



**Lakeland Electric  
Consumer Behavior Study  
Interim (Year 1)  
Evaluation Report  
Award Number: DE-OE0000242**

**Submitted  
Feb 2015**



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## 1. Executive Summary

This interim evaluation report summarizes results from the first year of the Lakeland Electric's two-year 3-Period Time of Use (TOU) program called "Shift-to-Save" (STS). Lakeland Electric has undertaken this study as part of a full system wide deployment of advanced metering infrastructure (AMI) funded in part by a grant from the U.S. Department of Energy's (D.O.E.) Smart Grid Investment Grant (SGIG) Program.

Lakeland's submission to the D.O.E. listed the objectives of this study to include estimating the following: the amount of peak demand savings, the amount of load shifting from on peak to off peak periods and from shoulder periods to off peak periods, and the amount of net overall electric usage savings to customers. Other objectives included assessing customer acceptance and retention, and assessing customer volunteer rates versus assigned rates, as well as customer dropout rates.

Lakeland Electric's residential customers were recruited and selected to participate in the two-year pilot using a Voluntary versus Assigned enrollment. Both groups were randomly placed in either a treatment group (on Shift to Save rate RST-1) or control group (on standard Residential rate RS) in the first year of the study. All customers were informed that they would receive monthly notifications that listed their savings or increases, and that they could choose to return to the standard rate in the first six months, along with any difference in bills being credited back to their account. In total, 6,586 customers participated in the study (2228 voluntary, and 4358 assigned) and were placed in four groups: Treatment Voluntary (Y1V) with 1017 customers, Treatment Assigned (Y1A) with 998 customers, Control Voluntary (Y2V) with 1211 customers, and Control Assigned (Y2A) with 3360 customers. The two treatment groups were placed on the Shift to Save treatment rate (RST-1) from April 2012 through April 2013, while the two control groups remained on the standard rate (RS) during the same period. Of the original 1017 Voluntary Treatment customers in Year 1, 641 remained in the program the entire year (63% retention rate). Similarly, of the original 998 Assigned Treatment customers in Year 1, 692 remained in the program the entire year (69% retention rate).

Data analysis was conducted to develop 12 different load impact metrics (listed in the Data Section of this report). The data analysis was broken out by the two groups of customers participating in the study: Assigned and Voluntary. None of the Assigned Group's load impact metrics were statistically



significant, and most reflected a slight increase in consumption when a decrease was expected. So turning to the Voluntary treatment groups load impact analysis, the first set of load impact metrics focused on three different time periods on the system coincident peak day (August 28, 2012): peak hour of 17:00, the peak period of 15:00-20:00 and the entire 24 hours. Customers in the Voluntary treatment group produced statistically significant reductions in load on the system coincident peak hour (-0.22 kWh/customer), peak period (-1.11 kWh/customer), and peak day (-3.15 kWh/customer or -7.35%). The second set of load impact metrics focused on the same different time periods as the previous set of metrics but for each of the 12 months during the first year of the study. Customers in the Voluntary treatment group consistently produced a statistically significant reduction in electricity consumption in the monthly peak hour, peak period, and peak day in at least the first five months of the study (April-August). Thereafter (September-May), monthly load impacts varied substantially and were sporadically statistically significant for all metrics. The final set of load impact metrics focused on the same different time periods but over the entire course of the first year of the study. None of the Yearly load impacts over the three time periods were statistically significant. Over all time horizons, it does not appear that the Peak period usage reductions reflect a shift in usage but was rather overall energy conservation across all time periods.

The education of our customers about energy in general and specifically about TOU rate and related conservation methods appeared extremely important. Customers who understood these things appeared more likely to volunteer for the rate structure and demonstrated being receptive to the advertised behavior modifications. Those who did not volunteer appeared less likely to understand energy use and how different activities throughout the day affect their overall use and use during the peak periods.

As expected, the results of this study re-emphasize two key points:

1. Volunteers are much more likely to adjust their usage patterns in order to reduce (or shift) their electric usage, and
2. Additional educational materials are needed in order to allow our customers to better understand the practices they can use to provide any significant benefits (to the customer or the utility) of the Smart Grid and the Shift to Save Program.



## **2. Introduction**

This report presents the Consumer Behavior Study (CBS) associated with award number DE-OE0000242. This study is a part of Lakeland Electric’s “Smart Metering” infrastructure initiative designed to meet the capacity needs of Lakeland Electric’s service territory with an environmentally conscious methodology. The Advanced Metering Infrastructure will create a 2-way communication channel that gives our utility the potential ability to influence behavior by offering direct incentives in the form of dynamic energy prices. In addition, the monitoring efforts will demonstrate how different behaviors lead to different patterns of energy consumption and drive costs, and also can allow consumers to learn through experimentation. Our study objectives are focused on five (5) primary areas:

- Promote efficiency and reduce electric consumption during peak times;
- Educate customers on pricing options, usage patterns, and peak times to enable them to make changes in their consumption behavior;
- Measure customer satisfaction with different pricing options;
- Determine the value and usefulness of the various pricing plans; and
- Compare Elect-in and Elect-out enrollment approaches.

### **A. Project Background**

Lakeland Electric is the third largest publicly owned utility in Florida, servicing over 120,000 customers. While Lakeland Electric has always operated an efficient distribution system, receiving a Smart Grid Investment Grant (SGIG) from the Department of Energy (DOE) allowed for further automation and optimization of the distribution system. As a result of the grant, Lakeland Electric integrated Advanced Metering Infrastructure (AMI) throughout the city of Lakeland over a two and a half year schedule. The economics of AMI metering devices provides many benefits, including providing a less expensive means to monitor and control distribution feeders, capacitor banks, re-closers, and critical switch locations on a much larger, system-wide scale.

### **B. Project Overview**



Lakeland Electric's CBS is designed to learn more about how residential customers respond to time-differentiated pricing. The study's new TOU trial rates (RST-1) were used for participating customers only, and provides periods where a time shift in energy consumption should result in a reduction of their energy cost. In addition, that same time shift in energy consumption should also allow the utility to realize reduced operating costs by lessening the use of less efficient generating units.

Lakeland Electric's current Ten Year Operating Plan (2014 – 2023) does not call for the construction of any new generating assets; however, new generating assets will be required after that time frame. This CBS will allow Lakeland Electric to better assess the effect of customer response to time-differentiated pricing in contributing to the future deferral of generating assets.

The overall encompassing goal of this study is to help Lakeland Electric and its residential customers better understand how to maximize energy savings from changes in residential energy-use behavior and help clarify what role the Smart Grid technologies might play.

Lakeland Electric has identified many benefits associated with the Smart Metering infrastructure:

- Deferral of capital spending for generation capacity;
- Improvements in system line losses;
- Environmental benefits resulting from reduced vehicle emissions as meter reads are automated;
- Helping customers better manage their overall energy usage and energy spending.

## **C. Questions of Interest Addressed in Study**

Based on Lakeland Electric's study objectives and the benefits of a Smart Grid, this study was designed to address the following questions of interest:

- Would Lakeland Electric customers shift their energy consumption based on the RST-1 pricing?



- Would customer behavior be different based on enrollment status of volunteers versus being assigned?
- Would Lakeland Electric see a reduction in peak kWd by customers shifting their usage to off-peak and mid-peak?

## **3. Project Description**

### **A. Design Elements**

#### **I. Target Population**

Lakeland Electric has approximately 122,000 customers who are segmented into the following consumption groups:

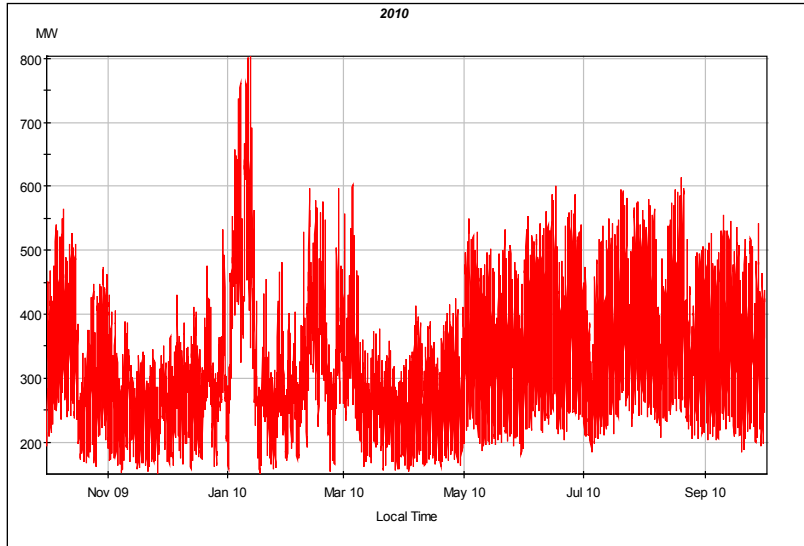
- Residential
- Small Commercial
- Commercial Demand
- Industrial

For purposes of this study, Lakeland Electric only focused on residential customers for both treatment and control group participants.

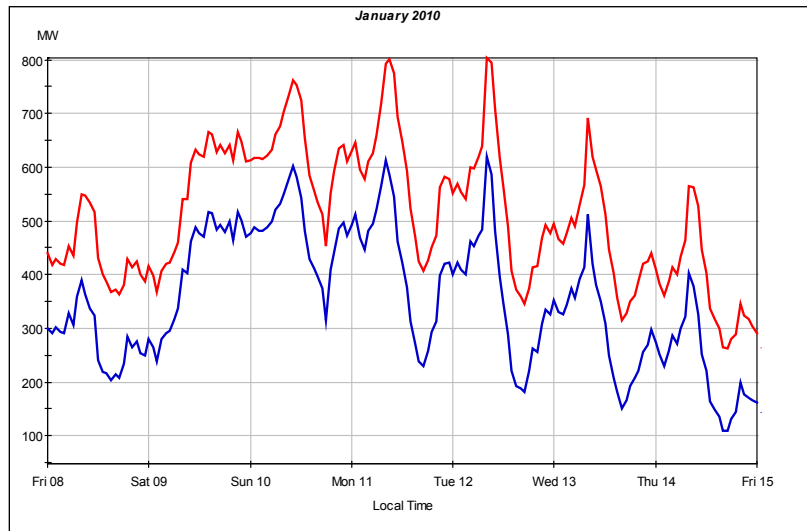
Figure 1 represents a graph of the hourly Lakeland Electric System load from October 1, 2009 through September 30, 2010. As evidenced by the graph, Lakeland Electric is a winter peaking utility. Typically, several times a winter, cold fronts trigger a peak demand caused by the need for early morning heat, along with other typical early morning residential home activity. In Figure 2, the



residential class load is overlaid with system load on the week of January 8<sup>th</sup> (which was Lakeland’s peak kWd week in 2010); clearly showing that the winter peaking dynamic at Lakeland Electric is predominately caused by residential load.



