objecting to smart-meter installation is shown in PSC 1-2 for Utility A.
[2] *See* http://www.psc.state.fl.us/Files/PDF/Utilities/Electricgas/SmartMeters/SmartMeterBriefingPaper.pdf.
[3] *See* https://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/25.133/25.133.pdf.
[4] *See, e.g.,* http://www.apscservices.info/pdf/16/16-060-U_93_1.pdf.
[5] *See, e.g.,*
https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7b00358C62-0000-C215-8AF9-E6A53E08D497%7d&documentTitle=20184-141629-01.
[6] *See, e.g.,*
http://www.psc.state.ms.us/InSiteConnect/InSiteView.aspx?model=INSITE_CONNECT&queue=CTS_ARCHIVEQ&docid=402804.
[7] *See, e.g.,* http://imaging.occeweb.com/AP/Orders/occ5360859.pdf.
[8] *See, e.g.,* http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/165307.PDF.
[9] *See, e.g.,*
http://webapp.psc.state.md.us/newIntranet/Casenum/NewIndex3_VOpenFile.cfm?filepath=C:\Casenum\9200-9299\9207\Item_245\\9208OptOutSecondOrder.pdf.
[10] *See, e.g.,* http://bcpiac.com/wp-content/uploads/2015/10/BCUC-Opt-out-program-decision-2014.pdf.

**Louisville Gas and Electric Company and Kentucky Utilities Company**
**Response to Commission Staff's Second Request for Information**
**Dated April 26, 2018**

**Case No. 2018-00005**

**Question No. 2**

**Witness: John P. Malloy**

Q-2. Refer to the response to Staff's First Request, Item 11. Provide the names of the other referenced utilities indicating a detection of non-technical losses, their perception of detection, and the average of their percentage of detection.

A-2. The Companies discussed the area of non-technical losses with several utilities, including National Grid and Duke Energy, and also reviewed case studies and filings of others like Sacramento Municipal Utility District and Baltimore Gas & Electric. See attached. In all cases the utilities stated that the information from the smart meters have improved their operational knowledge through the additional granularity of consumption data and associated metering alarms allowing them to respond to issues quicker. However, no utility has been able to quantify the percentage improvement.

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

# A Case Study on the Revenue Protection Software: Sacramento Municipal Utility District Smart Grid Demonstration

*December 2014*

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# Overview

When it completed rollout of advanced meters in 2013, the Sacramento Municipal Utility District (SMUD) implemented data analytics software to identify instances when a meter had been tampered with, by-passed, or had simply malfunctioned. Traditionally, SMUD meter readers would identify such issues while reading the meters each month. In order to meet or exceed the standard set by this manual inspection process, SMUD installed revenue protection software provided by Detectent, Inc. This software generates leads for on-site investigation based on results from theft detection algorithms that process numerous datasets from different utility systems as well as external sources.

The primary purpose of this project is to replace physical inspections with data analytics in order to achieve numerous objectives, including:

- Protect the customer and SMUD employees from potentially unsafe conditions due to someone tampering with the meter.
- Reduce annual revenue loss from theft.

The revenue protection software compiles utility and third party datasets for evaluation. The utility data used by the software includes datasets from the advanced metering infrastructure (kWh, voltage, register, alarm, event, and other alert data), the customer information system (customer, premises, billing, and service notifications) and from the GIS (geospatial information system). External or third party datasets, such as county assessor property information, weather data, and demographic data, are also utilized. Almost all of the datasets are updated daily with the exception of the GIS and county assessor datasets which are updated weekly and quarterly, respectively. In addition, SMUD attempts to query the datasets monthly to identify and to fill gaps in the datasets missed by the daily updates.

The software identifies and prioritizes the most likely theft cases. The rich datasets enable SMUD's revenue protection analysts to generate leads for investigation, using 20+ theft detection algorithms. Simple leads, such as a "zero usage" that match disconnection orders, are usually viewed and closed without a field inspection. The leads requiring field inspection are prioritized based on weighting criteria defined by the analysts. The weighting criteria are continuously adjusted so that investigation and recovery activities are optimized.

## Results

The revenue protection software permitted SMUD to move from a reactive response, relying on tips from the public and from SMUD employees, to a proactive response, using statistical analyses to make inferences of the data and identify possible theft.

SMUD has benefited from the technology and reduced revenue loss. However, the methodology that SMUD uses to track various types of leads makes it difficult to pinpoint the actual success rate of the generated theft leads. For example, the system assigns a new order each time an investigation is undertaken. If the original investigation determines that there is theft occurring and the meter is removed, all subsequent follow-ups to the premises are issued a new investigation order even though each one relates back to the original order.

Even though the precise theft detection success rate is elusive, SMUD does assign the following benefits to the detection software, and is starting to see trends, such as increases in the kWh billed and dollars collected, as shown in the table below. Benefits to the customer:

- Improves customer safety by better identifying meter tampering.
- Reduces revenue loss that would negatively impact customers by contributing to future rate increases.

Benefits to the utility:

- Improves employee safety.
- Prioritizes leads based on ones with the highest probability of theft.
- Provides efficient use of SMUD resources (labor, fuel, investigation costs, and software).

Table 1 illustrates the billed amount versus the collected amount associated with theft cases. The increases from 2011–12 to 2013 are largely driven from the use of the detection software to identify theft case and determine customers that are more likely to pay, such as commercial customers. This is shown in more detail in the last two columns that show a 12 month comparison between before and after the installation of the revenue protection software.

*Table 1 – Summary of the Billed versus Collected Amounts with and without the Revenue Protection Software*

| | 2011 | 2012 | 2013 | 12 Months Prior to Detectent | 12 Months After Detectent |
|---|---|---|---|---|---|
| $ Billed | $1,752,820 | $1,120,860 | $2,953,334 | $1.36M | $3.11M |
| kWh Billed | 9,912,680 | 5,009,350 | 13,738,497 | - | - |
| $ Collected | $138,020 | $337,030 | $653,418 | $334k | $723k |

## Introduction and Background

The revenue protection software provided by Detectent, Inc. provides SMUD a solution to reduce revenue lost to theft each year by identifying instances of theft. SMUD estimates that approximately 1% of its annual revenues are lost to theft. For the 2007-2012 time period, SMUD back-billed $8.6 million from theft-related cases. As a result, the primary goal of the software solution is to utilize proven pattern recognition algorithms to detect probable cases of meter tampering, by-pass, and malfunctioning that tend to be signs of theft occurring. This is extremely important since the installation of advanced metering infrastructure (AMI) meters has eliminated monthly meter readings by trained staff that would have detected these issues in the past. Moving forward, the revenue protection and detection software now serves as the virtual "eyes in the field" for SMUD.

Figure 1 illustrates an example of attempted power theft. The revenue protection software flagged the account associated with this meter installation as having a probable case of tampering. The field investigation determined that someone attempted to steal power by drilling thru the meter cover to install a stick on a pushbutton used to place the meter in to a diagnostic mode. Although this was an attempt of power theft, the meter continued to register energy consumption as programmed.

The objectives of the software implementation were twofold: 1) SMUD moved from a reactive to a proactive approach for identifying theft. This was a natural outgrowth of the AMI project since the periodic visual inspections were abandoned along with the manual meter reading activities. 2) The analytics software would serve as a platform to build future applications in billing, customer segmentation, and data-based decision making. Above all of these business-related objectives was the primary goal to ensure customer and employees safety by identifying meter tampering.

*Figure 1 – Example of Attempted Power Theft*

The revenue protection software is composed of two applications: an analytics platform called CustomerIP and a revenue protection application called RevEnhance. For Detectent, the software usually resides on their servers and the data from the utility is collected and supplied to them for processing and generation of possible theft leads that would then be sent to the utility for investigation. The uniqueness of the SMUD project was that the software is hosted on SMUD servers, although Detectent provides troubleshooting and technical support for SMUD. As a result, SMUD revenue protection analysts collect and process the data using the same core algorithms that Detectent would have used to generate leads for investigation. The data used by the software comes from both internal sources, such as the data from the customer information and AMI systems, and from external sources, such as weather and demographic data. The third party data resources enable the analysts to understand what is affecting the usage trends and to fortify the utility data for graphic display and for enhanced analytics.

Upon generating the leads for investigation, the revenue protection software has robust life-cycle tracking and reporting tools to trace theft cases from beginning to closeout. All evidence, such as notes and photos, gathered during an investigation is stored by the software. The software tracks the billed versus the collected amounts for each case and for an aggregate of cases. Additional reports can be configured to match utility reporting preferences.

## Approach/Methodology

The revenue protection software was implemented over an 18 month time period to identify and prioritize cases of AMI meter tampering associated with power theft. The software performs data analytics on various data sets to rank probable theft cases. Table 2 and Table 3 show the most common data sets from internal and external sources. The data from the AMI meters provides key insights into the condition of each of SMUD's approximately 620,000 meters. The meters provide interval, register, voltage, and other data including events, alerts, and alarms. This meter data is pulled from the Itron Enterprise Edition meter data management system and from the suite of applications in the Silver Springs UtilityIQ platform. This data and the other data from customer related SMUD legacy systems are uploaded, in most cases, on a daily basis to the revenue protection software.

*Table 2 – SMUD Data Sources Supplied to the Revenue Protection System*

| Data Category | Source | Frequency | Transfer Method |
|---|---|---|---|
| Customer Records | SAP | Daily | ETL (flat file) |
| Meter Records | SAP | Daily | ETL (flat file) |
| Billed Consumption | SAP | Daily | ETL (flat file) |
| Service Orders | SAP | Daily | ETL (flat file) |
| Meter Values | Itron Enterprise Edition (IEE) Meter Data Management System | Daily | Direct connection |
| Meter Events | Silver Spring UtilityIQ | Daily | ETL (flat file) |
| Device Location Notes | Revenue Protection System/Customer IP | On Demand | ESB |
| Past Investigations | SMUD Revenue Protection database | One time | Access Database |

*Table 3 – External Data Sources used by Revenue Protection System*

| Data Category | Source | Frequency | Transfer Method |
|---|---|---|---|
| Weather | Detectent (NOAA) | Daily | Web Service |
| County Assessor | DataQuick | Every 3 years | Manual Flat File |
| Customer Listings | SalesGenie (Yellow Pages) | Every 3 years | Manual Flat File |

The revenue protection software processes the data to rank probable tamper and theft cases. The ranking relies on a combination of algorithms. The weight given to each algorithm result can be configured. This permits refinement of the total weighted score used to rank each case. Some of the algorithms utilized in the software are listed below.

- Consumption drop score – looks for decrease in consumption over past two years.
- Drop on tamper flag – looks for consumption drop immediately following a tamper or power down event.
- Frequent tamper alert – looks for a pattern of multiple tamper flags and a repeatable pattern.
- Load factor score – targets businesses with low consumption relative to their demand, a possible indication of intermittent tampering.
- Local chain business comparison – compares usage of customer to usage of similar customers.
- Max monthly usage – records the highest monthly energy consumption for comparison.
- Meter capacity score – finds businesses with CT services that have low consumption relative to their capacity.
- Meter set score – compares the seasonal interval consumption before and after the meter set.
- Minimum consumption score – assigns a score to the minimum energy use by the customer.
- Neighbor score – measures deviation from expected consumption based on nearby residences.
- Reverse power alert – records when power flow through the meter is from the customer to the utility.
- Slope percent – slope component of the linear regression over past 2 years.
- Total score – combines resultant scores of other algorithms to determine the likelihood of theft.
- Unauthorized use alert – records and flags energy consumption on an idle meter.
- YP score – identifies location of the customer based on phone number of customer.
- Zero use alert – registers zero energy consumption.

The revenue protection software analyzes the input data with the algorithms described above to identify and prioritize accounts that score the highest. This initial screening provides SMUD analysts a methodology to investigate and rank the accounts using the software so that the leads with the highest probability of having tampering and theft occurring are given to the field technicians to investigate first. Daily and weekly field investigations can be displayed geographically so that field investigations can be ordered to minimize travel time and fuel costs. Figure 2 shows an example graphical display used for daily field investigations. This prioritization ensures that the SMUD resources are used effectively throughout the process.

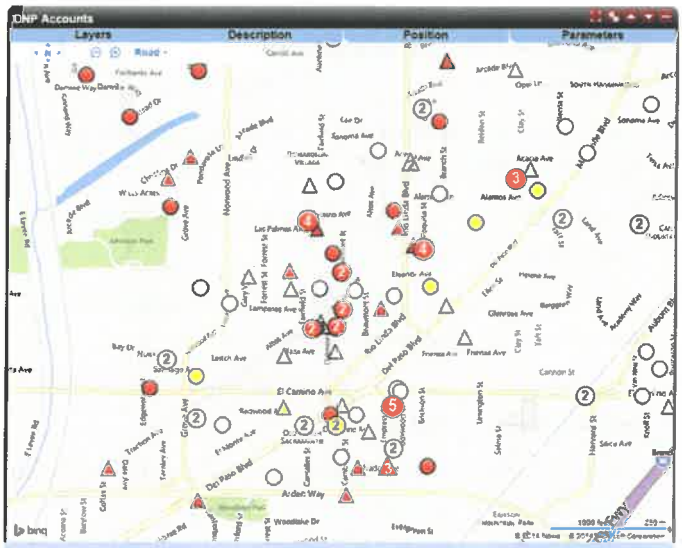


*Figure 2 – Graphic Display of Investigation sites within the SMUD Service Territory*

Modifications to the revenue protection software were made to optimally interface with SMUD systems and for reporting purposes. Different graphical views were created for SMUD staff to support the daily activities of identifying and investigating theft leads. Also, the detection algorithms were customized to facilitate better tracking and monitoring throughout the investigation process. All data and instigation material are stored in the revenue protection database to support on-going and future investigations.

In summary, the following are the main functions of the revenue protection software:

- Lead generation
  - Lists
  - Layer maps
  - Account detail
- Investigation tracking
- Reporting
- Database of Investigations

## Results

As of May 2014, the revenue detection software was operational for one year. Thousands of leads have been generated with many of them leading to work orders for field technicians to investigate meter tampering and potential theft. The software has directly benefitted SMUD by ensuring employee and public safety through quick response to indications of meter tampering that could result in an unsafe condition associated with the meter and service installation of a customer. SMUD has been and will continue to prioritize investigations with the highest probability of theft and the greatest chance of collecting back payments. In addition, the software optimizes the screening and investigation process so that resources, such as fuel and labor, are utilized efficiently.

The benefits to the customers are improved neighborhood and personal safety. In addition, the reduced revenue loss lessens the impacts that could lead to a future rate increase for all customers.

Table 4 shows the impacts of the revenue protection software on both the amount billed and collected. In the first twelve months following the installation of the software, SMUD has billed 15.5 million additional kWh due to theft detection and investigation. This equates to more than $3 million in additional billing. The amount billed and collected has increased two- to threefold with the addition of the revenue protection software.

*Table 4 – Summary of Monetary Effects of the Revenue Protection Software*

| | 12 Months Prior to Detectent | 12 Months After Detectent |
|---|---|---|
| $ Billed | $1.36M | $3.11M |
| $ Collected | $334k | $723k |

SMUD has benefited from the technology and reduced revenue loss over the first year of operations. Trends in the amounts billed and collected from theft cases are evident. Secondarily, the measures of success of the algorithms are more qualitative than quantitative. This is largely due to the methodology SMUD uses to track various types of leads. SMUD's configuration of the software assigns a new order each time an investigation is undertaken even if the investigation is a follow-up investigation issue to the same premises. This makes it difficult to determine the success rate of the theft leads being generated; however, successful collection of back payments from theft illustrates the effectiveness of the software solution to detect and prioritize theft leads.