**Figure 1 – Lakeland Electric System Load**



**Figure 2 – Winter Peak: System and Residential Contribution**

## II. Treatments

### Standard Tiered Rate (RS)





The current standard Lakeland Electric rate for residential standard service (RS) is an inverted block, three-tier rate. The pricing applies to all energy (kWh) consumed in the billing period without regard to the time of consumption. The price per kWh increases based on the billing period usage of the customer in 500 kWh increments after the first 1,000 kWh. Table 1 shows the standard RS rate.

Residential Service (RS) Rate	Rate
Customer Charge	\$8.00
Energy Charge (without Fuel Charge)	Rate/kWh
First 1,000 kWh in the billing period	\$0.04882
1,001 kWh to 1,500 kWh	\$0.05382
All usage greater than 1,500 kWh	\$0.05882

**Table 1 - Residential Standard Service Rate (RS)**

### **Trial TOU Rate with Peak Period Definition (RST-1)**

Lakeland’s winter morning load peak is six hours long (6am to noon) with a pronounced spike between 7am to 9am. Winter evening load peak is five hours long (5pm to 10pm) with a broadly defined peak. The summer afternoon load peak is nine hours long (1pm to 10pm) with a broadly defined peak. The design of the trial TOU rate (RST-1) begins with Lakeland Electric’s standard TOU rate (RSX-1), which has three (3) peak periods defined for the year; two (2) periods for winter and one (1) period for summer. The trial rate introduced a mid-peak period, which eliminates the winter afternoon peak pricing period entirely and reduces the duration of each remaining peak pricing period. The winter afternoon peak pricing period is re-designated as a mid-peak for two reasons as described below:

- If mid-peak hours in the winter evening period are designated off-peak hours, the customer has no price incentive to control consumption during these hours. While the winter evening peak is not as high as the winter morning peak, it is comparable to the summer peak, and therefore worth addressing.
- One of the pricing strategies for recharging electric vehicles is to encourage off-peak charging. Winter evening hours must deliver a price signal to electric vehicle owners that will discourage charging vehicles during the winter evening secondary peak.

### **Hourly TOU Schedule**

All treatment customers were enrolled in the three period trial TOU rate (RST-1). This TOU rate has hours of On-Peak, Off-Peak, and Mid-Peak pricing periods. The TOU Winter Schedule was in effect



from November through March and the TOU Summer Schedule from April through October. Table 2 shows the hours in each period of the RST-1 rate. The rate is designed to be revenue neutral.

Winter Schedule (November – March)			Summer Schedule (April – October)		
Season	Hour	RST-1	Season	Hour	RST-1
Winter	12 Mid	N	Summer	12 Mid	N
Winter	1 am	N	Summer	1 am	N
Winter	2 am	N	Summer	2 am	N
Winter	3 am	N	Summer	3 am	N
Winter	4 am	N	Summer	4 am	N
Winter	5 am	N	Summer	5 am	N
Winter	6 am	P	Summer	6 am	N
Winter	7 am	P	Summer	7 am	N
Winter	8am	P	Summer	8am	N
Winter	9 am	P	Summer	9 am	N
Winter	10 am	M	Summer	10 am	N
Winter	11 am	M	Summer	11 am	N
Winter	Noon	N	Summer	Noon	M
Winter	1 pm	N	Summer	1 pm	M
Winter	2 pm	N	Summer	2 pm	P
Winter	3 pm	N	Summer	3 pm	P
Winter	4 pm	N	Summer	4 pm	P
Winter	5 pm	M	Summer	5 pm	P
Winter	6 pm	M	Summer	6 pm	P
Winter	7 pm	M	Summer	7 pm	P
Winter	8 pm	M	Summer	8 pm	M
Winter	9 pm	M	Summer	9 pm	M
Winter	10 pm	N	Summer	10 pm	N
Winter	11 pm	N	Summer	11 pm	N

**Table 2 – Hourly Time of Use Schedule for Lakeland Electric**  
(P - Denotes Peak Hour) (N – Denotes Off-Peak Hour) (M - Denotes Mid-peak Hour)

Table shows pricing<sup>1</sup> for TOU on weekdays only. Holidays and weekends are considered off-peak.

Trial Residential Rate Pricing for Time of Use (TOU)	Proposed Rate \$/kWh
RST-1 – Residential Trial TOU – 3 Periods (Energy Charge without Fuel Charge)	
Off-Peak	\$0.02435
Mid-Peak	\$0.0742
On-Peak	\$0.1113

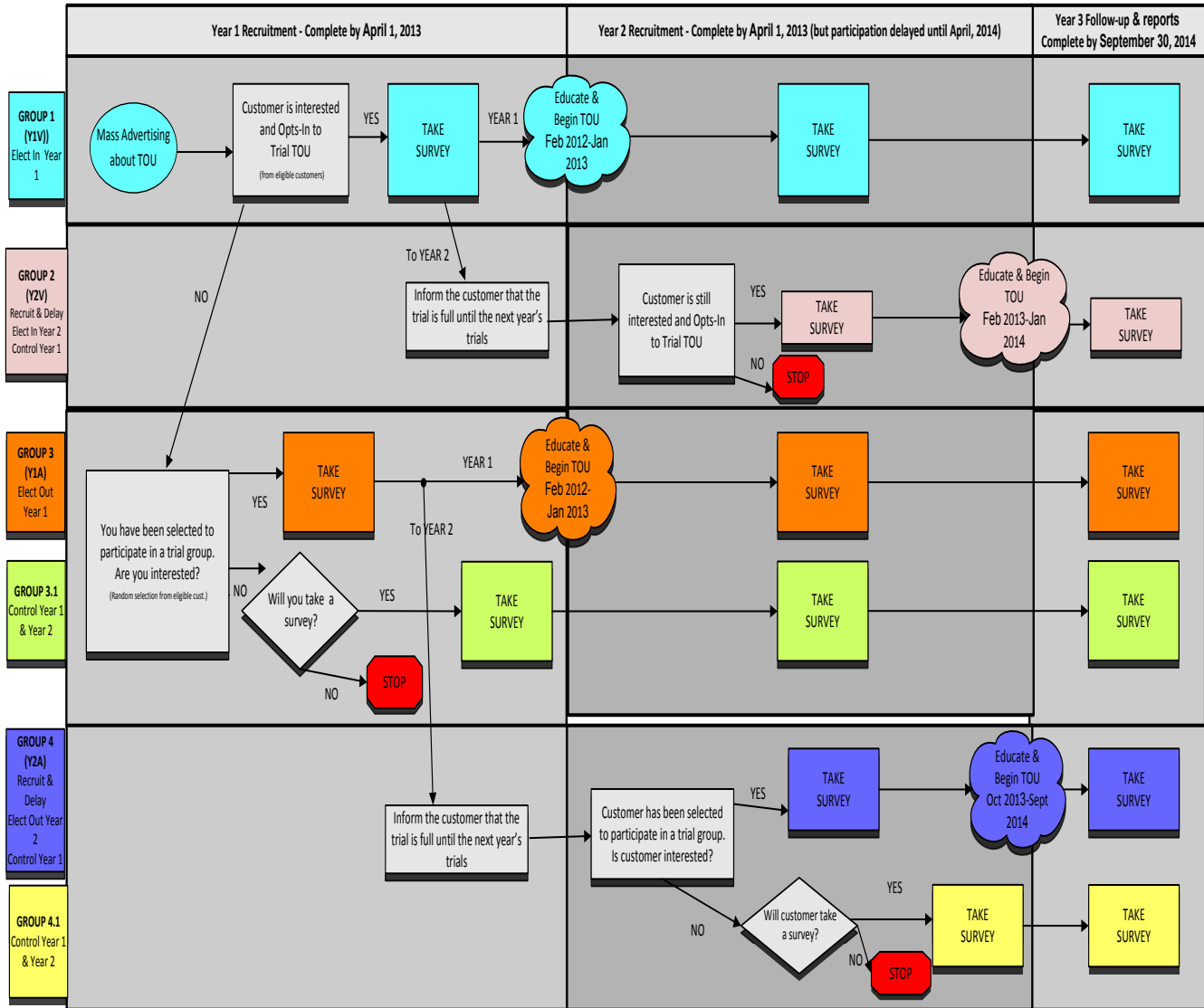
**Table 3 – Proposed Residential Rate Pricing for Trial Time of Use (TOU)**

### Recruitment Process

The flow chart below summarizes the Recruitment Process mapping. This flow chart is also shown in an expanded format in Appendix C



Lakeland Electric/DoE Consumer Behavior Recruitment and Study Process



Specifically, a subset of Lakeland’s eligible residential customers was to be randomly selected to receive an offer to voluntarily participate in the new trial rate for this study. Of those who expressed an interest in affirmatively participating in the study, half were to randomly be assigned to Group 1 (Y1V), who would take service under this new trial rate in years 1 and 2 of the study, while the other half were to randomly be assigned to Group 2 (Y2V), who would take service under their existing tiered rate in year 1 and move to the new trial rate in year 2.



The eligible residential customers who were not randomly selected to be part of the voluntary recruitment population were included in the assigned recruitment population. This smaller subset of customers were to be notified that they had been selected to take service under this new trial rate but could elect-out if they wanted to remain on their existing tiered rate. Those who did not elect-out were randomly assigned to either Group 3 (Y1A), who would take service under this new trial rate in years 1 and 2 of the study, or to Group 4 (Y2A), who would take service under their existing tiered rate in year 1 and move to the new trial rate in year 2.

The control groups for Year 1 consisted of the delayed treatment groups both Voluntary (Y2V) and Assigned (Y2A). There is no formal control group in Year 2 of the study.

### **Control and Treatment Group Sample Sizes**

The minimum required sample sizes for the randomized control trial for a TOU pricing experiment were established by the DOE's Technical Advisory Group ("TAG") as 600 for the treatment group and 600 for the control group. Lakeland Electric selected a final sample size of 1000 per group, anticipating a reasonable number of early exits by participants.



### III. Randomization & Assignment Methods

A randomized control trial design is foremost in the selection of customers to the defined study groups. During the early tasks of the SGIG project, Phase I, the Advanced Metering Infrastructure backbone was installed to allow the flexibility of activating customers anywhere on the Lakeland Electric system. The installment of AMI meters increased the eligible pool of customers.

## B. Implementation

### I. Project Schedule

#### Timeline

The installation of the smart meters began in March 2011. Next, treatment data was collected during the first 12 months of the Study and evaluated. This interim report will cover the design, operation, analysis and study results at the end of the first Study period. A final report will be provided at the end of the Project and Study period as required by the DOE’s Award Agreement.

Evaluation and reporting dates for the Consumer Behavior Study are outlined Table 7 below:

<b>Reports/Evaluation</b>	<b>Target Date</b>
“Preliminary” Draft of Consumer Behavior Study to DOE	11/1/2010
<b>Final and Approved Study Plan</b>	<b>8/01/2011</b>
Trial Rates approved by Utility Committee and City Commission	11/21/2011
First Study Evaluation (4/1/2012 – 3/31/2013)	3/31/2013
Strategy Review of CBSP Schedule and Progress with DOE/TAG	5/31/2013
<b>Interim Report (from 1<sup>st</sup> Study Evaluation) to DOE</b>	<b>7/1/2014</b>
Second Study Evaluation (4/1/2013 – 3/31/2014)	3/31/2014
Data Collection and Study Period Ends	3/31/2014
Study Closeout	12/31/2014
<b>Final Evaluation and Report</b>	<b>Q4 2014</b>

Table 7 – Proposed Evaluation and Reporting Dates



## Sequence

**First Study Evaluation Period** - During the first twelve (12) months of the study, the emphasis was on rate implementation and the launch of the marketing effort. Enrollment and usage data was collected for use in the evaluation.

In addition, Trial Rates were not adjusted during the study two year period. Similarly, the base rate charge was not changed throughout the study period; however the Fuel Adjustment charge was subject to quarterly adjustments and was adjusted several times.

**Second Study Evaluation Period** - Enrollment and data collection continues. Year 1 participants that continued through the end of Year 1 were allowed to continue their participation during Year 2.

**Final Evaluation, Other Analysis, and Reports** – Lakeland Electric will perform analysis to guide its future marketing efforts.

## II. Recruitment and Customer Retention Method

**The Recruitment Packages consisted of the following items:**

- **Eligibility Letter:** Provides a brief introduction to the study, describes key features, and informs eligible participants how to confirm participation.
- **Brochure:** Provides an explanation of all the key features of the program, including the option of price plans and the technology involved, such as the smart meters.
- **Confirmation Form:** This form had to be completed, signed and returned to the Lakeland Electric to enroll the customer's participation.



- **Pre-Study Survey** (Subsequently Sent): The participants were asked questions that will assist in the analysis of the data being collected. They were also asked to provide demographic information such as number of occupants, total square footage of home, average income, etc.

Participants in the study received a “Confirmation Package” approximately two weeks prior to the commencement of the study period.

**These confirmation packages included include the following:**

- **Cover Letter:** Sent to the customer to confirm that they are enrolled under the assigned rate plan.
- **Refrigerator Magnet:** Provides a reminder of the key program features, TOU schedules and how to contact customer service and utilize the Web Portal.
- **Customers’ Bill Enhancement:** Participants received an additional letter each month with their bill. This letter compared the customers’ bill on the TOU rate and what their bill would have been if they remained on the standard Tiered rate. It also indicated the Savings or Losses for the month.

**Bill Protection Program**

It was expected that some customers enrolled in the study would be skeptical of the advertised benefits and/or reluctant to change behavior patterns. In addition, the study could be perceived as a financial risk to the customers as well. In order to address this perception/reality, a financial guarantee was implemented. Customers who enrolled in the study were provided a “bill protection credit”, where the customer would be provided with a calculated refund credit of the difference between their TOU bill and a calculated “standard tier rate” bill. This guarantee was active for the first six (6) month billings, if they elected to be removed from the study program during that time frame.

### **III. Recruitment and Customer Retention Experience**

At the start of the study, Lakeland had deployed 45,000 AMI residential meters across their entire system. Lakeland randomly selected 40,000 residential AMI-enabled customers who would be asked to volunteer to the study by volunteering to take service under the utility’s new experimental TOU rate. The remaining 5,000 customers who were not invited were instead included in the assigned study



population and were told they would take service under the utility's new experimental TOU rate unless they indicated to the utility they wanted to remain on their existing tiered rate.

For the first phase of the “recruit and delay”, 50% (1,017) of the Volunteer and (998) Assigned study population were respectively placed on the TOU rate. These customers began the six-month period of bill protection and yearlong treatment period. The remaining Volunteer and Assigned customers were considered the “delayed” control group, as they remained on their existing rate in the first year of the study. . At the beginning of the second year of the study, all “delayed” control group customers transitioned on to the TOU rate for a 12 month period, receiving bill protection for the first six months. The Year 1 treatment group participants (Voluntary and Assigned) who were still active were encouraged to remain on the study for Year 2.

## **Consumer Behavior Treatment Groups Group Descriptions**

### Year 1 Volunteers (Y1V)

- This is the Opt-in group
- They are the customers that show interest in participating in the trial TOU rate
- They were asked to take a pre-study survey
- The first year's participants were randomly selected from this group
- They were the participants during year 1
- They took a post-study survey at end of year 1
- They will continue on the rate (if they desire)
- They will take a survey at end of year 2

### Year 2 Volunteers (Y2V)

- This is the Recruit and Delay, Opt-in group
- These are remaining customers not selected for Group 1 that show interest in participating in the trial TOU rate
- They were asked to take a pre-study survey
- After the first year's participants are identified, then the remaining participants were informed that the trial is full for the first year and they will be placed into the second year study group
- They did not participate during year 1
- They did take another pre-study survey at end of year 1
- They will start their study for year 2
- They will take a survey at end of year 2

### Year 1 Assigned (Y1A)

- This is the Assigned group
- They were randomly selected customers that are asked to participate in the trial TOU rate
- Those that agree were asked to take a pre-study survey
  - Those that do not agree (Group 3.1) were still asked if they would take a survey. Those that do were also asked to take a survey at end of years 1 & 2. These customers were used as an additional control group
- They did participate during year 1
- They did take a post-study survey at end of year 1
- They will continue on the rate (if they desire)
- They will take a survey at end of year 2

### Year 2 Assigned (Y2A)

- This is the Recruit and Delay, Assigned group





- After the 1<sup>st</sup> study another randomly selected group of customers were asked to participate in the trial TOU rate
- Those that agree were asked to take a pre-study survey
  - Those that do not agree (Group 4.1) were still asked if they would take a survey. Those that do were also asked to take a survey at end of year 2. These customers were used as an additional control group
- They will participate during year 2
- They will take a post-study survey at end of year 2

### Analysis of (Volunteer) Group Table 1

Y1V	
# of Customer Volunteer Requests Sent	40000
# of Requests Returned Volunteering	2228
% of Customers that Volunteered	5.57%
# of Volunteer Participants at the start (random)	1017
# of Participants Completing Entire Year	641
% of Participants Completing Entire Year	63.03%
# of Customers Moving Out during year 1	110
# of Customers Requesting Out during year 1	266
# of Volunteers Delay Until Year 2 (control)	1211

### Analysis of (Assigned) Group Table 2

Y1A	
# of Customers Assignment Sent	4999
# of Customers that Requested Out Initially	631
% of Customers that Requested Out Initially	12.62%
# of Assigned Customers at the start (random)	998
# of Participants Completing Entire Year	692
% of Participants Completing Entire Year	69.34%
# of Customers Moving Out during year 1	164
# of Customers Requesting Out during year 1	142
# of Assigned Customers Eligible for Year 2 (control)	3360

Unfortunately, no survey was conducted to determine the reasons that customers chose to leave the program during the first year.



## IV. Survey Approach

### Customer Engagement and Education

Lakeland Electric promoted new rate designs and emphasized the customer information features through the distribution of information that discussed in practical terms TOU billing and efficiency.

Initial participant education, beyond the material in the recruitment package, focused on engaging and educating the customer on the Smart Grid Initiative. The program required a multi-media campaign approach to promote and recruit participants. Communication medium such as direct mail brochures, company Web site, TV advertisements, and billboards also were utilized.

### Education and Recruitment Materials – Focus Groups

As part of the CBS, Lakeland conducted a series of focus groups to obtain feedback from small, diverse groups of customers. Each group included up to 10 customers and lasted approximately 1.5 hours. The focus groups examined how best to communicate the complexities of the TOU rate to the average customer. In addition, the focus groups reviewed all materials that were sent to the participants.

### Participant Surveys

As part of the CBS, Lakeland plans to conduct three surveys of the program participants. The surveys include:

1. **Baseline Survey** – This survey was conducted on all treatment and control group participants. The survey gathered basic demographic and attitudinal data;
2. **Follow-Up Survey** – This survey was conducted in year 2, approximately 1 year after the Volunteer and Assigned Treatment Groups' exposure to the TOU rate. The follow-up survey also obtained data on attitude and behaviors modified as a result of the TOU experience;
3. **Close-Out Survey** – This survey will be conducted in year 3, approximately 1 year after the year 1 control group has been exposed to the TOU pricing.

The DOE and the Technical Advisory Group required a minimum set of survey questions to be asked of all program participants. These guidelines provided Lakeland Electric with a basis for our surveys<sup>2</sup>.

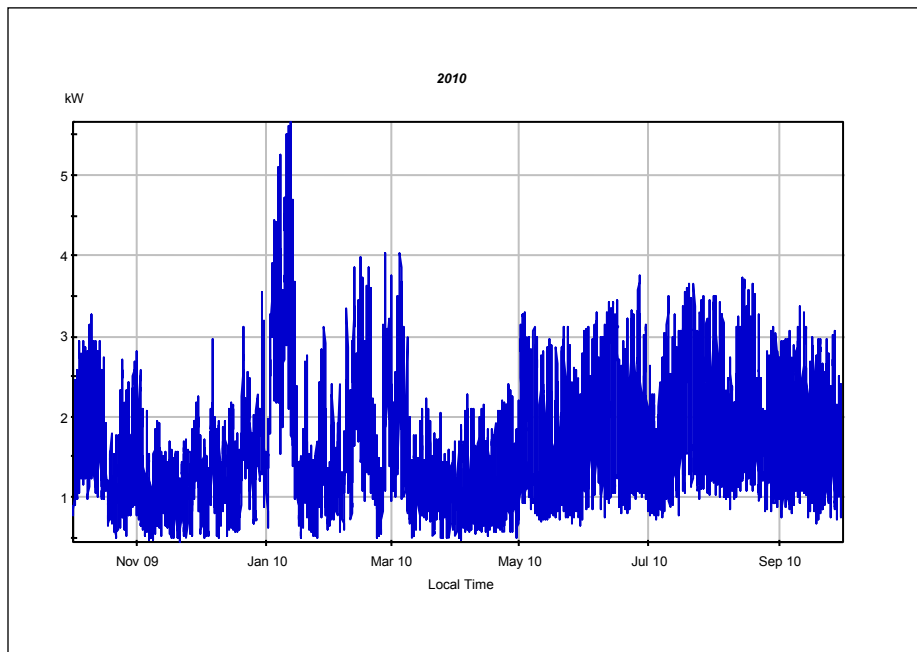
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<sup>2</sup> The survey sample can be found in Appendix A

## 4. Data

### Data Collection – Interval Load Data

Lakeland Electric collected one (1) hour interval load data on all treatment and control group participants. Figure 3 displays an example of the type of data that is available for each of the treatment and control groups. The figure presents the average residential load from October 1, 2009 through September 30, 2010 (January 11, 2010 was a new record peak day). The residential class peaks at 5.67MW in the winter morning, i.e., 7 am. During the summer, the residential load peaks at 3.75MW in the early evening, i.e., 6 pm. The hourly detail will allow us to roll-up the data into seasonal and TOU periods for analysis.