## Lessons Learned and Key Recommendations

A number of lessons were learned by SMUD during 2013-2014 on use of the detection software:

- Some customization of the software may be needed so that it works well with utility processes, and increases the efficiency of the workforce. For example, at the beginning of the project, SMUD adjusted the standard software so that it operated efficiently with the SMUD systems and provided reports that closely matched the ones that SMUD employees were accustomed to working with. Also, algorithms were adjusted to increase the probability that each lead was a case of theft. At a minimum, SMUD recommends that a utility implementing a revenue protection data analytics program includes the following types of algorithms: kWh drop, meter set, minimum kWh usage, zero use, frequent tamper, load factor, meter capacity, max monthly usage, reverse power, high seasonal load, load factor deviation, similar customer comparison, and other demographic comparison algorithms.
- Purge non-essential data periodically to alleviate huge data storage. The data entered into the database daily provides a wealth of information but can be burdensome to store over time. The large set of data can be utilized to reduce the average estimated revenue loss to theft of 0.5%-1% that electric utilities experience each year. As the amount of data grows over time, SMUD has decided and would recommend purging non-essential data periodically. For SMUD, data is purged after two years. Essential data, such as investigation records, algorithm performance indices, and other important case data, is stored permanently.

## Acknowledgements

This report was prepared for the Electric Power Research Institute by:

- Dan Christopher, Sacramento Municipal Utility District
- Michelle Giles, Sacramento Municipal Utility District

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## *EPRI Resources*

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***Smart Grid Demonstration Initiative***

3002004623 December 2014

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**Louisville Gas and Electric Company and Kentucky Utilities Company**
**Response to Commission Staff's Second Request for Information**
**Dated April 26, 2018**

**Case No. 2018-00005**

**Question No. 3**

**Witness: David E. Huff**

Q-3. Refer to the response to Staff's First Request, Item 15. State how many meters have already been ordered by the Companies for the AMS Customer Offering, and how many have been received to date.

A-3. In total, the Companies have ordered and received 10,480 meters to date for the DSM AMS Customer Offering. The Companies have procured more meters than the 10,000 participant cap approved by the Commission in its November 14, 2014 Order in Case No. 2014-00003[11] because customers may have more than 1 eligible meter at their premise and to support timely installations for enrollees by distributing stock across the Companies' service territory. An additional reason for the meter volume exceeding 10,000 is that the Companies' DSM filing assumptions for residential and small commercial participation has differed from the actual participation; see table below. As residential and 3-phase commercial customers on GS rates require different meter types this variance has resulted in the need for additional meters.

| | DSM Filing Assumption | | Actual Participation | |
|---|---|---|---|---|
| Company | RS | GS | RS | GS |
| LG&E | 89% | 11% | 97% | 3% |
| KU | 84% | 16% | 95% | 5% |

[11] *In the Matter of: Joint Application of Louisville Gas and Electric Company and Kentucky Utilities Company for Review, Modification, and Continuation of Existing, and Addition of New, Demand-Side Management and Energy-Efficiency Programs,* Case No. 2014-00003, Order (Nov. 14, 2014).

**Louisville Gas and Electric Company and Kentucky Utilities Company**
**Response to Commission Staff's Second Request for Information**
**Dated April 26, 2018**

**Case No. 2018-00005**

**Question No. 4**

**Witness: John P. Malloy**

Q-4. Refer to the response to Staff's First Request, Item 19.c. Pages 11- 13 of 54 have headings but do not contain any information. If necessary, provide any updates that need to be made to these pages.

A-4. The Companies were unaware that during the conversion process from the native PowerPoint file to the PDF filed with the Commission the pages referenced did not contain any information. Also, in reviewing the file provided, additional pages contained missing information that did not convert. The Companies are resubmitting a corrected attachment (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)

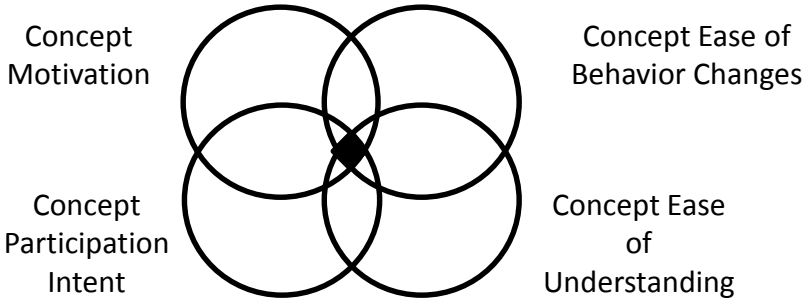
# Methodology – Take Rate

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

Smart Meter unaided awareness is low, with only one in four LG&E/KU customers having heard of the technology, although LG&E customer awareness was ahead of KU.

- Even among those who claimed awareness, many couldn't articulate what the benefits or even the disadvantages of Smart Meters are, indicating they have heard the terminology but have little/no understanding of the concept. However, those with a better understanding noted the key benefits as the ability to track electricity usage, conserve energy and save money.

Although awareness is low, once a customer was provided more information about the program over half stated they would likely participate. Participation levels vary by age, with greater participation more likely among younger households.

Customer attitudes also play a key role in participation. Customers with higher energy conservation awareness and who are technology driven are more likely to participate.

- Conversely, customers that don't think reducing energy is important and are willing to pay for comfort are less likely to participate.

Over half of customers are already adjusting their thermostat. And most customers who are not adjusting it now would do so if it would lower their utility bill, particularly younger households where both adults work full-time outside the home.

The key price point motivating customers to change their usage behavior was monthly savings of $25 off their utility bill, although just under half would be satisfied with savings of at least $20.

- Customers who are skeptical about the program and not likely to participate require higher dollar savings to make behavior changes.

# Key Conclusions

Of the four rate options evaluated, Peak Time Rebate was the clear winner with a significantly higher "Take Rate" than the other three options.

- Peak Time Rebate also rated significantly higher than any other option on likelihood to participate, ease of making behavior changes and motivation to lower usage/save money.
- However, "Take Rates" among customers 65+ years old were fairly comparable for Peak Time Rebate and Time of Use. They found Time of Use easiest to understand, but rated Peak Time Rebate most motivating.
- The least favorable rate option was the Inclining Block, rated as the most difficult to understand and also scoring low on ease of making usage changes.

Tracking and alerts are key features customers want as part of a Smart Meter program. The top two preferred features were the ability to track electricity usage on an in-home display or online. The next most important feature was Email alerts when higher rates would start to apply.

- Although younger customers prefer Smartphone features over Email, older customers prefer Email driven by lower Smartphone penetration. Offering options will meet varying customer preferences.

# Implications

A Smart Meter offering by LG&E/KU that would drive the greatest acceptance would include:

- A Peak Time Rebate rate (if implementation of this rate plan is not feasible then the Time of Use rate could be considered)
- The ability to track usage either on an in-home display and/or online, also offer a Smartphone tracking app which would appeal to younger customers
- Email alerts when higher rates apply, with the option to sign up for text message alerts
- The ability to adjust the thermostat online, with the option to use a Smartphone app
- Monthly utility bill savings of $25 on average

Building awareness of Smart Meters and educating customers of its benefits will be key in driving participation. Currently, even those claiming to be aware of the Smart Meter terminology do not fully understand its benefits.

- Thus far the utility has played a key role in exposing customers to the Smart Meter terminology, but more education is needed on what it means.
- Barriers such as loss of control, system malfunctions, uncomfortable temperatures and lack of privacy should be addressed openly.
- In general, raise energy conservation awareness across all customers.

Older, retired customers present more of a challenge in gaining acceptance. They are more likely to be home during the day and are less likely to adjust their thermostat until night.

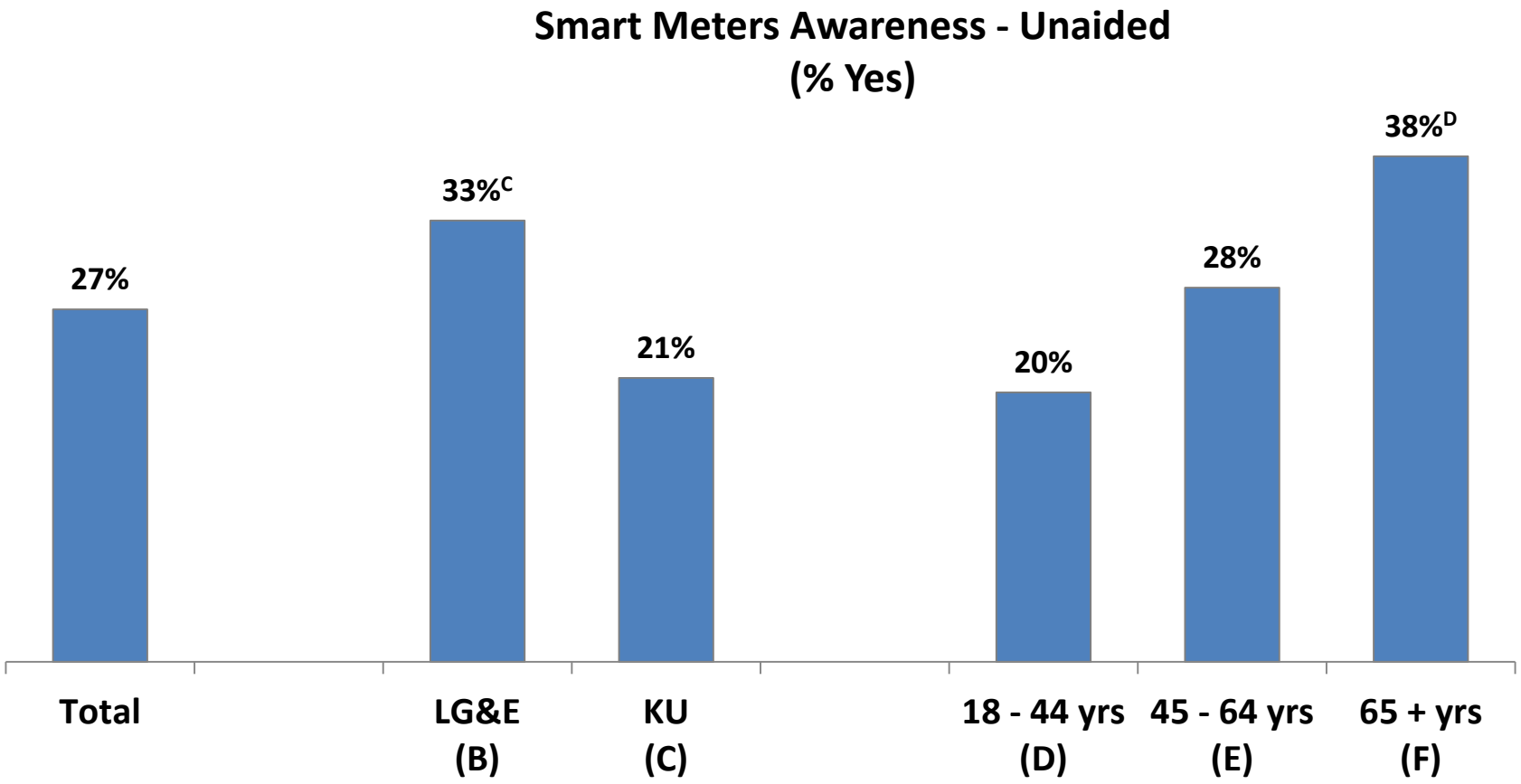
- Temperature control may not be as appealing to this demographic group, however they can be educated on other ways to shift their energy usage such as when they use their appliances. They are more likely to use appliances during peak hours but might have more flexibility to make changes to this usage pattern.

# Detailed Findings

# Smart Meters

# Awareness

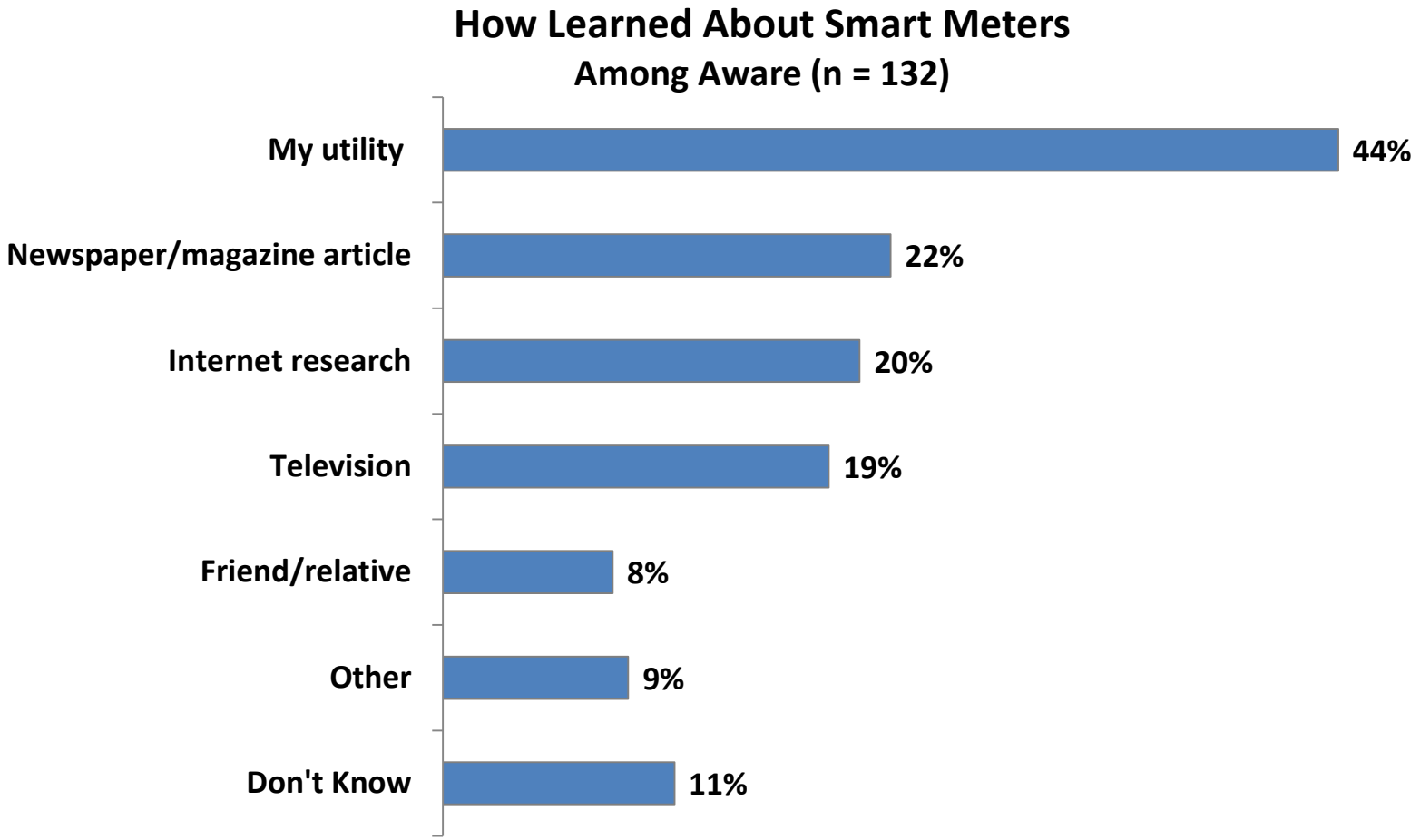
Just over one-fourth of LG&E/KU customers are aware of Smart Meter technology, with higher awareness among LG&E customers. Awareness also increases with age.




Q5: Are you aware of the latest electric meter technology called "Smart Meters"?

# Awareness

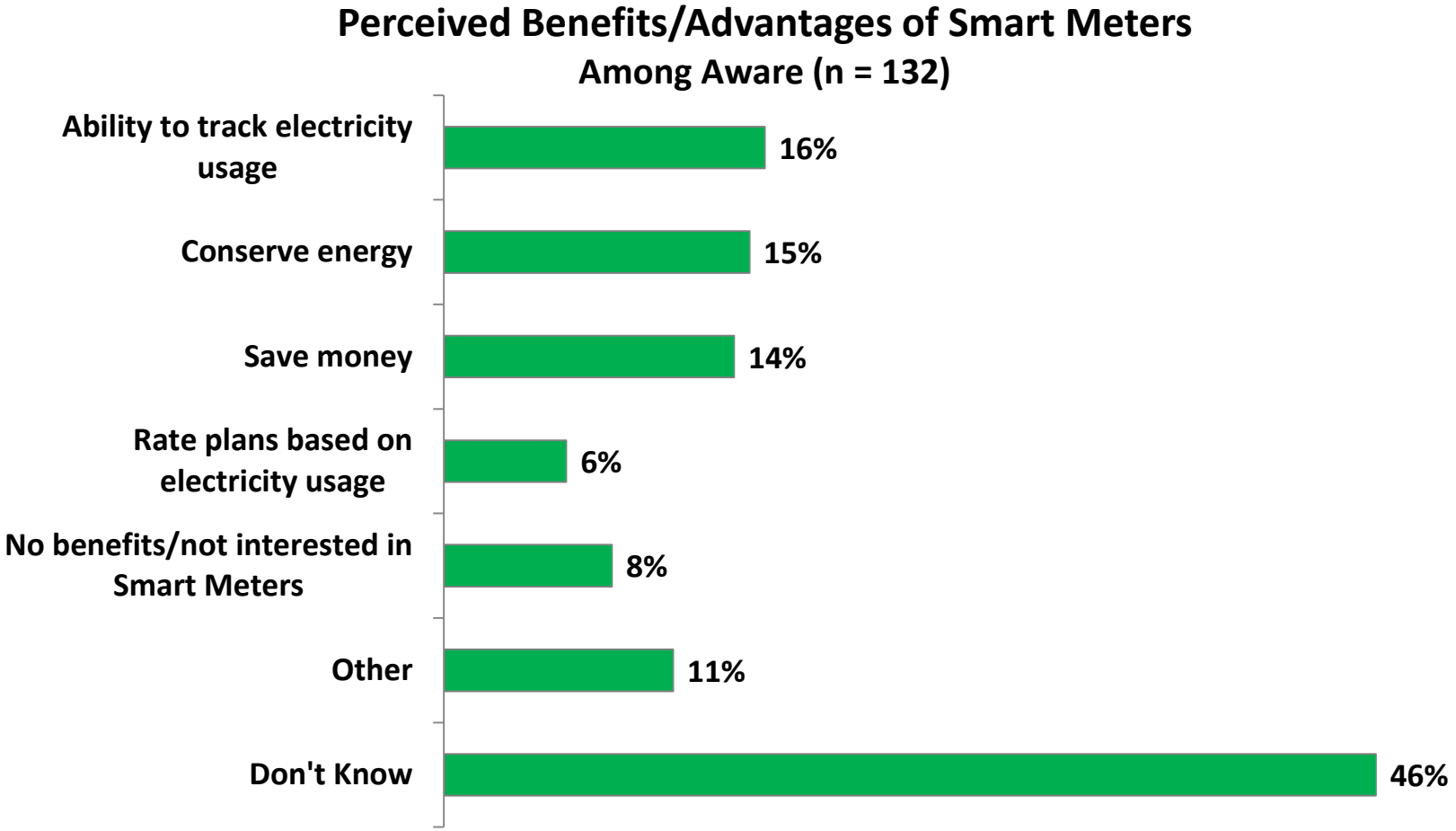
Most customers aware of Smart Meters learned about them through their LG&E or KU utility. Newspapers, magazines, internet and television were also good sources for educating customers.




Q6: How did you learn about Smart Meters? Select all that apply.

# Benefits

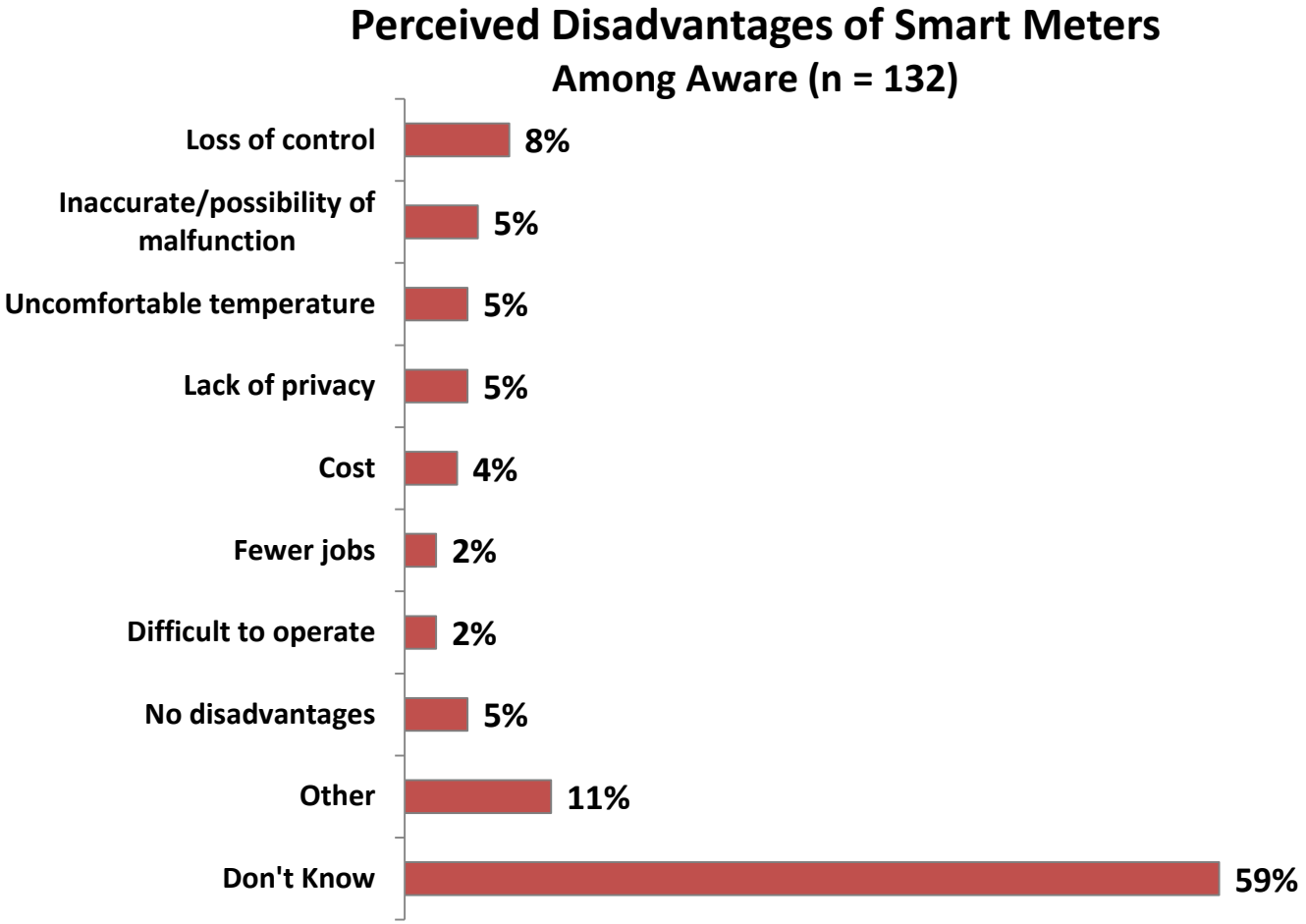
Nearly half of customers aware of Smart Meters were not able to explain the benefits of the technology. Those who could noted benefits such as the ability to track usage, conserve energy and save money.




Q7a: What do you think the benefits and/or advantages of Smart Meters are?

# Disadvantages

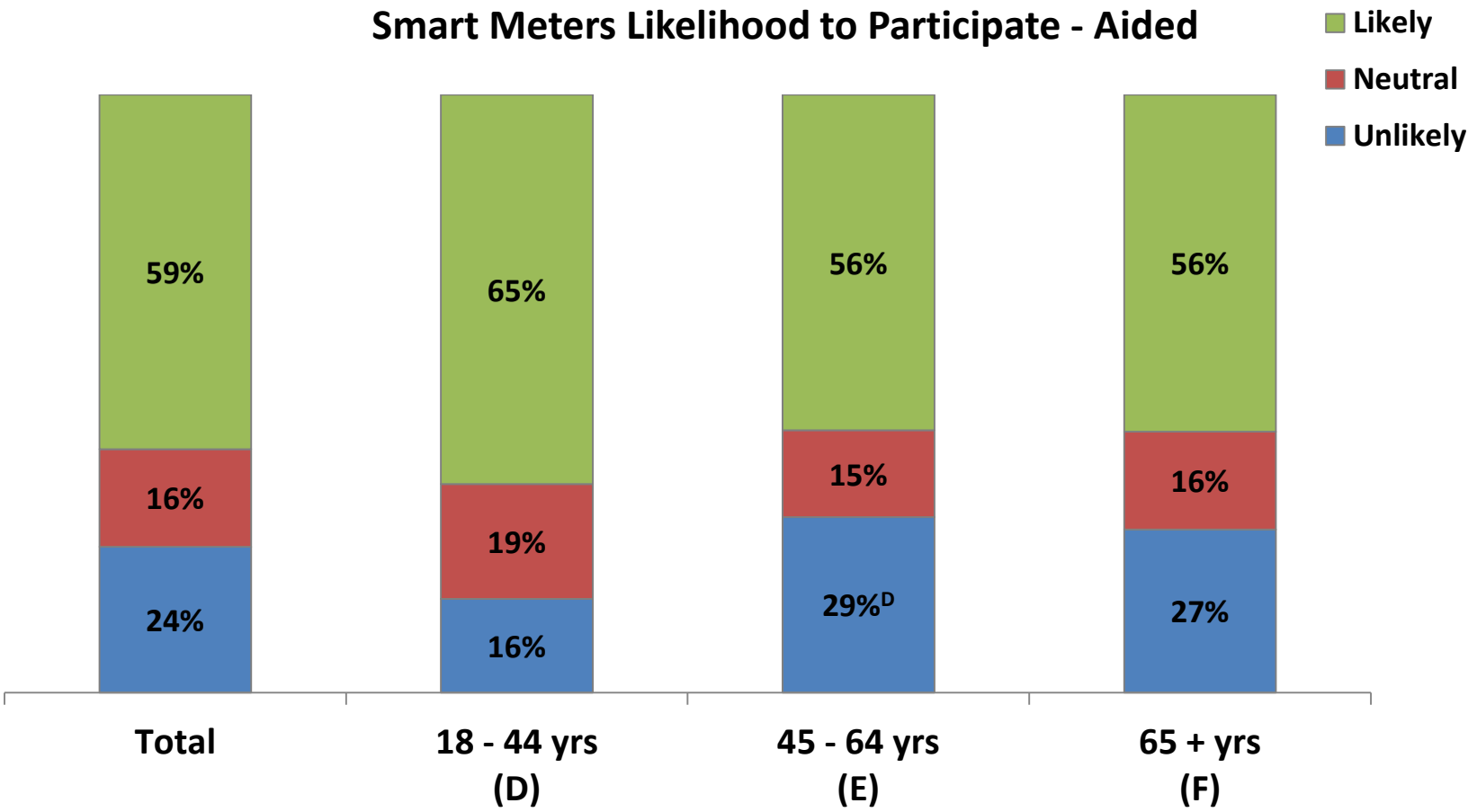
The majority of customers aware of Smart Meters don't know what the disadvantages are. Other customers were concerned with loss of control, system malfunctions, uncomfortable temperatures and lack of privacy.




Q7b: What do you think the disadvantages of Smart Meters are?

# Likelihood to Participate

Following a brief description of Smart Meters, over half of LG&E/KU customers responded that they were likely to participate if the utility offered a program. Likelihood to participate was lower among customers 45+ years, with over one-fourth not likely to participate.




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

Take Rate is highest for the Peak Time Rebate rate option and significantly ahead of the other three options. Inclining Block was the least favorable rate option.

## 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

Peak Time Rebate had the highest Take Rate among both LG&E and KU customers. In general, Take Rates were lower among KU customers.

## 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

Take Rate is highest for the Peak Time Rebate rate option among both the 18-44 and 45-64 year old groups. However, for older customers Take Rates were comparable for Peak Time Rebate and Time of Use.

## 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

The features most preferred by customers were tracking electricity usage on an in-home display/energy monitor or on-line. Smartphone features were least preferred overall, but were more preferred among younger customers over Email (coincides with Smartphone ownership).

## MaxDiff Preference Score

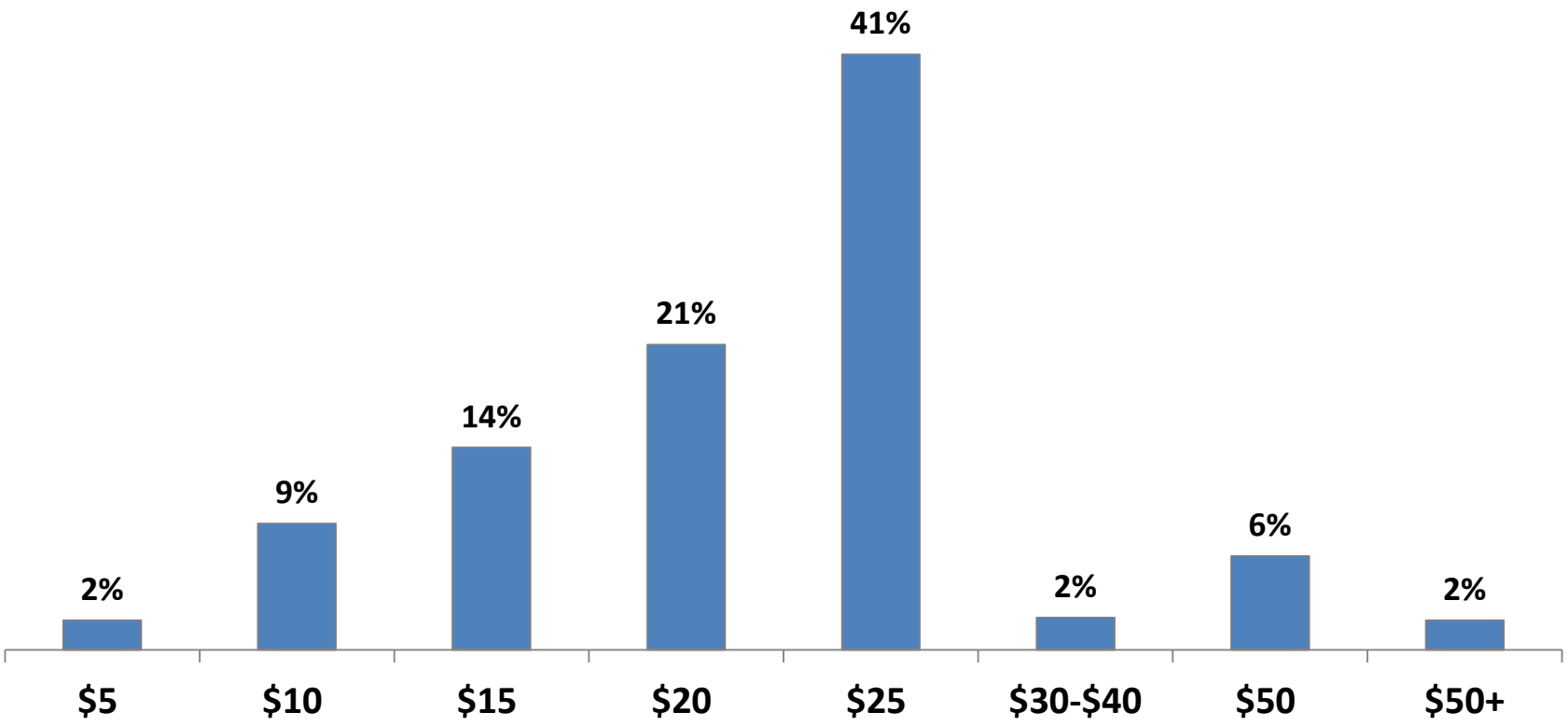
| Smart Meter Features | Total LG&E/KU (n = 495) | Age 18-44 (n = 172) | Age 45-64 (n = 268) | Age 65+ (n = 55) |
|---|---|---|---|---|
| Track your electricity usage on an in-home display or energy monitor | 20.18 | 18.09 | 21.37 | 20.91 |
| Track your electricity usage on-line | 16.96 | 16.35 | 17.16 | 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 |

Q10: Of the tools or features listed, please choose which one is the Most Important and which is the Least Important to your participation in a Smart Meter program.

# Monthly Savings

In order to drive a change in behavior, 41% of customers want to save $25 a month. However, another 46% would be willing to save $20 or less a month.