**Figure 3 – Average Residential Load**



### **Statistical Analysis**

During year 1, the project was analyzed using direct comparison techniques under a treatment-control, i.e., test-control, experimental design. During year 2, the experimental design focuses more on the longitudinal study and will use a pre-post analytical frame work for the 600 participants that were originally assigned to the control group.

### **Study Metrics**

Once the Study parameters and customer population of interest were identified and the data collected, Lakeland Electric evaluated the outcome, using direct comparison techniques.



## A. Study Analysis and Observations

### I. Definitions of Acronyms

- TY – Trial Year (April 2012 - April 2013)
- Y1V – Interval data for year one Volunteer participants (4/12 – 4/13)
- Y1A – Interval data for year one Assigned participants (4/12 – 4/13)
- Y2V – Interval data for year two Volunteer participants during year one (4/12– 4/13)
- Y2A – Interval data for year two Assigned participants during year one (4/12 – 4/13)
- TU – Total Use for the entire year (4/12-4/13)
- OPP – On Peak Period
- OPPU – On Peak Period Use – Energy use during the entire On-Peak Period
- DPH – Daily Peak Hour - the kWh for the hour during day with highest System use
- DPP – Daily Peak Period - the total kWh for the OPP for the Day
- DPD – Daily Peak Day - the total kWh for each Peak Day
- TOU Day – Any day which has an On Peak Period (no weekends or holidays)
  
- **Analysis Calculations**
  - **SPH – (II-1a)** System Peak Hour - the hour during year with highest System use
    - This analysis compares kWh reduction between the treatment groups and the control groups for the one hour that is considered the System Peak Hour during the entire year.
  - **SPP – (II-1b)** System Peak Period - the OPP for the day the system experiences the peak for the year.
    - This analysis compares the kWh reduction between the treatment groups and the control groups for the one OPP that occurs on the day in which the SPH occurs.
  - **MPH – (III-1a)** Monthly Peak Hour - the hour during the Month with highest System use
    - This analysis compares the treatment groups and the control groups for the one hour each month that is considered the Monthly Peak Hour for that month.
  - **MPP – (III-1b)** Monthly Peak Period - the OPP for the MPD
    - This analysis compares the treatment groups and the control groups for the OPPU each month that contains the Monthly Peak Hour (MPH).



- **YDPH – (III-2a)** Year Daily Peak Hour – total of peak hours for the entire year
  - This analysis compares the treatment groups and the control groups for the totals of the peak hour each day for the entire year.
- **YPD – (III-2b)** Year Peak Day – Total of all DPP
  - This analysis compares the treatment groups and the control groups for the totals of the DPP for the entire year.
- **SPD% – (IV-1a)** System Peak Day % - the day in which the SPH occurs
  - This analysis compares the treatment groups and the control groups % of energy use On Peak verses Off and Mid Peak use on the day the SPH occurs.
- **MPD% – (IV-1b)** Monthly Peak Day % - the day in which the MPH occurs
  - This analysis compares the treatment groups and the control groups % of energy use On Peak verses Off and Mid Peak use on the day each month the MPH occurs.
- **YDPP% – (IV-1c)** Year Daily Peak Period % – total of hours during the DPP for the entire year
  - This analysis compares the treatment groups and the control groups % of energy use On Peak verses Off and Mid Peak use for the totals of the DPP for the entire year.
- **SDPD – (V-1a)** System Peak Day kWh - the day in which the SPH occurs
  - This analysis compares the treatment groups and the control groups kWh energy use for the entire day the SPH occurs.
- **MDPD – (V-1b)** Monthly Peak Day kWh - the day in which the MPH occurs
  - This analysis compares the treatment groups and the control groups kWh energy use for the entire day each month the MPH occurs.
- **YDPD – (V-1c)** Year Daily Peak Day kWh - total of hours during the DPP for the entire year
  - This analysis compares the treatment groups and the control groups kWh energy use for every day of the year.



**Note on the manipulation of the data:**

The resulting data used in the following analysis is the data that resulted after we applied the following basic parameter to the raw data in order to remove obvious data collection and recording errors.

- All data points with negative numbers or a value over 50 kWh become blank data points.
  - The rationale for eliminating negative numbers was due to the fact that no one in the survey could produce a negative number, since none of the meters were reverse flow meters.
  - The rationale for eliminating numbers above 50 kWh was that only a handful of customers on our system can actually consume greater than 50 kWh, and none of them were in any of the survey groups.
  - 0 kWh interval reads were allowed to remain since this can be a valid data point for the Residential class.



II. Determine the **change of peak demand reduction** in **kWh** occurring as a result of the TOU rate. The following comparison will be performed for the “Volunteered” and “Assigned” groups;

1. Compare **System Peak** kWh usage of participants to control group
  - a) **System Peak Hour (SPH)** (2 comparisons)
    - 1) Select SPH
    - 2) Total Y1V energy use and count for SPH
    - 3) Total Y1A energy use and count for SPH
    - 4) Total Y2V energy use and count for SPH
    - 5) Total Y2A energy use and count for SPH
    - 6) Calculate Lower and Upper CI (Confidence Interval)
    - 7) Compare Average kWh savings of
      - a) Y1V with Y2V
      - b) Y1A with Y2A

System CP	Adjusted Sum				Adjusted Count				Y1A			Y1V		
	Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Savings	Lower CI	Upper CI	Savings	Lower CI	Upper CI
<u>Thu.Aug.09.2012 17:00</u>	10,708	4,067	3,184	3,183	3,324	1,200	985	1,006	0.01	0.17	(0.14)	(0.22)	(0.06)	(0.39)

**Analysis 1**

Y1V customers reduced their usage on average by 0.22 kWh on the System Peak Hour compared to Y2V. This impact estimate is statistically significant. Y1A customers increased their usage on average by 0.01 kWh on the System Peak Hour compared to Y2A. This impact estimate is not statistically significant.





b) **System Peak Period (SPP)** (2 comparisons)

- 1) Select SPP
- 2) Total Y1V energy use and count for SPP
- 3) Total Y1A energy use and count for SPP
- 4) Total Y2V energy use and count for SPP
- 5) Total Y2A energy use and count for SPP
- 6) Calculate Lower and Upper CI (Confidence Interval)
- 7) Compare Average kWh savings of
  - a) Y1V with Y2V
  - b) Y1A with Y2A

System CP	Adjusted Sum				Adjusted Count				Y1A			Y1V		
	Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Savings	Lower CI	Upper CI	Savings	Lower CI	Upper CI
<b>Thu.Aug.09, 2012 15:00 - 20:00</b>	48,993	18,327	14,644	14,259	3,360	1,211	998	1,017	0.09	0.84	(0.65)	(1.11)	(0.31)	(1.91)

**Analysis 2**

Y1V customers reduced their usage by an average of 1.11 kWh on System Peak Period hours compared to Y2V. This impact estimate is statistically significant.

Y1A customers increased their usage by an average of 0.09 kWh on System Peak Period hours compared to Y2A. This impact estimate is not statistically significant.



III. Determine the change of peak period usage in kWh occurring as a result of the TOU rate. The following comparison will be performed for the “Volunteered” and “Assigned” groups;

1. Compare Monthly Peak average kWh usage of participants to control group

a) **Monthly Peak Hour (MPH)** (2 comparisons for 12 months)

- 1) Select MPH
- 2) Total Y1V energy use and count for MPH
- 3) Total Y1A energy use and count for MPH
- 4) Total Y2V energy use and count for MPH
- 5) Total Y2A energy use and count for MPH
- 6) Calculate Lower and Upper CI (Confidence Interval)
- 7) Compare Average kWh savings of
  - a) Y1V with Y2V
  - b) Y1A with Y2A

System CP	Adjusted Sum				Adjusted Count				Y1A			Y1V		
	Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Savings	Lower CI	Upper CI	Savings	Lower CI	Upper CI
Tue.Apr.03, 2012 18:00	9,184	3,296	2,690	2,500	3,324	1,201	969	993	0.01	0.16	(0.13)	(0.23)	(0.07)	(0.38)
Wed.May.23, 2012 17:00	9,873	3,696	2,977	2,835	3,327	1,200	985	1,005	0.05	0.20	(0.10)	(0.26)	(0.10)	(0.42)
Wed.Jun.13, 2012 18:00	10,685	4,116	3,134	3,089	3,331	1,203	987	1,007	(0.03)	0.12	(0.19)	(0.35)	(0.19)	(0.52)
Mon.Jul.09, 2012 15:00	10,127	3,878	3,007	2,946	3,325	1,201	985	1,006	0.01	0.15	(0.14)	(0.30)	(0.14)	(0.46)
Thu.Aug.09, 2012 17:00	10,708	4,067	3,184	3,183	3,324	1,200	985	1,006	0.01	0.17	(0.14)	(0.22)	(0.06)	(0.39)
Tue.Sep.04, 2012 17:00	10,006	3,713	2,971	2,978	3,325	1,200	985	1,006	0.01	0.16	(0.14)	(0.13)	0.02	(0.29)
Thu.Oct.04, 2012 17:00	8,568	3,163	2,488	2,560	3,326	1,200	985	1,005	(0.05)	0.09	(0.19)	(0.09)	0.06	(0.23)
Mon.Nov.26, 2012 08:00	6,693	2,695	2,003	2,252	3,324	1,200	984	1,006	0.02	0.18	(0.13)	(0.01)	0.17	(0.19)
Sun.Dec.23, 2012 09:00	10,257	4,044	3,064	3,464	3,324	1,200	984	1,005	0.03	0.23	(0.18)	0.08	0.32	(0.17)
Thu.Jan.24, 2013 08:00	7,915	3,099	2,340	2,487	3,323	1,201	984	1,006	(0.00)	0.17	(0.18)	(0.11)	0.08	(0.30)
Mon.Feb.18, 2013 08:00	10,873	4,544	3,243	3,413	3,322	1,201	983	1,005	0.03	0.27	(0.22)	(0.39)	(0.11)	(0.67)
Thu.Mar.07, 2013 08:00	8,547	3,381	2,567	2,738	3,324	1,201	984	1,006	0.04	0.24	(0.17)	(0.09)	0.15	(0.34)

**Analysis 3**

Y1V customers reduced their kWh usage in 11 of the 12 Monthly Peak Hour measurements. These impact estimates are statistically significant in 6 of the 12 months (April, May, June, July, August, and February).

Y1A customers reduced their kWh usage in 3 of the 12 Monthly Peak Hour measurements. None of the impact estimates are statistically significant.



- b) **Monthly Peak Period (MPP)** (2 comparisons for 12 months)
- 1) Select MPP
  - 2) Total Y1V energy use and count for MPP
  - 3) Total Y1A energy use and count for MPP
  - 4) Total Y2V energy use and count for MPP
  - 5) Total Y2A energy use and count for MPP
  - 6) Calculate Lower and Upper CI (Confidence Interval)
  - 7) Compare Average kWh savings of
    - a) Y1V with Y2V
    - b) Y1A with Y2A

System CP	Adjusted Sum				Adjusted Count				Y1A			Y1V		
	Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Savings	Lower CI	Upper CI	Savings	Lower CI	Upper CI
Tue.Apr.03, 2012 15:00 - 20:00	50,529	17,854	14,974	13,426	3,360	1,211	998	1,017	(0.03)	0.69	(0.76)	(1.54)	(0.80)	(2.29)
Wed.May 23, 2012 15:00 - 20:00	41,943	14,949	12,630	11,316	3,360	1,211	998	1,017	0.17	0.86	(0.52)	(1.22)	(0.48)	(1.96)
Wed.Jun.13, 2012 15:00 - 20:00	42,367	15,551	12,738	11,867	3,360	1,211	998	1,017	0.15	0.84	(0.53)	(1.17)	(0.45)	(1.90)
Mon.Jul.09, 2012 15:00 - 20:00	48,642	18,028	14,465	13,832	3,360	1,211	998	1,017	0.02	0.74	(0.70)	(1.29)	(0.52)	(2.05)
<b>Thu.Aug.09, 2012 15:00 - 20:00</b>	48,993	18,327	14,644	14,259	3,360	1,211	998	1,017	0.09	0.84	(0.65)	(1.11)	(0.31)	(1.91)
Tue.Sep.04, 2012 15:00 - 20:00	34,671	12,696	10,568	9,831	3,360	1,211	998	1,017	0.27	0.87	(0.33)	(0.82)	(0.14)	(1.49)
Thu.Oct.04, 2012 15:00 - 20:00	30,865	11,182	9,291	8,733	3,360	1,211	998	1,017	0.12	0.66	(0.41)	(0.65)	(0.08)	(1.21)
Mon.Nov.26, 2012 07:00 - 10:00	9,752	3,709	2,985	2,978	3,360	1,211	998	1,017	0.09	0.30	(0.12)	(0.14)	0.11	(0.38)
Sun.Dec.23, 2012 07:00 - 10:00	24,670	9,773	7,554	7,581	3,360	1,211	998	1,017	0.23	0.75	(0.29)	(0.62)	(0.02)	(1.21)
Thu.Jan.24, 2013 07:00 - 10:00	8,665	3,101	2,601	2,544	3,360	1,211	998	1,017	0.03	0.18	(0.13)	(0.06)	0.13	(0.24)
Mon.Feb.18, 2013 07:00 - 10:00	12,103	4,184	3,382	3,451	3,360	1,211	998	1,017	(0.21)	0.07	(0.50)	(0.06)	0.28	(0.40)
Thu.Mar.07, 2013 07:00 - 10:00	12,153	4,411	3,589	3,413	3,360	1,211	998	1,017	(0.02)	0.27	(0.31)	(0.29)	0.02	(0.59)

**Analysis 4**

Y1V customers reduced their kWh usage in 12 of the 12 Monthly Peak Periods measurements. These impact estimates are statistically significant in 8 of the 12 months (April, May, June, July, August, September, October, and December).

Y1A customers reduced their kWh usage in 3 of the 12 Monthly Peak Periods measurements. None of these impact estimates are statistically significant.



2. Compare Year average peak kWh usage of participants to control group

a) **Year Daily Peak Hour (YDPH)** (2 comparisons)

- 1) Select DPH
- 2) Total Y1V energy use and count for All DPH in TY
- 3) Total Y1A energy use and count for All DPH in TY
- 4) Total Y2V energy use and count for All DPH in TY
- 5) Total Y2A energy use and count for All DPH in TY
- 6) Calculate Lower and Upper CI (Confidence Interval)
- 7) Compare Average kWh savings of
  - a) Y1V with Y2V
  - b) Y1A with Y2A

Adjusted Sum				Adjusted Count				Y1A			Y1V		
Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Savings	Lower CI	Upper CI	Savings	Lower CI	Upper CI
2,642,850	974,197	788,705	759,341	3,325	1,201	985	1,006	5.80	132.15	(120.56)	(56.44)	4.77	(117.64)

**Analysis 5**

Y1V customers reduced their usage by an average of 56.44 kWh on the total of the YDPH compared to Y2V. This impact estimate is not statistically significant.

Y1A customers increased their usage by an average of 5.80 kWh on the total of the YDPH compared to Y2A. This impact estimate is not statistically significant.



b) **Year Daily Peak Day (YDPP)** (2 comparisons)

- 1) Select DPP
- 2) Total Y1V energy use and count for All DPP in TY
- 3) Total Y1A energy use and count for All DPP in TY
- 4) Total Y2V energy use and count for All DPP in TY
- 5) Total Y2A energy use and count for All DPP in TY
- 6) Calculate Lower and Upper CI (Confidence Interval)
- 7) Compare Average kWh savings of
  - a) Y1V with Y2V
  - b) Y1A with Y2A

Adjusted Sum				Adjusted Count				Y1A			Y1V		
Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Savings	Lower CI	Upper CI	Savings	Lower CI	Upper CI
13,008,025	4,823,440	3,891,661	3,731,011	3,325	1,201	985	1,006	38.83	1085.81	(1008.16)	(308.21)	147.95	(764.37)

**Analysis 6**

Y1V customers reduced their usage by an average of 308.21 kWh on the total of the YDPP compared to Y2V. This impact estimate is not statistically significant.

Y1A customers increased their usage by an average of 38.83 kWh on the total of the YDPP compared to Y2A. This impact estimate is not statistically significant.



IV. Determine **how much load** in % is used during higher priced on-peak periods as compared to lower priced off-peak and mid-peak periods.

Lakeland Electric estimated that up to 5% of a customer's load will be shifted from on-peak to off-peak (other) periods;

1. Compare total Peak usage to Total energy use

a) **System Peak Day % (SPD%)** (2 comparisons)

- 1) Select SPD
- 2) Total Y1V OPPU, TU and count for SPD
- 3) Total Y1A OPPU, TU and count for SPD
- 4) Total Y2V OPPU, TU and count for SPD
- 5) Total Y2A OPPU, TU and count for SPD
- 6) Calculate Lower and Upper CI (Confidence Interval)
- 7) Compare Average % savings of
  - a) Y1V with Y2V
  - b) Y1A with Y2A

System CP	Adjusted Peak Hours				Adjusted Peak Day				Adj Count				Y1A %			Y1V %		
	Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Savings	Lower CI	Upper CI	Savings	Lower CI	Upper CI
<u>Thu.Aug.09, 2012</u>	48,993	18,327	14,644	14,259	170,690	63,705	51,732	50,298	3,360	1,211	998	1,017	0.63%	5.73%	-4.47%	-7.35%	-2.06%	-12.65%

**Analysis 7**

Y1V reduced an average of 7.35% from their usage during Peak Periods. This impact estimate is statistically significant.

Y1A increased an average of 0.63% from their usage during Peak Periods. This impact estimate is not statistically significant.



b) **Monthly Peak Day % (MPD%) usage** (2 comparisons for 12 months)

- 1) Select MPD
- 2) Total Y1V OPPU, TU and count for MPD
- 3) Total Y1A OPPU, TU and count for MPD
- 4) Total Y2V OPPU, TU and count for MPD
- 5) Total Y2A OPPU, TU and count for MPD
- 6) Calculate Lower and Upper CI (Confidence Interval)
- 7) Compare Average % savings of
  - a) Y1V with Y2V
  - b) Y1A with Y2A

System CP	Adjusted Peak Hours				Adjusted Peak Day				Adj Count				Y1A %			Y1V %		
	Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Savings	Lower CI	Upper CI	Savings	Lower CI	Upper CI
Tue.Apr.03, 2012	50,529	17,854	14,974	13,426	128,235	45,029	38,223	35,063	3,360	1,211	998	1,017	-0.23%	4.56%	-5.02%	-10.46%	-5.41%	-15.50%
Wed.May 23, 2012	41,943	14,949	12,630	11,316	151,112	55,563	45,879	43,053	3,360	1,211	998	1,017	1.38%	6.89%	-4.13%	-9.87%	-3.87%	-15.86%
Wed.Jun.13, 2012	42,367	15,551	12,738	11,867	159,501	58,875	48,125	45,620	3,360	1,211	998	1,017	1.22%	6.65%	-4.20%	-9.13%	-3.49%	-14.78%
Mon.Jul.09, 2012	48,642	18,028	14,465	13,832	171,137	62,737	51,095	48,786	3,360	1,211	998	1,017	0.12%	5.10%	-4.86%	-8.64%	-3.48%	-13.80%
Thu.Aug.09, 2012	48,993	18,327	14,644	14,259	170,690	63,705	51,732	50,298	3,360	1,211	998	1,017	0.63%	5.73%	-4.47%	-7.35%	-2.06%	-12.65%
Tue.Sep.04, 2012	34,671	12,696	10,568	9,831	160,122	57,927	47,862	46,275	3,360	1,211	998	1,017	2.62%	8.45%	-3.22%	-7.79%	-1.35%	-14.24%
Thu.Oct.04, 2012	30,865	11,182	9,291	8,733	129,740	46,587	38,520	37,789	3,360	1,211	998	1,017	1.35%	7.18%	-4.48%	-7.00%	-0.91%	-13.10%
Mon.Nov.26, 2012	9,752	3,709	2,985	2,978	108,057	39,930	32,601	32,511	3,360	1,211	998	1,017	3.06%	10.34%	-4.23%	-4.41%	3.53%	-12.35%
Sun.Dec.23, 2012	24,670	9,773	7,554	7,581	165,951	63,609	50,583	52,351	3,360	1,211	998	1,017	3.09%	10.17%	-3.99%	-7.63%	-0.24%	-15.02%
Thu.Jan.24, 2013	8,665	3,101	2,601	2,544	114,719	43,601	33,963	34,475	3,360	1,211	998	1,017	1.07%	7.05%	-4.90%	-2.31%	4.90%	-9.53%
Mon.Feb.18, 2013	12,103	4,184	3,382	3,451	168,090	64,458	49,406	49,486	3,360	1,211	998	1,017	-5.92%	1.92%	-13.76%	-1.78%	8.14%	-11.70%
Thu.Mar.07, 2013	12,153	4,411	3,589	3,413	136,570	51,333	40,641	40,430	3,360	1,211	998	1,017	-0.59%	7.44%	-8.62%	-7.86%	0.60%	-16.32%