## Monthly Savings Desired to Change Behavior

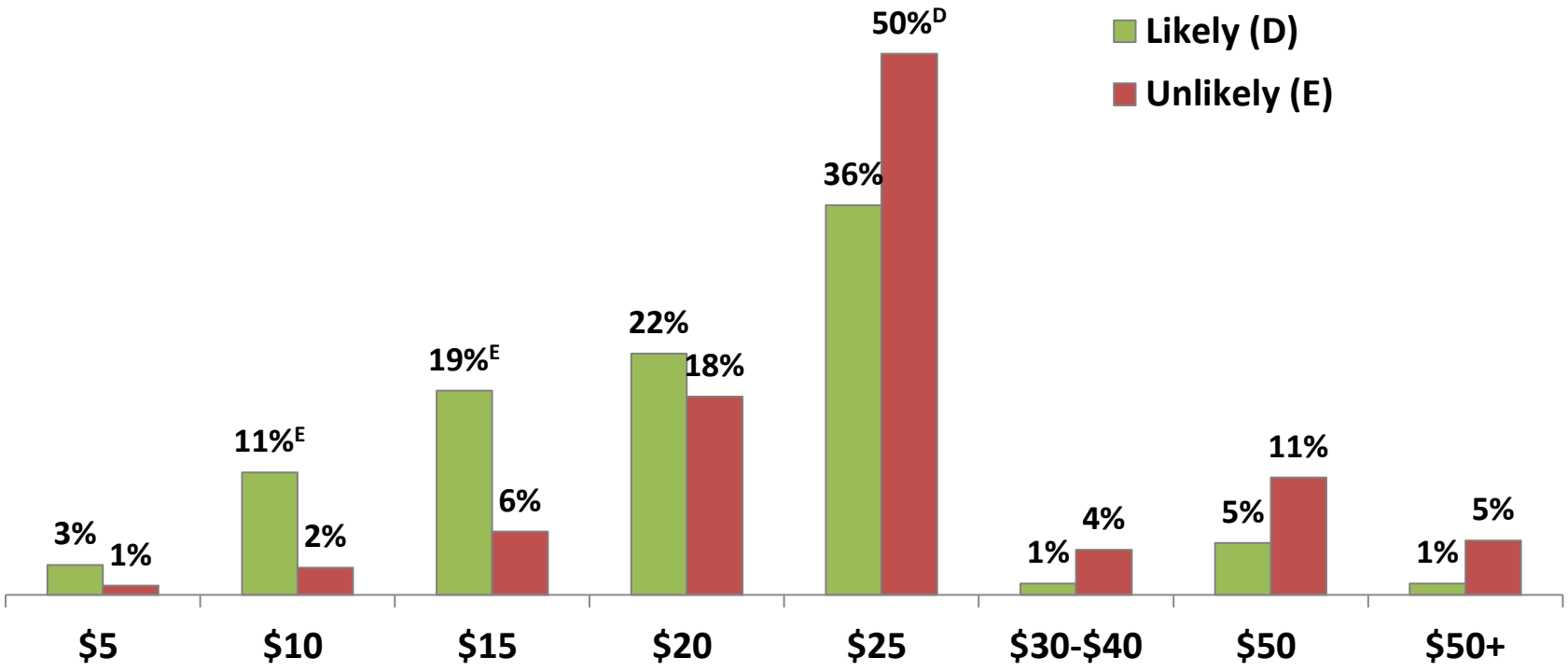



Q11: How much would you need to save on your monthly electric bill in order to change your behavior, such as adjusting your thermostat to sometimes less-comfortable settings, changing the time of day you use appliances, etc.?

# Monthly Savings

Customers stating they are unlikely to participate in a Smart Meter program require higher savings in order to motivate them to change their behavior than those likely to participate.

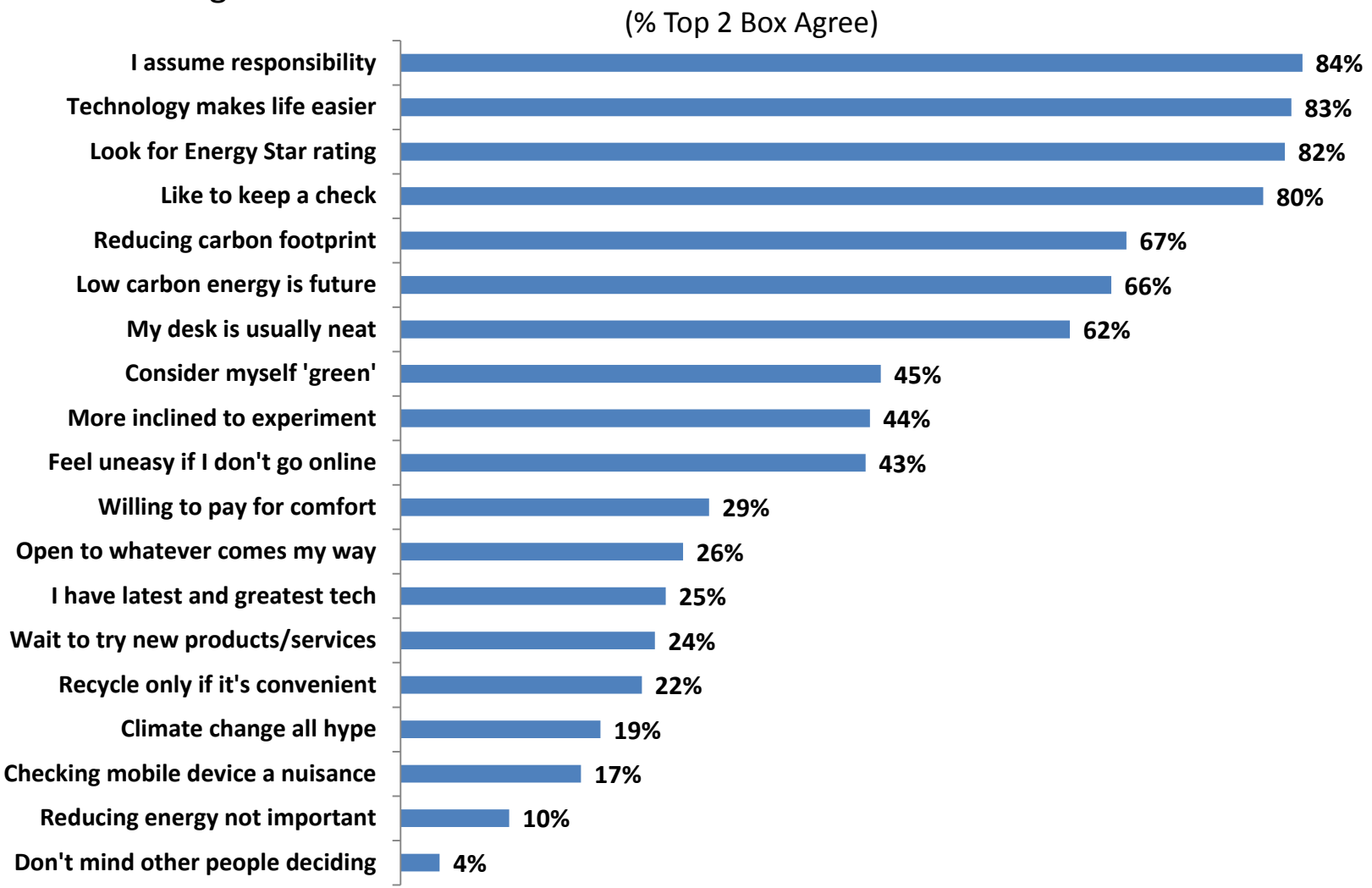
**Monthly Savings Desired to Change Behavior**
**Likely vs Unlikely to Participate***




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

Only one in 10 customers felt that reducing energy was not important. Less than half consider themselves "green".




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

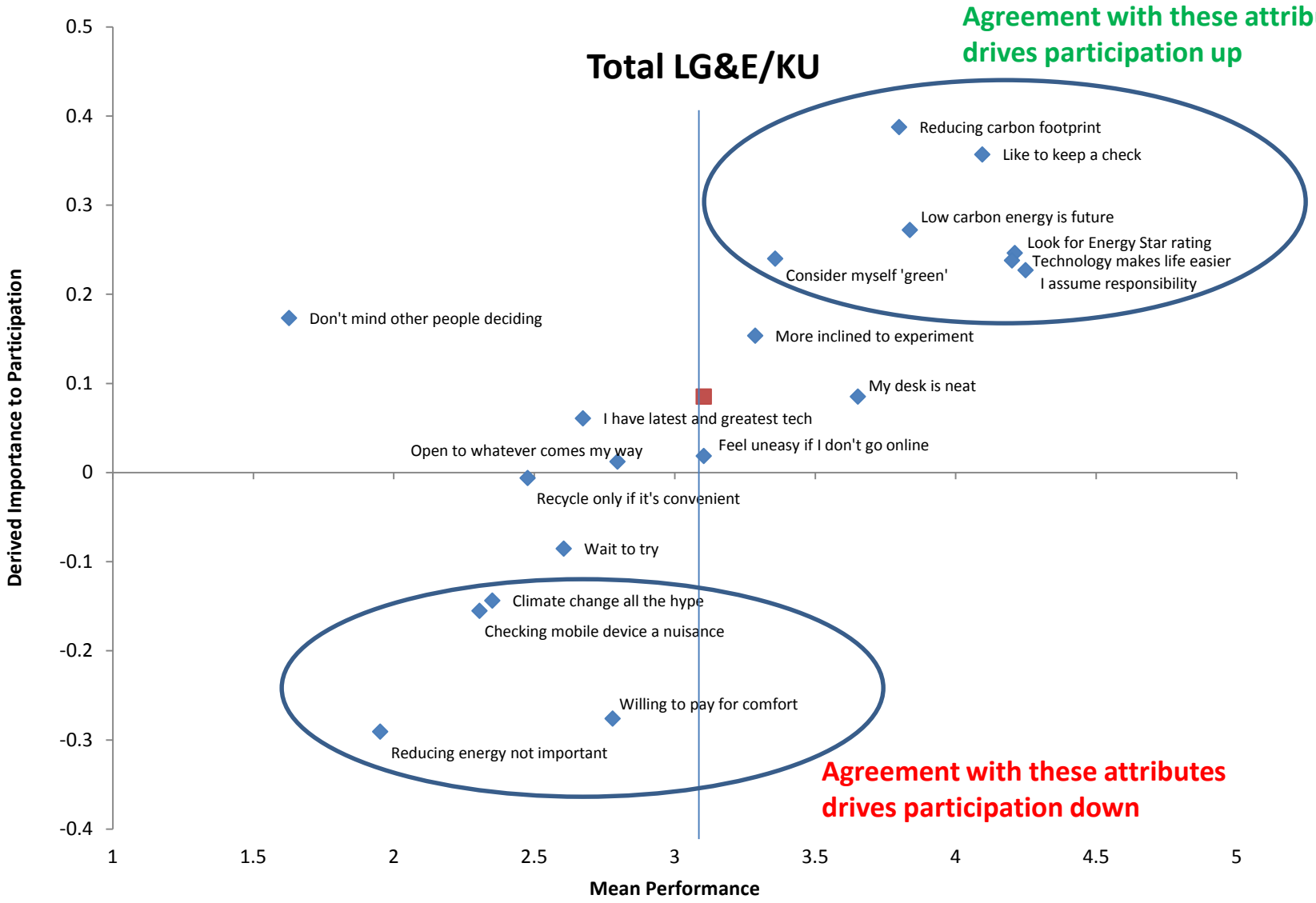
# Attitudes

There were some attitudinal differences across age groups.

| % 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% |

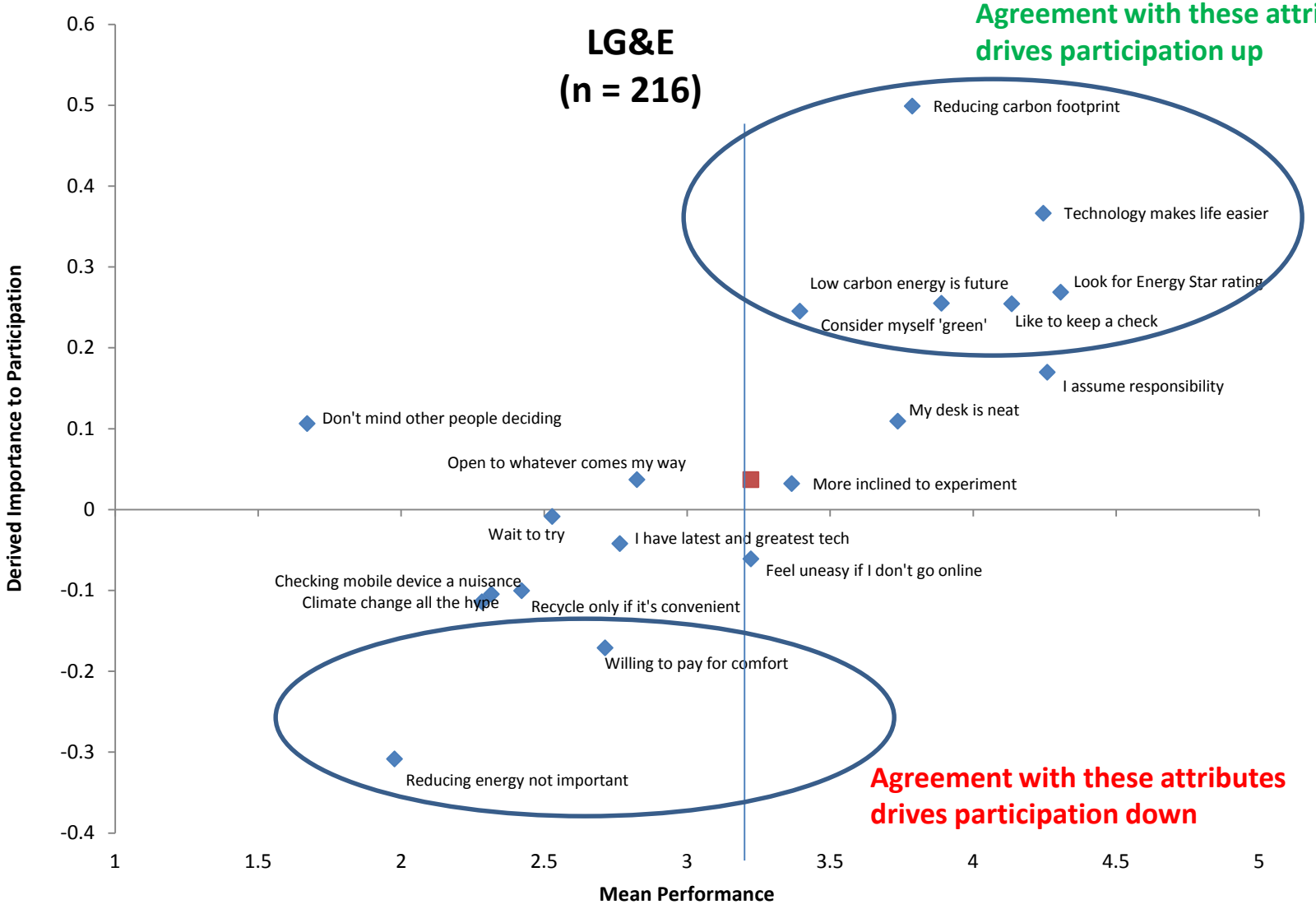
Q12: How much do you agree or disagree with each of the following statements? (5pt scale)

# Attitudes and Participation



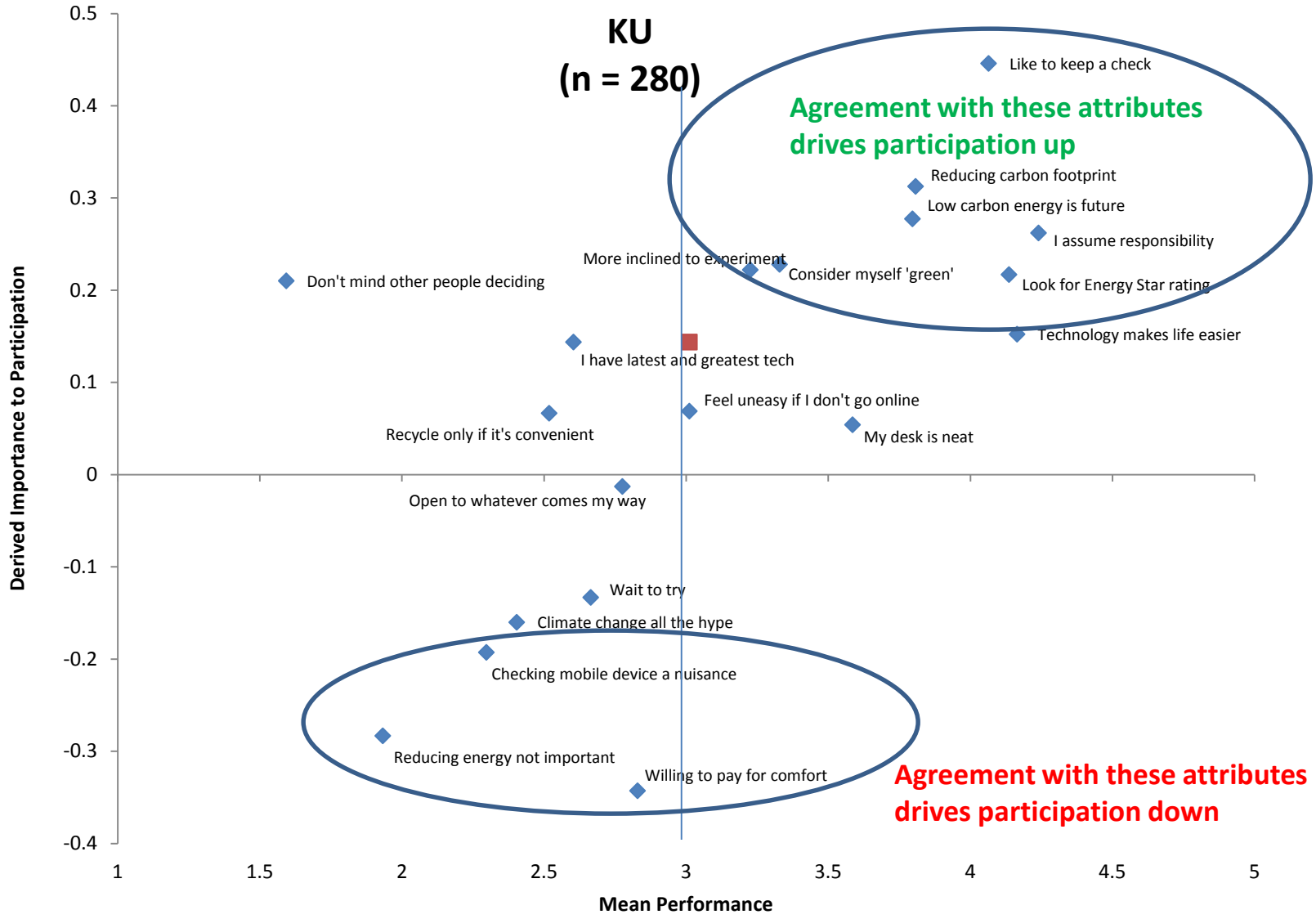

Q12: How much do you agree or disagree with each of the following statements? (5pt scale)

# Attitudes and Participation



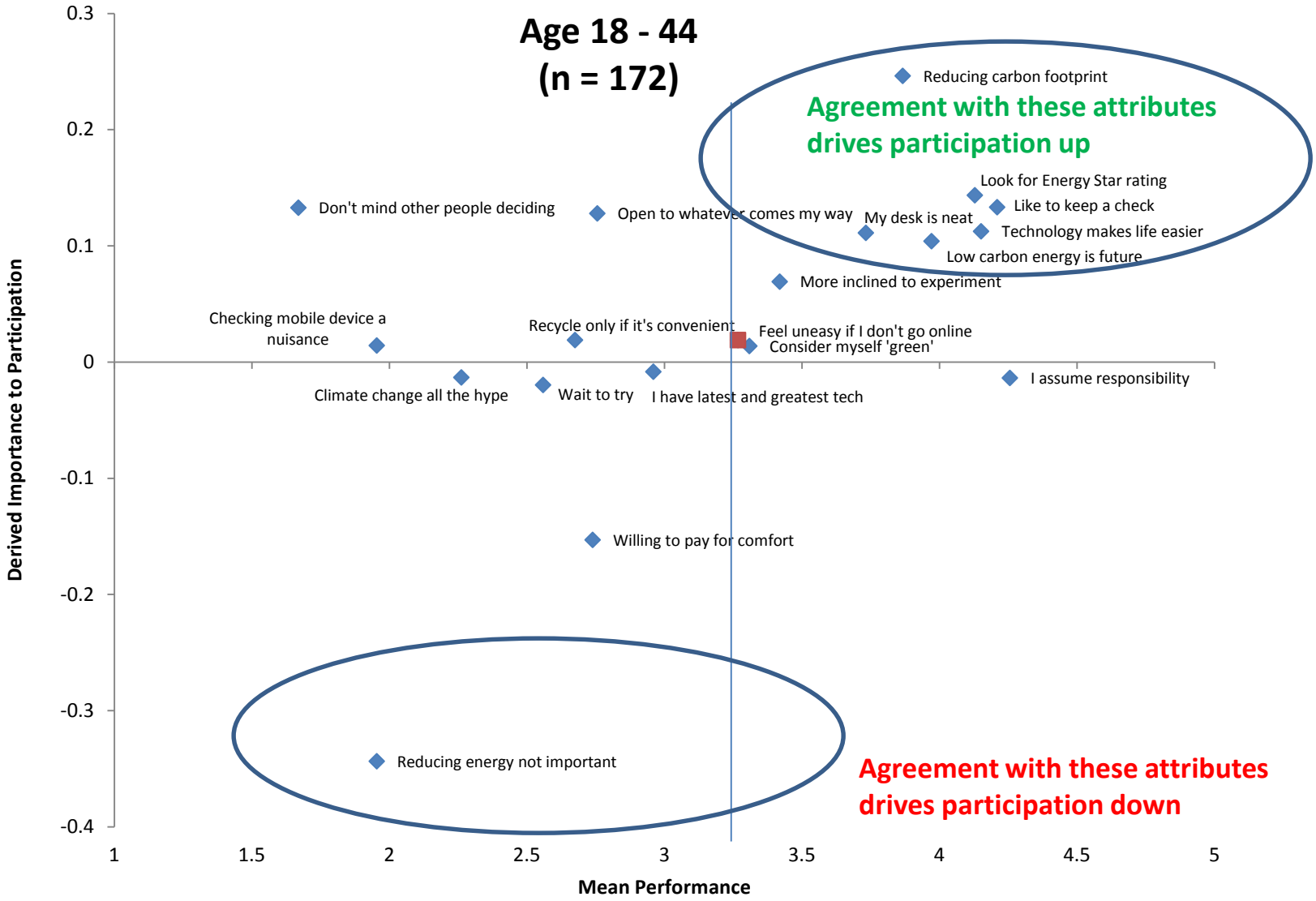

Q12: How much do you agree or disagree with each of the following statements? (5pt scale)

# Attitudes and Participation



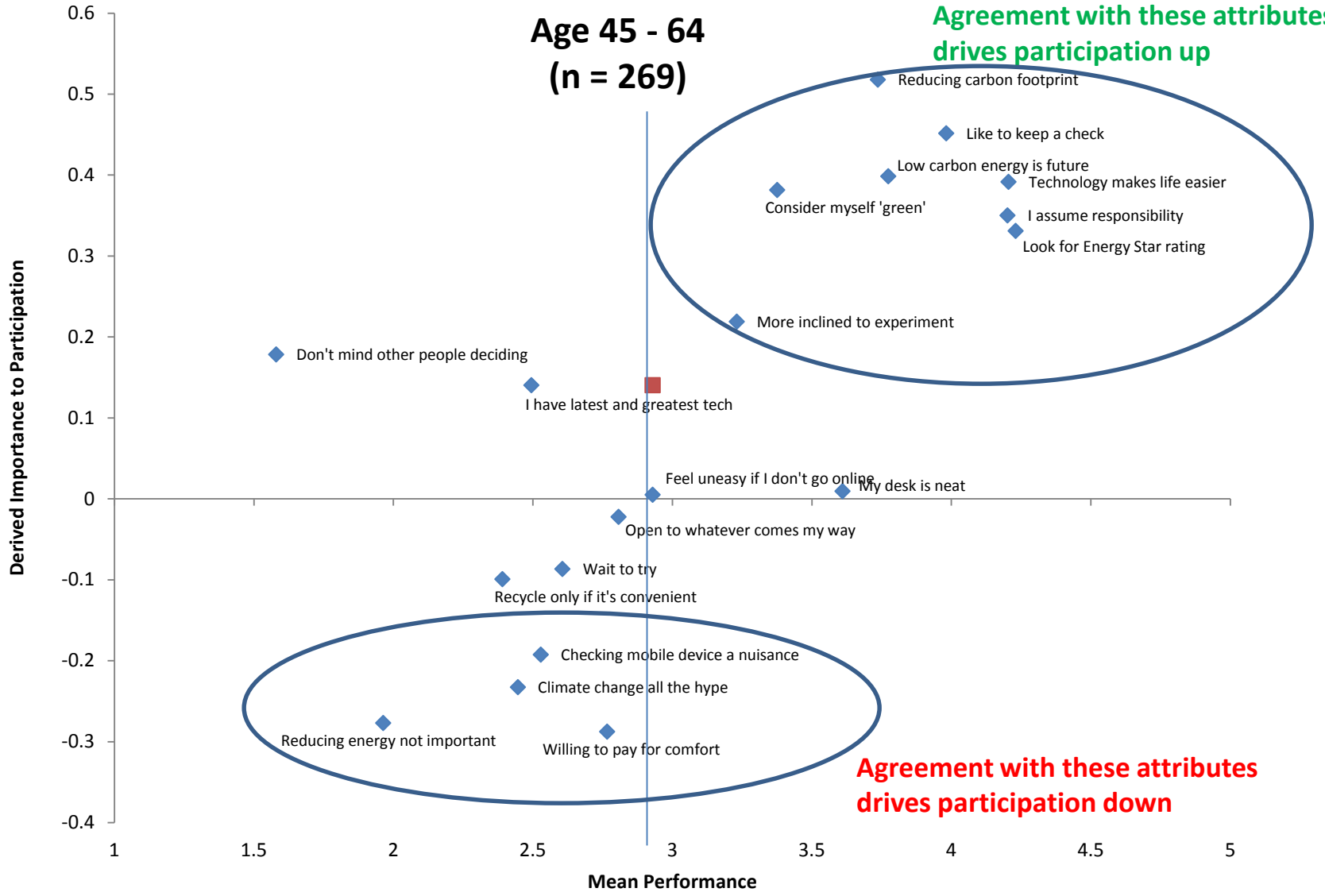

Q12: How much do you agree or disagree with each of the following statements? (5pt scale)

# Attitudes and Participation



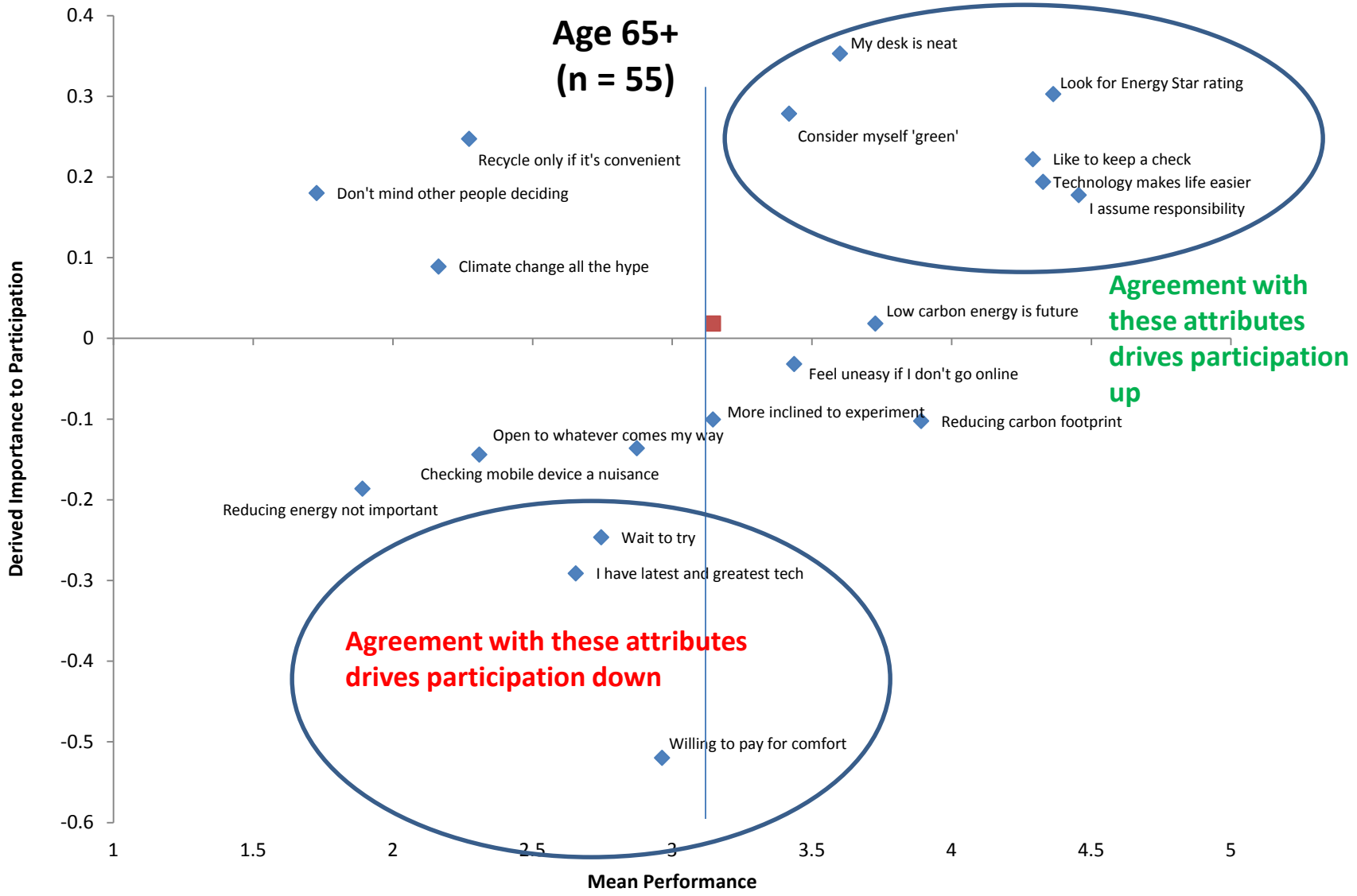

Q12: How much do you agree or disagree with each of the following statements? (5pt scale)