**Analysis 8**

Y1V customers reduced their % of load in 12 of the 12 months from Peak Periods. These impact estimates are statistically significant in 8 of the 12 months (April, May, June, July, August, September, October, and December).

Y1A customers reduced their % of load in 3 of the 12 months from Peak Periods. None of these impact estimates are statistically significant.



c) **Yearly usage for Daily Peak Periods % (YPD%) (2 comparisons)**

- 1) Select DPP
- 2) Total Y1V OPPU, TU and count for every TOU day
- 3) Total Y1A OPPU, TU and count for every TOU day
- 4) Total Y2V OPPU, TU and count for every TOU day
- 5) Total Y2A OPPU, TU and count for every TOU day
- 6) Calculate Lower and Upper CI (Confidence Interval)
- 7) Compare Average % savings of
  - a) Y1V with Y2V
  - b) Y1A with Y2A

Adjusted Peak Hours				Adjusted Peak Day				Adj Count				Y1A %			Y1V %		
Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Savings	Lower CI	Upper CI	Savings	Lower CI	Upper CI
13,008,025	4,823,440	3,891,661	3,731,011	44,140,084	15,982,415	13,196,647	12,631,850	3,325	1,201	985	1,006	0.99%	27.75%	-25.77%	-7.67%	3.68%	-19.03%

**Analysis 9**

Y1V reduced an average of 7.67% from their usage during all Peak Periods. This impact estimate is not statistically significant.

Y1A increased an average of 0.99% from their usage during all Peak Periods. This impact estimate is not statistically significant.





V. Establish the amount of **net energy savings** in **kWh**. The cross sectional experimental design will allow comparison of the amount of energy consumed by test participants and control participants as a measure of net energy savings. Furthermore, the longitudinal component of the study will allow Lakeland Electric to observe change in customers use from year 1 to year 2;

1. Compare treatment groups total kWh usage.

a) **System Peak Day kWh** (SDPD) (2 comparisons)

- 1) Select SPD
- 2) Total Y1V TU and count for SPD
- 3) Total Y1A TU and count for SPD
- 4) Total Y2V TU and count for SPD
- 5) Total Y2A TU and count for SPD
- 6) Calculate Lower and Upper CI (Confidence Interval)
- 7) Compare Average kWh savings of
  - a) Y1V with Y2V
  - b) Y1A with Y2A

System CP	Adjusted Sum				Adjusted Count				Y1A			Y1V		
	Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Savings	Lower CI	Upper CI	Savings	Lower CI	Upper CI
<u>Thu.Aug.09.2012</u>	170,689.9	63,704.5	51,732.4	50,297.8	3,360	1,211	998	1,017	1.04	3.32	(1.25)	(3.15)	(0.67)	(5.63)

**Analysis 10**

Y1V customers reduced their daily usage by an average of 3.15 kWh on the SPD compared to Y2V. This impact estimate is statistically significant. Y1A customers increased their daily usage by an average of 1.04 kWh on the SPD compared to Y2A. This impact estimate is not statistically significant.



b) **Monthly Peak Day kWh (MDPD)** (2 comparisons for 12 months )

- 1) Select MPD
- 2) Total Y1V TU and count for MPD
- 3) Total Y1A TU and count for MPD
- 4) Total Y2V TU and count for MPD
- 5) Total Y2A TU and count for MPD
- 6) Calculate Lower and Upper CI (Confidence Interval)
- 7) Compare Average kWh savings of
  - a) Y1V with Y2V
  - b) Y1A with Y2A

System CP	Adjusted Sum				Adjusted Count				Y1A			Y1V		
	Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Savings	Lower CI	Upper CI	Savings	Lower CI	Upper CI
Tue.Apr.03, 2012	128,235.2	45,029.2	38,222.6	35,062.7	3,360	1,211	998	1,017	0.13	1.86	(1.59)	(2.71)	(0.93)	(4.49)
Wed.May 23, 2012	151,111.7	55,563.3	45,879.1	43,052.5	3,360	1,211	998	1,017	1.00	3.06	(1.06)	(3.55)	(1.38)	(5.72)
Wed.Jun.13, 2012	159,500.7	58,874.5	48,125.2	45,620.1	3,360	1,211	998	1,017	0.75	2.92	(1.41)	(3.76)	(1.45)	(6.07)
Mon.Jul.09, 2012	171,137.1	62,736.9	51,094.7	48,785.9	3,360	1,211	998	1,017	0.26	2.56	(2.04)	(3.84)	(1.40)	(6.27)
Thu.Aug.09, 2012	170,689.9	63,704.5	51,732.4	50,297.8	3,360	1,211	998	1,017	1.04	3.32	(1.25)	(3.15)	(0.67)	(5.63)
Tue.Sep.04, 2012	160,122.1	57,927.2	47,862.3	46,275.3	3,360	1,211	998	1,017	0.30	2.49	(1.88)	(2.33)	(0.07)	(4.60)
Thu.Oct.04, 2012	129,739.8	46,586.6	38,520.4	37,788.5	3,360	1,211	998	1,017	(0.02)	1.83	(1.86)	(1.31)	0.57	(3.20)
Mon.Nov.26, 2012	108,057.3	39,930.0	32,601.2	32,510.7	3,360	1,211	998	1,017	0.51	2.14	(1.12)	(1.01)	0.66	(2.67)
Sun.Dec.23, 2012	165,951.1	63,609.1	50,582.8	52,351.0	3,360	1,211	998	1,017	1.29	3.81	(1.22)	(1.05)	1.75	(3.85)
Thu.Jan.24, 2013	114,718.6	43,600.5	33,962.6	34,475.0	3,360	1,211	998	1,017	(0.11)	1.56	(1.79)	(2.10)	(0.33)	(3.88)
Mon.Feb.18, 2013	168,090.0	64,457.5	49,406.4	49,486.3	3,360	1,211	998	1,017	(0.52)	1.90	(2.95)	(4.57)	(1.89)	(7.25)
Thu.Mar.07, 2013	136,570.2	51,333.5	40,641.4	40,430.3	3,360	1,211	998	1,017	0.08	2.12	(1.97)	(2.63)	(0.36)	(4.91)

**Analysis 11**

Y1V customers reduced their daily usage in 12 of the 12 months during the on peak day compared to Y2V. These impact estimates are statistically significant in 9 of the 12 months (April, May, June, July, August, September, January, February, and March).

Y1A customers reduced their daily usage in 3 of the 12 months during the on peak day compared to Y2A. None of these impact estimates are statistically significant



- c) **Year Daily Peak Period kWh (YDPD)** (2 comparisons)
- 1) Select DPD
  - 2) Total Y1V energy use and count for All DPD in TY
  - 3) Total Y1A energy use and count for All DPD in TY
  - 4) Total Y2V energy use and count for All DPD in TY
  - 5) Total Y2A energy use and count for All DPD in TY
  - 6) Calculate Lower and Upper CI (Confidence Interval)
  - 7) Compare Average kWh savings of
    - a) Y1V with Y2V
    - b) Y1A with Y2A

Adjusted Sum				Adjusted Count				Y1A			Y1V		
Y2A	Y2V	Y1A	Y1V	Y2A	Y2V	Y1A	Y1V	Savings	Lower CI	Upper CI	Savings	Lower CI	Upper CI
44,140,084	15,982,415	13,196,647	12,631,850	3,325	1,201	985	1,006	122.70	1,836.55	(1,591.16)	(753.64)	22.69	(1,529.96)

**Analysis 12**

Y1V customers reduced their daily usage by an average of 753.64 kWh on the total of the YDPD compared to Y2V. This impact estimate is not statistically significant.

Y1A customers increased their daily usage by an average of 122.70 kWh on the total of the YDPD compared to Y2A. This impact estimate is not statistically significant.



## 5. Conclusions

Data analysis was conducted to develop 12 different load impact metrics (listed in the Data Section of this report). Customers in the Voluntary treatment group produced statistically significant reductions in load on the system coincident peak hour (-0.22), peak period (-1.11), and peak day (-3.15 and -7.35%). At a monthly level, customers in the Voluntary treatment group consistently produced a statistically significant reduction in electricity consumption in the peak hour, peak period, and peak day in at least the first five months of the study (April-August). Thereafter, monthly load impacts were sporadically statistically significant for all metrics. This resulted in none of the Yearly load impacts being statistically significant. It does not appear that the Peak period usage reductions reflect a shift in usage but was rather overall energy conservation across all time periods. This particular finding will be investigated further in year two. None of the Assigned Group's load impact metrics were statistically significant, and most reflected a slight increase in consumption when a decrease was expected.

The education of our customers about energy in general and specifically about TOU rate and related conservation methods appeared extremely important. Customers who understood these things appeared more likely to volunteer for the rate structure and demonstrated being receptive to the advertised behavior modifications. Those who did not volunteer appeared less likely to understand energy use and how different activities throughout the day affect their overall use and use during the peak periods.

As expected, the results of this study re-emphasize two key points:

1. Volunteers are much more likely to adjust their usage patterns in order to reduce (or shift) their electric usage, and
2. Additional educational materials are needed in order to allow our customers to better understand the practices they can use to provide any significant benefits (to the customer or the utility) of the Smart Grid and the Shift to Save Program.