# Attitudes and Participation




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

# Attitudes and Participation

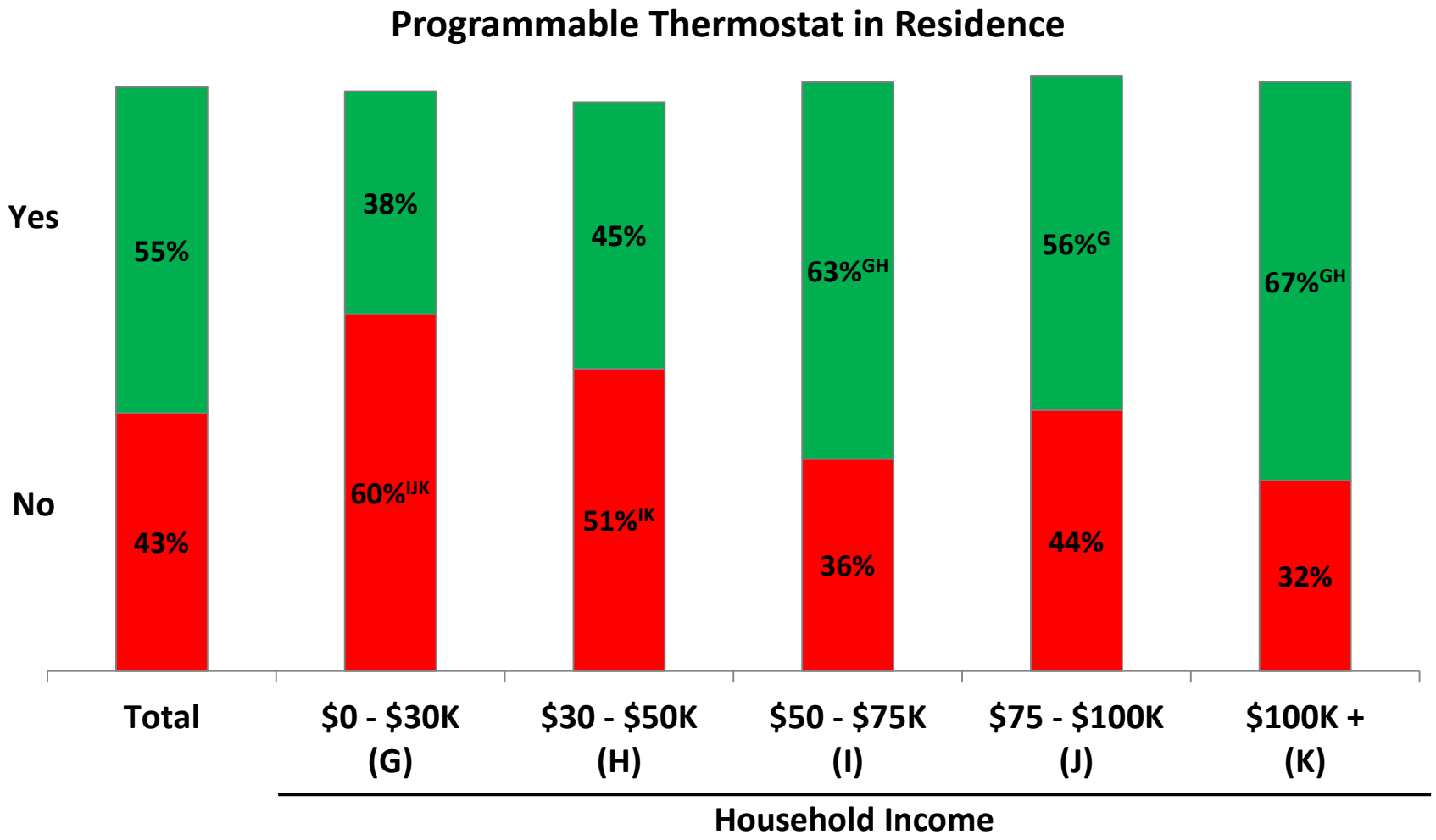



Q12: How much do you agree or disagree with each of the following statements? (5pt scale)

# Thermostat Adjustment

# Programmable Thermostat

Just over half of all customers have a programmable thermostat in their home. Significantly fewer low income households have a programmable thermostat.

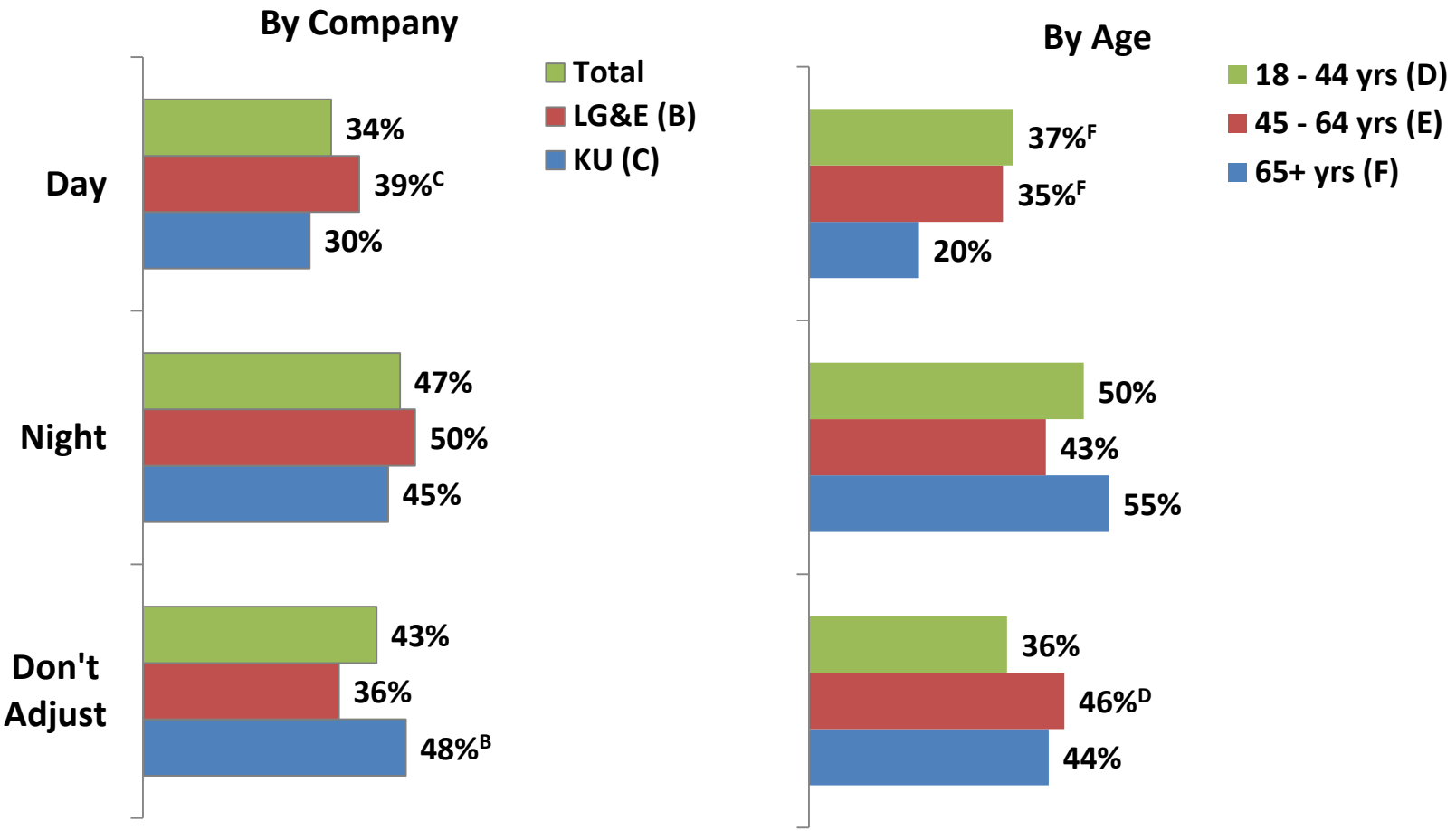



Q4: Is the thermostat in your residence programmable?

# Thermostat Adjustment

In general, about one-third of customers adjust their thermostat during the day (fewer if 65+ years old) and half adjust at night. Significantly more KU customers don't adjust their thermostat at all.

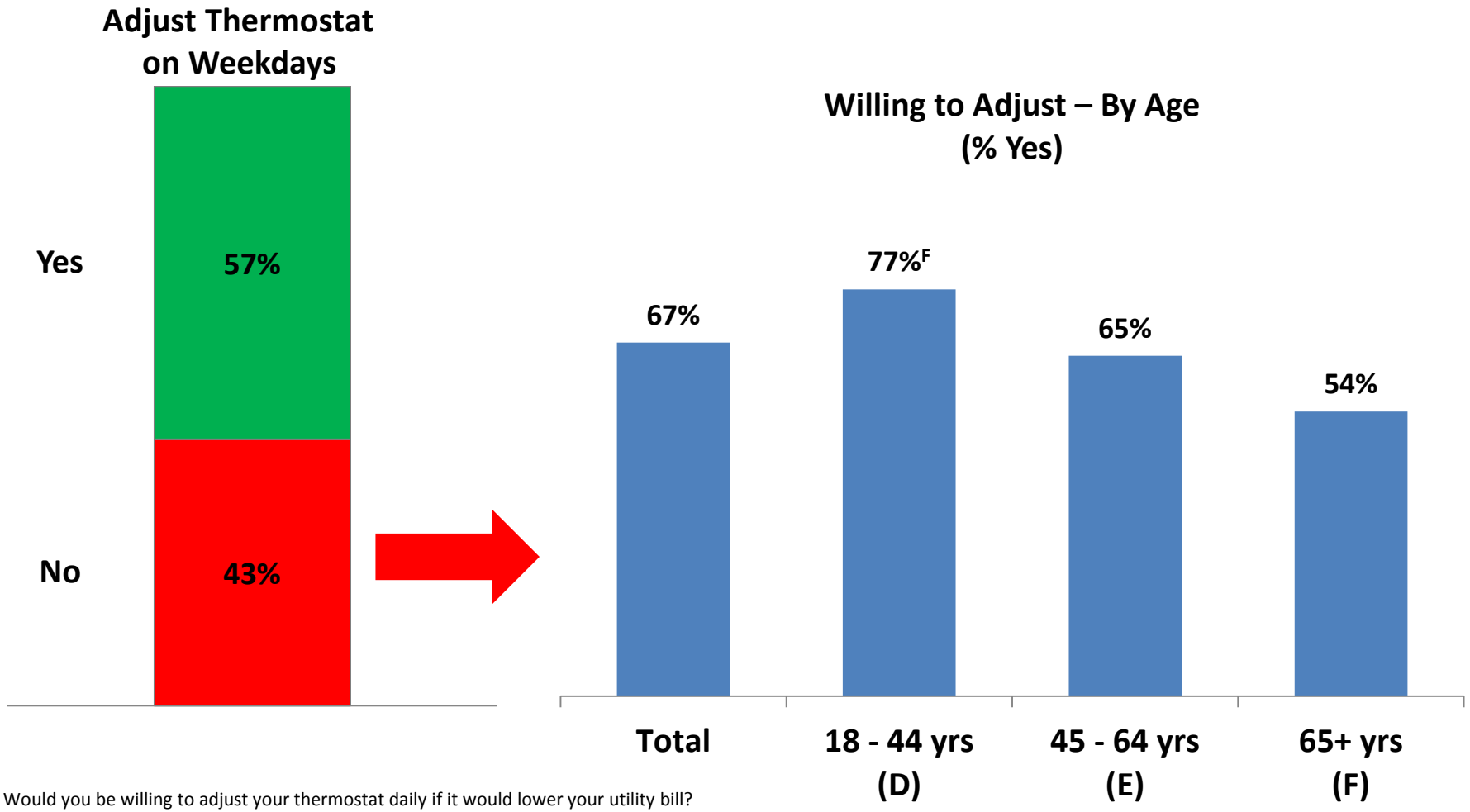
## When Adjust Thermostat on Weekdays




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

Nearly two in five customers currently do not adjust their thermostat, however two-thirds reported they would be willing to adjust if it would lower their utility bill. Willingness to adjust declines as age increases.

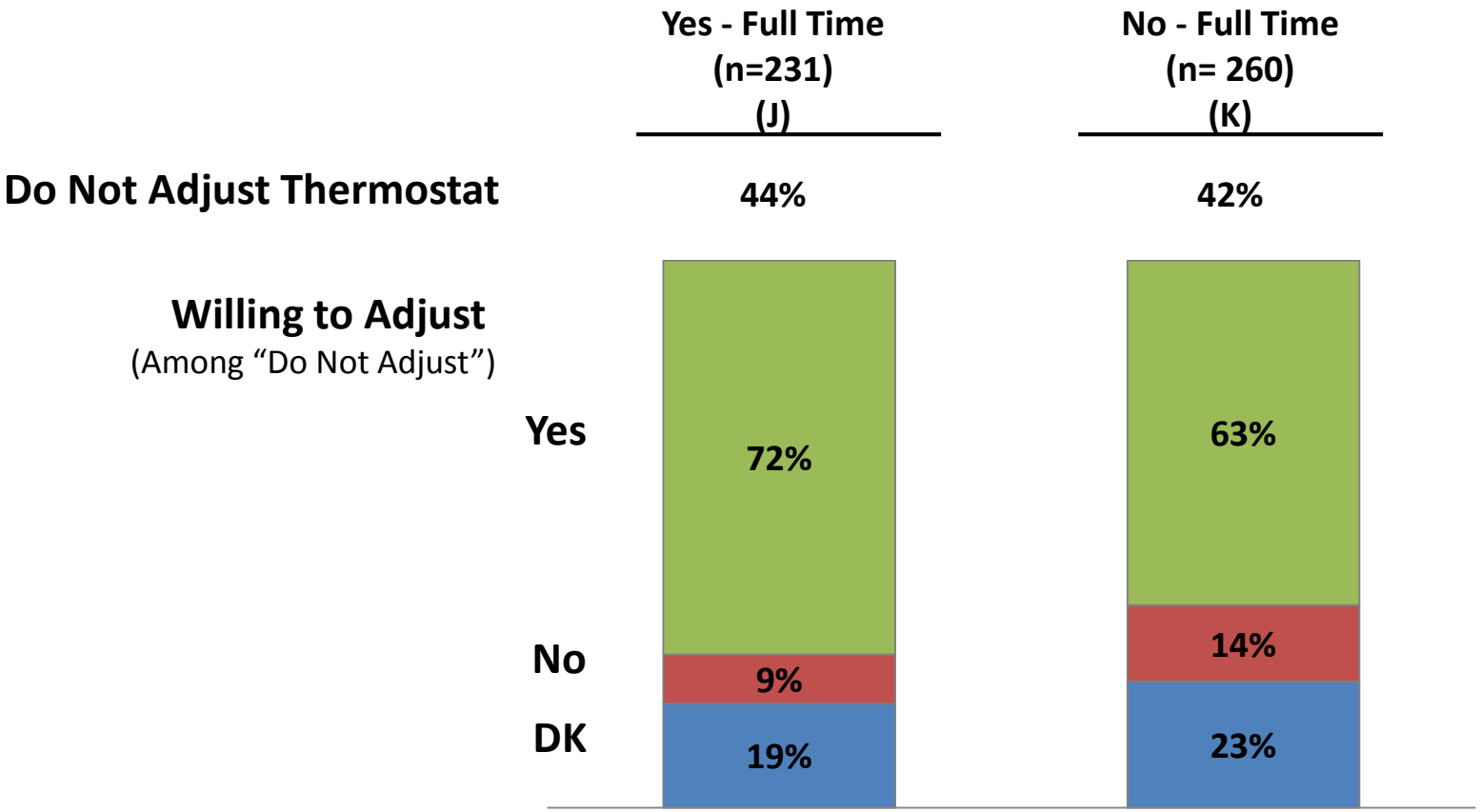



Q3: Would you be willing to adjust your thermostat daily if it would lower your utility bill?

# Thermostat Adjustment

Just under half of households where all adults work full time outside of the home do not adjust their thermostat, comparable to non-full time households. However, full time working households are more willing to adjust if it will save them money on their bill.

## Thermostat Adjustment - All Adults Employed Full Time

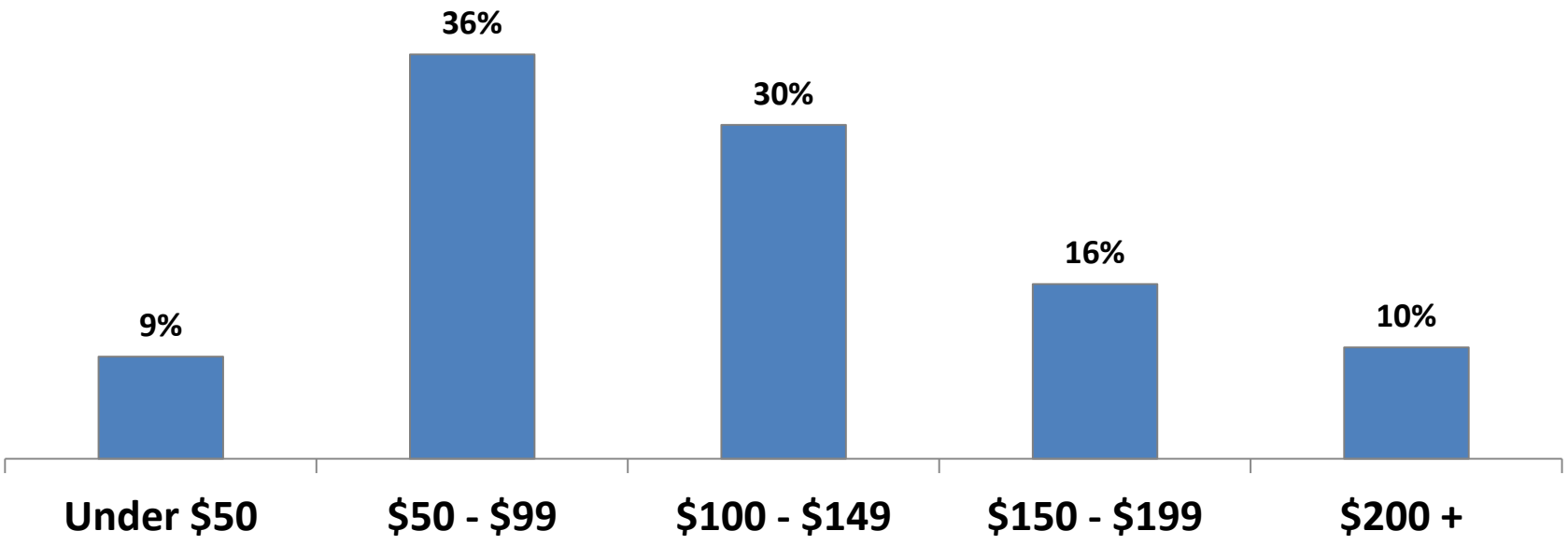



Q3: Would you be willing to adjust your thermostat daily if it would lower your utility bill?

# Utility Bill

Two-thirds of customers reported that their most recent utility bill was between $50 to $150. Bills for LG&E customers skewed higher than KU.

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




| | Under $50 | $50 - $99 | $100 - $149 | $150 - $199 | $200 + |
|---|---|---|---|---|---|
| LG&E (B) | 4% | 31% | 31% | 22%[C] | 12% |
| KU (C) | 13%[B] | 40%[B] | 29% | 10% | 8% |

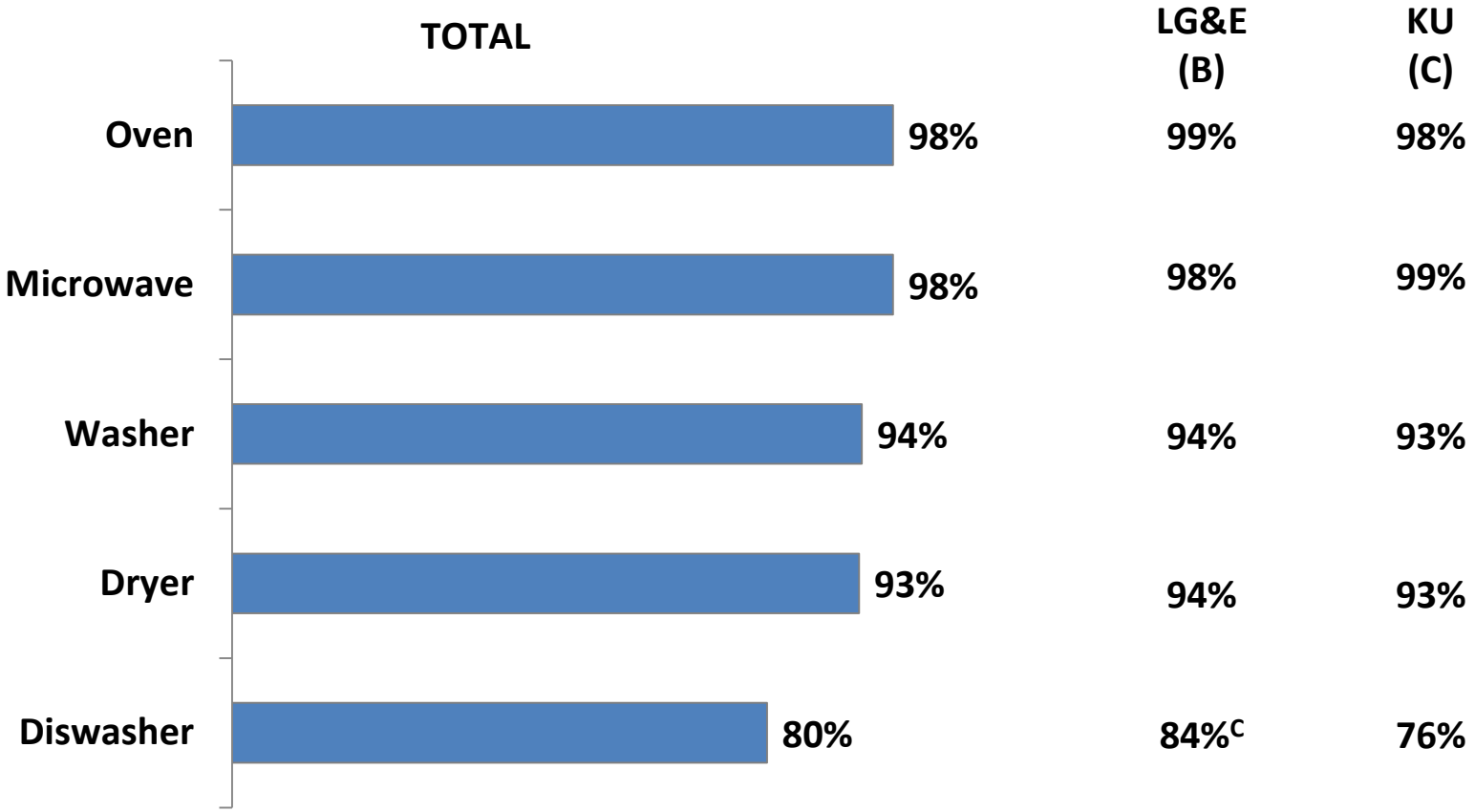
QS4a: Approximately, how much was your most recent [LG&E or Kentucky Utilities] bill (excluding any past due amounts)? Please round to the nearest whole dollar.

# Appliance Usage

# Appliance Ownership

Nearly all customers own an oven and/or microwave, while 4 in five customers owns a dishwasher. Significantly more LG&E customers own a dishwasher than KU.

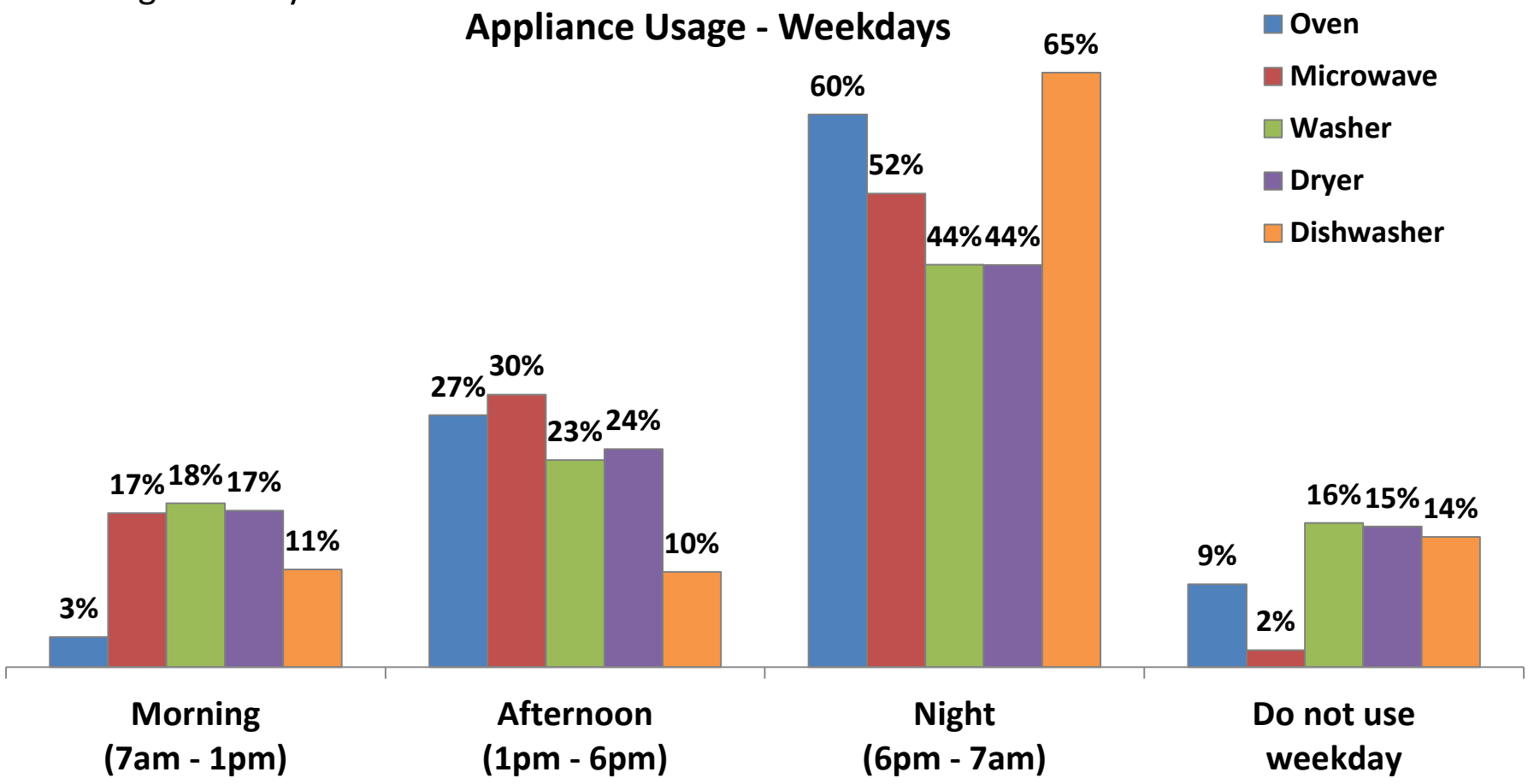
## Appliance Ownership




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

# Appliance Usage

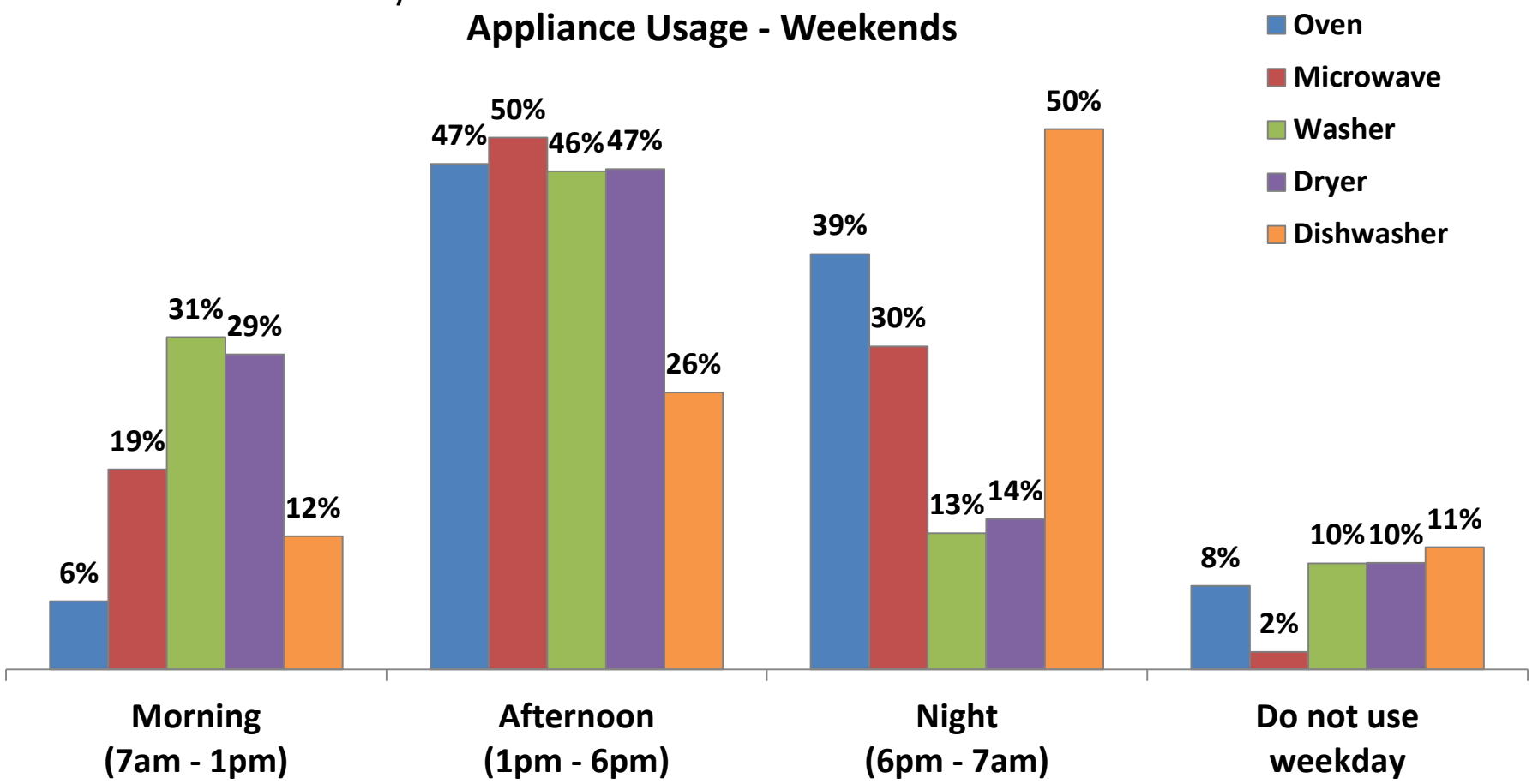
During weekdays, all appliances are used most heavily after 6pm, particularly the dishwasher and oven. On average, about 15% of customers don't use their washer, dryer or dishwasher at all during weekdays.




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

# Appliance Usage

On the weekends, usage spikes in the afternoon for all appliances, except the dishwasher which half of customers still use at night. Washer and dryer usage increases in the morning on the weekend versus weekdays.