# 6. Appendices

## Appendix A - Survey Instrument



### Lakeland Electric Shift to Save Campaign

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35
36	37	38	39	40
41	42	43	44	45
46	47	48	49	50

Instructions: For each of the following questions, please bubble in the circle that most closely approximates your answer. Use a black or blue pen or a #2 pencil to mark the form. Numbers between the endpoints of the scales represent intermediate values.

Shade Circles Like This--> ●

Not Like This--> ⊗ ⊙

The following survey is sponsored by Lakeland Electric, your local electric power provider. It is designed to help us understand our customers better. Please take a few minutes to answer the survey, then mail it back in the postage paid envelope. The survey is strictly confidential. Please do not include your name, address, or anything else that could identify you. Thank you in advance for your time and answers.

- Do you own or rent your home?       Own     Rent
- What type of residence do you live in? Do you live in a...
  - Single family
  - Duplex or two-family
  - Apartment/condo in a 2-4 unit building
  - Apartment/condo in a greater than 4 unit building
  - Townhouse or row house (adjacent walls to another house)
  - Mobile home house trailer
- Does your home have central air conditioning?       Yes     No
- Do you have any window unit air conditioners?       Yes (answer question 5)     No (skip to question 6)
- How many window unit air conditioners do you have?      \_\_\_\_\_
- Do you have a programmable thermostat?       Yes (answer question 7)     No (skip to question 8)
- Is the programmable thermostat currently set to automatically change temperatures during the day when no one is home?       Yes     No
- Do you have an electric clothes dryer?       Yes     No
- Including yourself, how many adults, 18 or over, currently live in your household?      \_\_\_\_\_
- And how many of these adults are over 65?      \_\_\_\_\_

Continued on back ...



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### Lakeland Electric Shift to Save Campaign

11. How many children under the age of 18 live in your household at least part of the week? \_\_\_\_\_
12. Do you or does anyone in your household have a chronic illness or disability that requires regular or occasional in-home medical treatment?  Yes  No
13. Is there someone home Monday to Friday sometime between 1 PM and 5 PM at least one day a week?  Yes  No
14. Is there anyone in your household working full time for pay?  Yes (answer question 15)  No (skip to question 16)
15. Do you or anyone in your household have a job where you work at home at least one weekday a week rather than go into an office or some other location?  Yes  No
16. Do you remember receiving information from your utility asking you to participate in a utility pilot program?  Yes (answer question 17)  No (skip to question 18)
17. Was the information useful in helping you decide whether or not to participate in the pilot?  Yes  No
18. What is the primary language spoken in your home?
- English  Vietnamese
  - Spanish  Russian
  - Chinese  Other
  - Korean
19. Last year- that is, in 2010- what was your total household income from all sources before taxes?
- Less than \$10,000  \$75-99,999
  - \$10-24,999  \$100-149,999
  - \$25-49,999  \$150,000 or more
  - \$50-74,999
20. What is the LAST grade or class that you COMPLETED in school?
- None, or grade 1-8
  - High School incomplete (grade 9-11)
  - High School graduate (12 or GED certificate)
  - Technical, trade, or vocational school AFTER high school
  - Some college, no four-year degree (includes associate degree)
  - College graduate (B.S., B.A., or other four-year degree)
  - Post-graduate or professional schooling after college (towards Master's degree or Ph.D., law, or medical school)
21. How many central air conditioning units do you have? \_\_\_\_\_



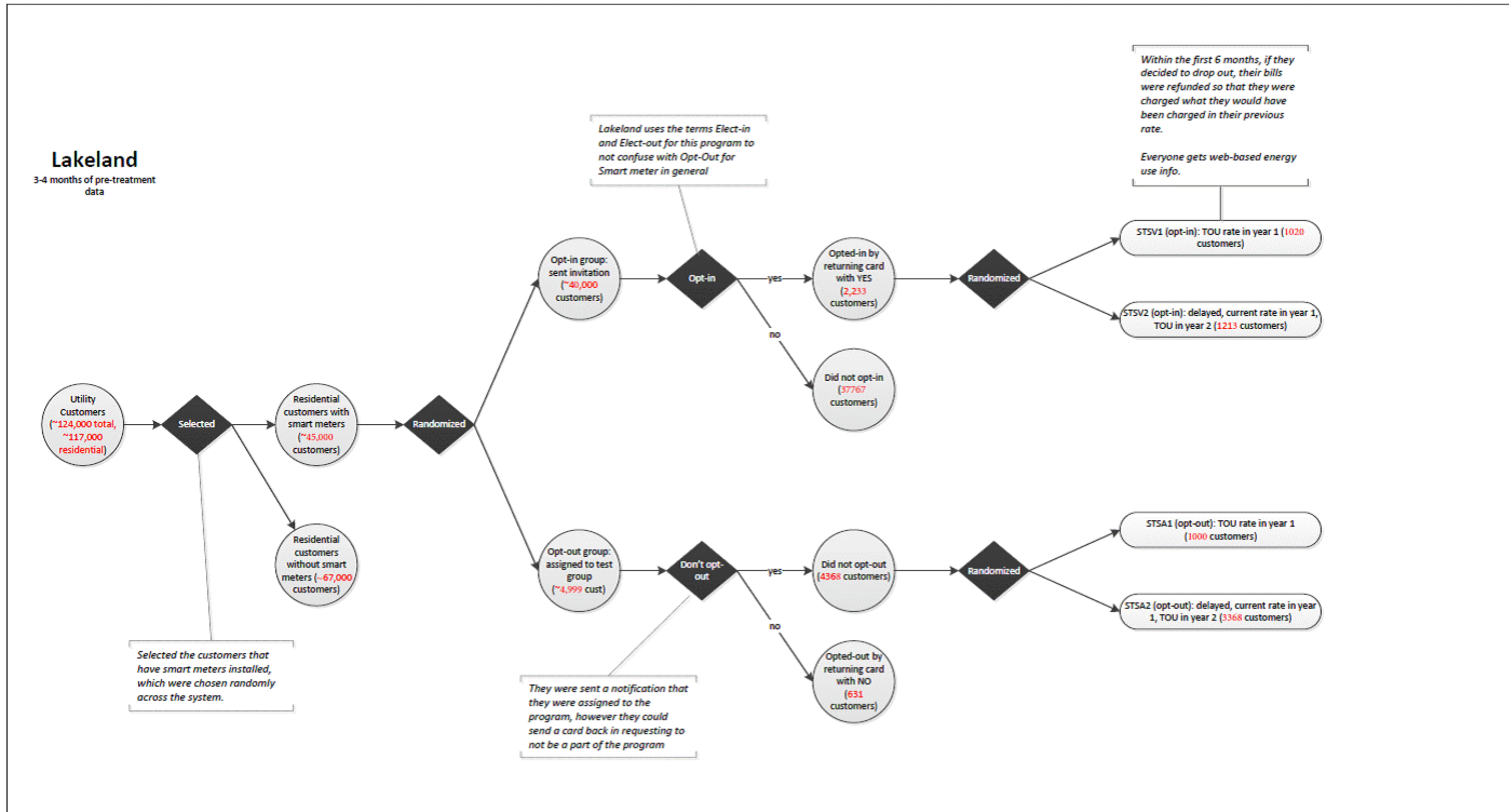
Lakeland Electric  
Shift to Save Campaign

22. Do you have a swimming pool pump?  Yes  No
23. Do you have any solar electric panels?  Yes  No
24. Do you have any solar hot water heater panels?  Yes  No
25. How many bedrooms are there in your primary residence? \_\_\_\_\_
26. How many bathrooms are there in your primary residence? \_\_\_\_\_
27. Do you have internet access in your primary residence?  Yes  No
28. Following are a list of things some people do and some don't. Please bubble in the things you normally do.
- In the winter, I keep the heat on so that I do not have to wear a sweater.
  - I wait until I have a full load before doing my laundry.
  - In the winter, I leave the windows open for long periods of time to let in fresh air.
  - I wash dirty clothes without prewashing.
  - In the winter, I crank up the heat when I get up to warm the house.
  - In the summer, I turn the air conditioner to a lower temperature so the house does not get too hot.
  - I usually turn off the lights in a room when I leave the room.
  - I usually set the thermostat at 68 degrees or lower in the winter.
  - I usually raise the thermostat to at least 78 degrees or higher, or use the air conditioner less, in the summer.
  - I have already switched or plan to switch to the new, energy efficient fluorescent compact light bulbs (CFLs).

This concludes our survey. Thank you for your time and answers. Now please put the survey in the postage paid envelope and mail it back to us.



## Appendix B Consumer Behavior Treatment Groups Recruitment Process





## Appendix C Consumer Behavior Treatment Groups Recruitment and Study Process

### Lakeland Electric/DoE Consumer Behavior Recruitment and Study Process

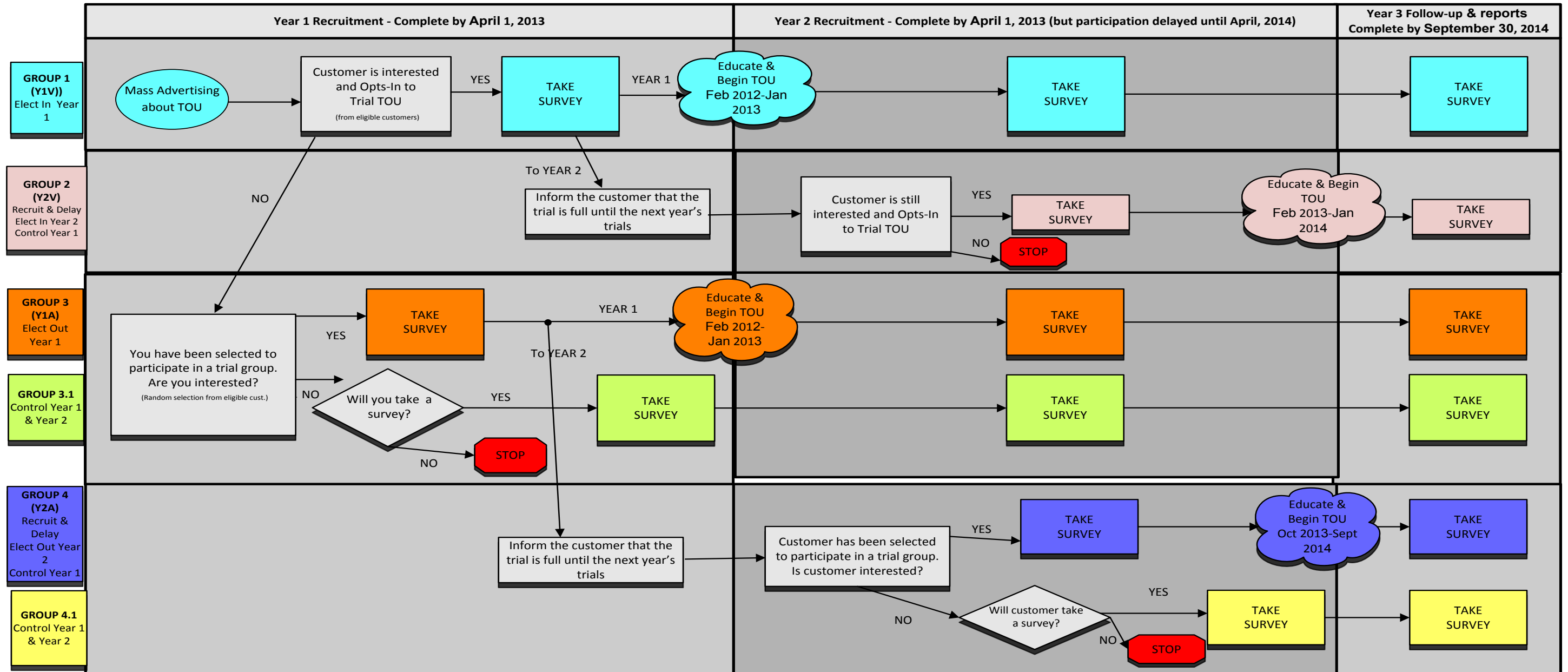


Figure 4 - Groups Recruitment and Study Process



## Appendix D Marketing Instruments

### I. Recruitment Letter for Assigned Customers



Dear Valued Customer,

One of the greatest advantages of having your new Smart Meter is that it now allows us to offer you a **new rate plan** that could **lower your electric bill**. It's called "Shift-to-Save." If you can shift some of your power usage to times of the day when power costs us less to generate ("Off-Peak"), you should be able to save money on your electric bill.

As a part of a trial study for the U.S. Department of Energy, **you have been selected at random to participate in the Shift-to-Save Rate Plan**. Please read the enclosed brochure for more details on the Shift-to-Save Rate Plan and how it compares to the Standard Rate Plan. After reading the brochure, we hope you'll be enthusiastic about being one of the first to experience and evaluate the benefits of the new rate plan.

Participation details:

- **Read the brochure** to become familiar with the benefits of the Shift-to-Save Rate Plan.
- Read the back of this letter for information about your start date, ongoing support and pricing protection.
- The trial study requires us to recruit a certain number of participants. However, if you do not wish to participate, **please fill out the enclosed response form and return it to us by March 9**. We've provided a postage-paid envelope for this purpose.
- You may go back on the Standard Rate Plan any time during your trial period.

Before you start on the new plan, you will receive a welcome package with further information.

Your feedback in shaping the future of Lakeland Electric is invaluable to us. We thank you for becoming a "smart grid pioneer" by participating in this innovative program!

Sincerely,

Jim Stanfield  
General Manager



PlugInto**SMART**.com

A Campaign for the Lakeland Smart Grid Initiative

501 E. Lemon Street • Lakeland, FL 33801 • [www.plugintosmart.com](http://www.plugintosmart.com)

O-0



## II. Enrollment Form for Assigned Customers




501 East Lemon Street • Lakeland, FL 33801-5079  
863.834.9535 • Fax 863.834.8450  
www.lakelandelectric.com

# shift to save

## Rate Plan

**NO, I do not wish to participate in the Shift-to-Save Rate Plan.**

If for any reason you do not wish to participate in the Shift-to-Save Rate Plan trial study, **please fill out this response form and return it to us by March 9.** When you're finished, place the form in the postage-paid envelope provided and drop it in a mailbox.

shift to  save Rate Plan

**No, I do not wish to participate in the Shift-to-Save Rate Plan.**

Name \_\_\_\_\_

Address \_\_\_\_\_

Lakeland Electric Account Number \_\_\_\_\_

Daytime Phone Number \_\_\_\_\_ Evening Phone Number \_\_\_\_\_

Home Address \_\_\_\_\_

Email Address \_\_\_\_\_

Signature \_\_\_\_\_

Comments? \_\_\_\_\_

\_\_\_\_\_



### III. Recruitment Letter for Voluntary Customers



Dear Valued Customer,

One of the greatest advantages of having your new Smart Meter is that it now allows us to offer you a **new rate plan** that could **lower your electric bill**. It's called "Shift-to-Save." If you can shift some of your power usage to times of the day when power costs us less to generate ("Off-Peak"), you should be able to save money on your electric bill.

As a part of a trial study for the U.S. Department of Energy, **we're offering this new rate plan to Lakeland Electric customers on a first-come, first-serve basis**. Please read the enclosed brochure for more details on the Shift-to-Save Rate Plan and how it compares to the Standard Rate Plan. After reading the brochure, we hope you'll decide to **become a smart grid "pioneer"** by being one of the first to experience and evaluate the benefits of the new rate plan.

How to get started:

- **Read the brochure** to become familiar with the benefits of the Shift-to-Save Rate Plan.
- Read the back of this letter for information about your start date, ongoing support and pricing protection.
- To sign up, fill out the enclosed confirmation form and **return it to us by March 9**. We've provided a postage-paid envelope for this purpose.
- The Shift-to-Save Rate Plan is voluntary. You may go back on the Standard Rate Plan any time during your trial period.

Before you start on the new plan, you will receive a welcome package with further information.

Your feedback in shaping the future of Lakeland Electric is invaluable to us – but it's up to you to take the first step by signing up for the Shift-to-Save Rate Plan. I hope you'll consider being a participant in this innovative program.

Sincerely,

Jim Stanfield  
General Manager



Plug into **SMART**.com

O-I

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501 E. Lemon Street • Lakeland, FL 33801 • [www.plugintosmart.com](http://www.plugintosmart.com)

## IV. Enrollment Form for Voluntary Customers

The graphic for the 'Shift to Save Rate Plan' features the words 'shift to' in a dark grey font, with a clock icon inside the 'o'. Below this, the word 'save' is written in a large, bold, green font. Underneath 'save', the words 'Rate Plan' are written in a smaller, dark grey font. The background is a light yellow with white lines radiating from the top right corner.

After completing this form, just **return it to us by March 9** in the enclosed postage-paid envelope. Please provide all information requested, including your email address. It will be used for account verification and to communicate updates and news about the Shift-to-Save Rate Plan.

The trial period will last 12 months. The purpose of the study is to show customers how they can save money by modifying their electricity usage patterns to their advantage. If you decide to leave the study within the first six months because you have not experienced savings, we will credit you the difference between what you paid on the Shift-to-Save Rate Plan versus what you would have normally paid on the Standard Rate Plan.

If we have any questions about the information you've provided, we will contact you. If not, you will receive a Shift-to-Save welcome package before you begin the new rate.

The logo for the 'Shift to Save Rate Plan' is identical to the one in the graphic above, featuring 'shift to' with a clock icon, 'save' in green, and 'Rate Plan' below it.

**Yes,  
please enroll me!**

Name \_\_\_\_\_

Lakeland Electric Account Number \_\_\_\_\_

Daytime Phone Number \_\_\_\_\_ Evening Phone Number \_\_\_\_\_

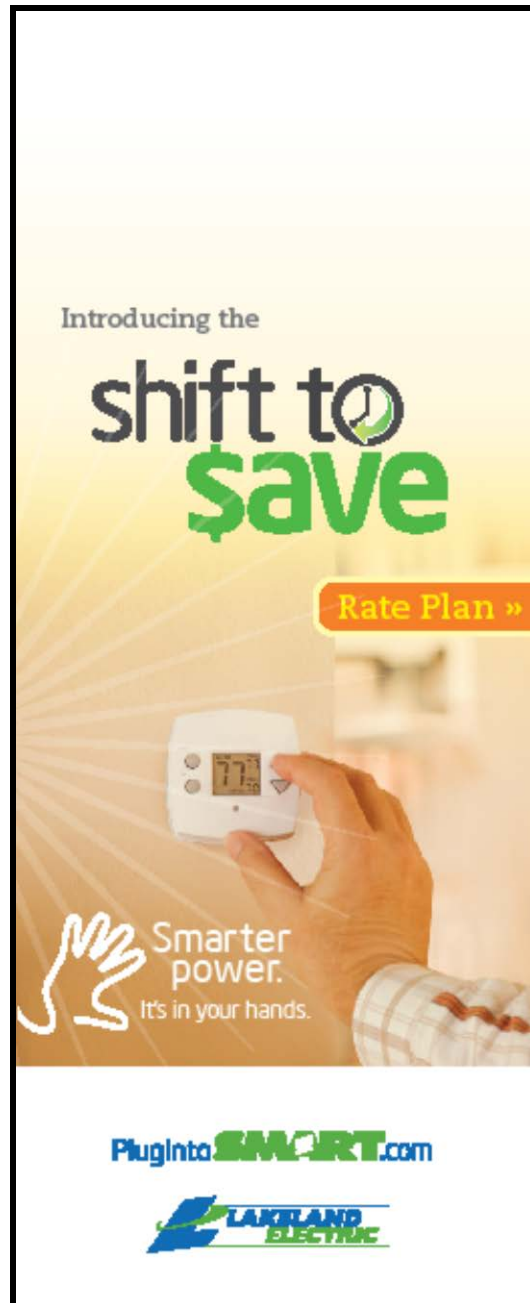
Home Address \_\_\_\_\_

Email Address \_\_\_\_\_

Signature \_\_\_\_\_



## V. Shift to Save Brochure



## Powering lower electric bills and higher customer satisfaction.

The new Shift-to-Save Rate Plan from Lakeland Electric is a good example of how we're putting smarter – and more economical – power in your hands. It's all made possible by your Smart Meter and the city-wide network that supports it. This brochure will help you understand the benefits of the new plan and how it compares to the way you're used to being billed for your electricity.

### Your Current or "Standard" Rate Plan.

Most Lakeland Electric customers are billed for their electricity usage based on the Standard Rate Plan. This plan uses three different levels or "tiers" and looks like this:

**0-1000 kWh: 9.89¢ per kWh**

**1,001-1,500 kWh: 10.39¢ per kWh**

**1,500 kWh and above: 10.87¢ per kWh**

**Costs include energy and average fuel charges only. Taxes and other surcharges may apply.**

The fewer kilowatt hours you use, the less your bill will be each month.

Rates as of October 1, 2011

## VI. TOU Schedule – Refrigerator Magnet