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

# 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.

## Appliance Usage by Age Group

(% of Respondents)

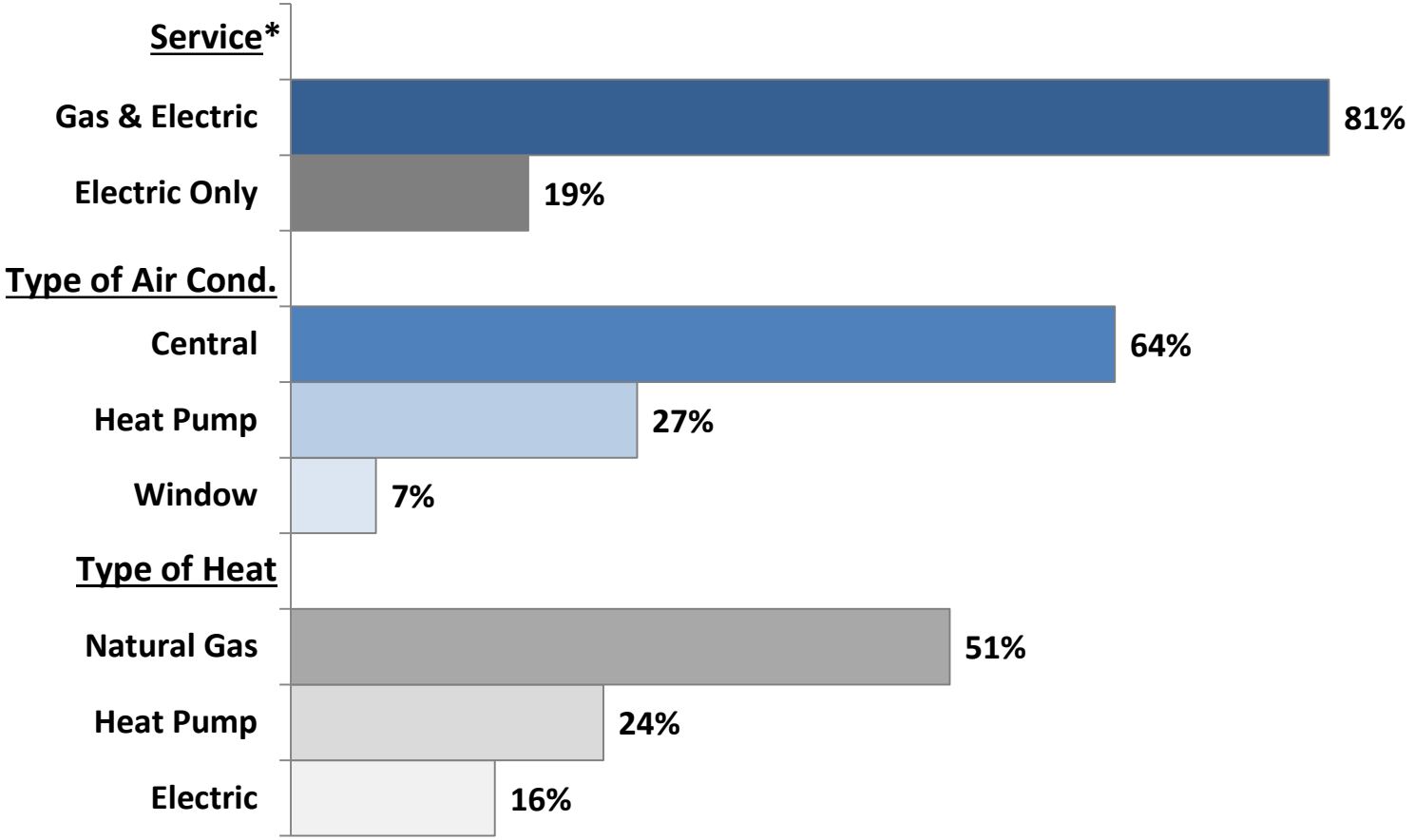
| | Washer | | | Dryer | | | Oven | | | Dishwasher | | | Microwave | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Weekdays** | 18-44 (D) | 45-64 (E) | 65+ (F) | 18-44 (D) | 45-64 (E) | 65+ (F) | 18-44 (D) | 45-64 (E) | 65+ (F) | 18-44 (D) | 45-64 (E) | 65+ (F) | 18-44 (D) | 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?

# Demographics

# Residence Profile

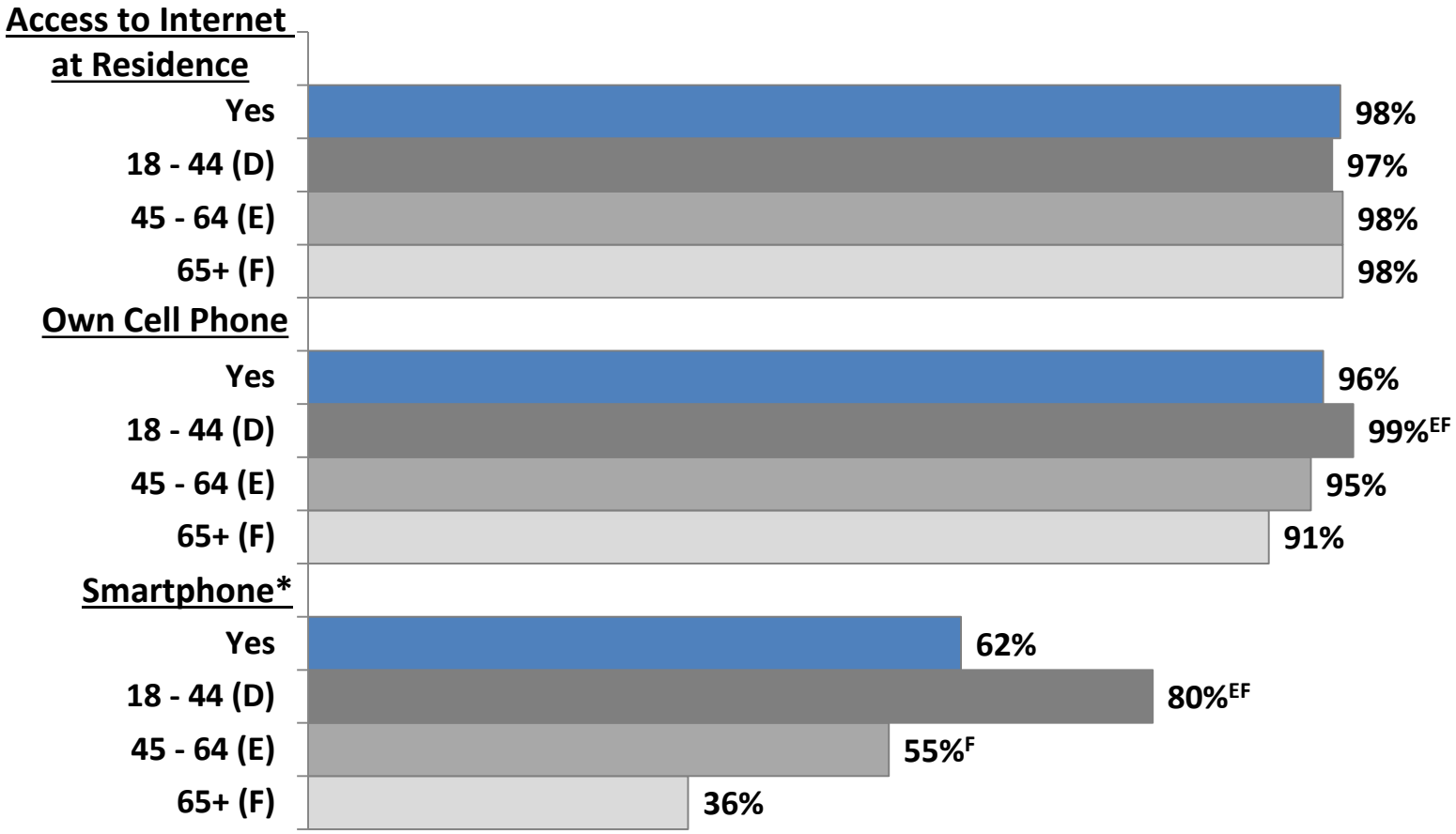
The majority of LG&E customers surveyed have gas and electric service. About two-thirds of all customers have central air conditioning and half use natural gas.




* 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

Although most customers own a cell phone, fewer than two-thirds own a Smartphone and ownership is significantly lower among older age groups. High internet access is a function of this being an internet study.




* 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 | |
|---|---|---|---|---|---|
| 1st through 8th 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% | | |

D1: What was the last grade or level of schooling that you completed?, D2: In what range does your total household income fall (before taxes)?, D3: Including yourself, how many people live in your household?, D4: How many children under the age of 18 live in your household?, D5: Are all adults in your household employed full-time outside of the residence?, and D6: Are you male or female?

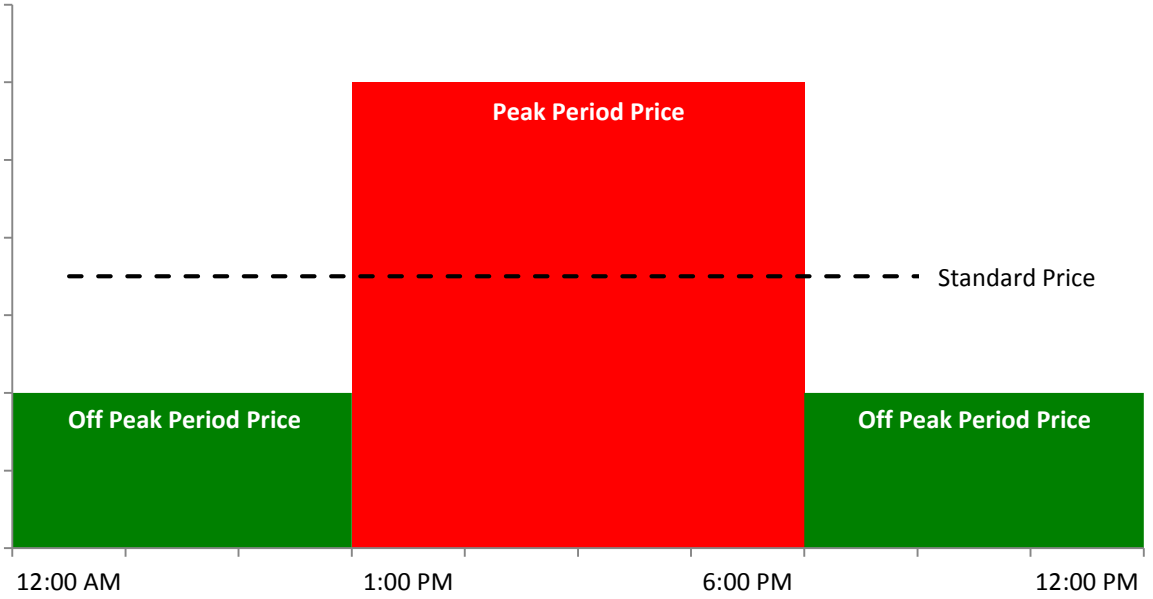
# Appendix

# Rate Option Definitions

## Time of Use

Under a time-of-use rate, the price a customer pays varies by season and by time of day. Prices are lower during "off-peak" hours, like nighttime, weekend and morning hours. Prices are higher during peak hours of electricity use, when demand is greatest.

Because time-of-use prices differ throughout the day, customers have an opportunity to save money by shifting electricity use to off-peak hours. Steps could include adjusting thermostats during peak hours; installing timers on water heaters, dehumidifiers and other equipment to make sure they are off during peak times; and postponing laundry and other activities until off-peak hours when demand and prices are lower. Customers who are unable or not willing to shift electricity use, would end-up paying more on the Time-of-Use rate.



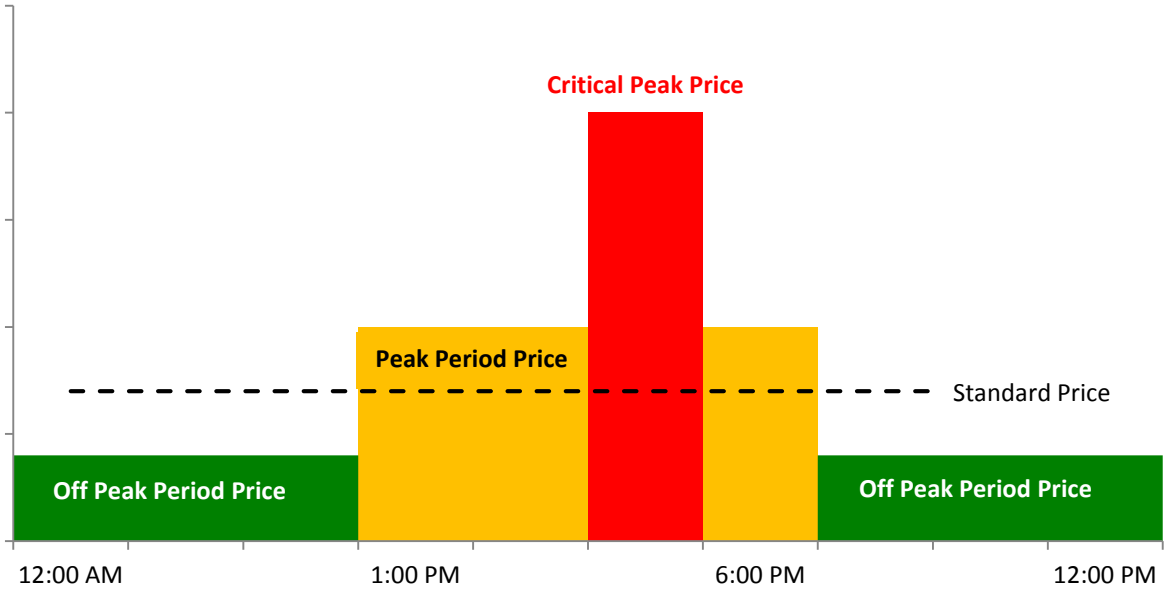
# Rate Option Definitions

## Critical Peak Pricing

Under a Critical Peak Pricing rate, the price a customer pays varies by season and by time of day. Customers on the Critical Peak Pricing plan benefit if they can adjust their use of electricity to "off-peak" hours, like mornings, nighttime and weekends. Critical Peak Pricing customers also have an additional opportunity to save money if they agree that when the electrical system occasionally experiences a very high demand for electricity, they will respond to the situation by further reducing their use of electricity during that time period.

Critical peak pricing alerts can be sent to a customer's mobile device, email, telephone, or even through an in-home display.

Customers who are unable or not willing to shift electricity use or respond to a critical peak pricing alert, could end-up paying more on the Critical Peak Pricing rate.



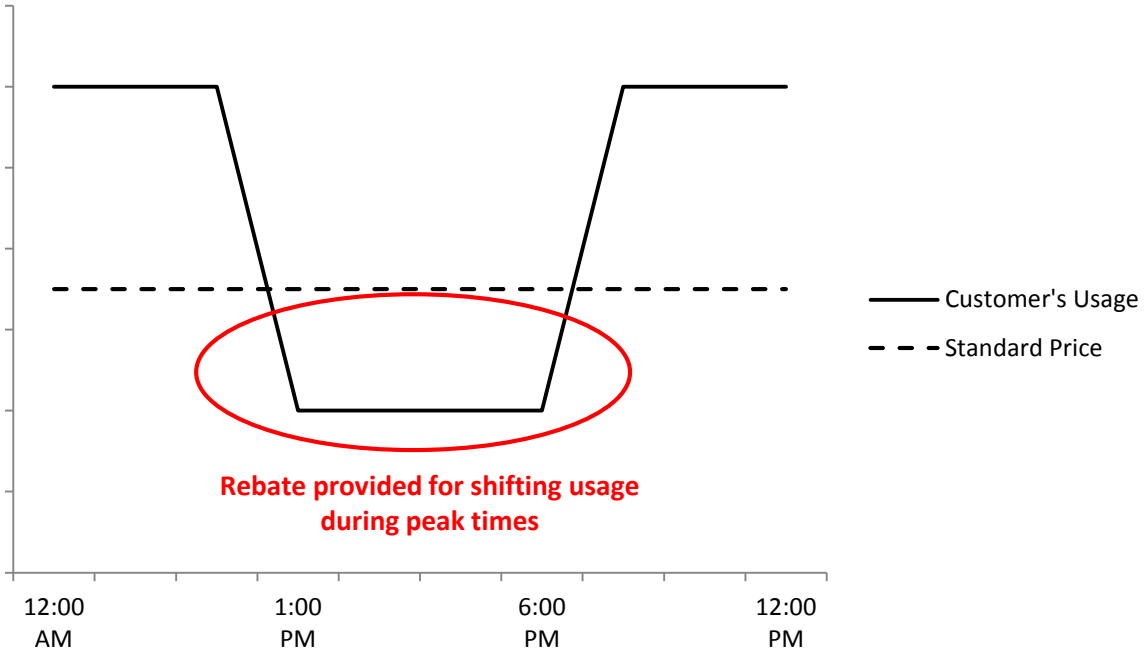
# Rate Option Definitions

## Peak Time Rebate

The Peak Time Rebate plan is designed for customers who are willing to try to shift electrical usage to off-peak hours, like mornings, nighttime and weekends, but who are not willing to risk paying more for electricity if they fail to shift their usage.

The customer is rewarded for shifting electric usage during peak hours when demand is greatest, but is not penalized for failing to shift electrical usage to off-peak hours.

Consumers' kilowatt hour reduction for the rebate is determined by comparing their usage during the peak period to their baseline usage during certain hours (e.g., 1PM-6PM) for the three to five weekdays prior to the peak period. If their usage during the peak period is less than their baseline usage, they receive a rebate which is based on a price per kilowatt hour saved.



# Rate Option Definitions

## Inclining Block

The Inclining Block rate is designed for customers who are willing to reduce their overall consumption regardless of the time of day. The monthly pricing structure is designed to provide price intervals of consumption where the amount charged per kilowatt hour for each interval block increases as energy consumption increases. At the beginning of each month, pricing would return to the Block 1 rate.