



# Residential Lighting Controls Initiative Evaluation Final Report

Part of the Massachusetts Residential Retrofit  
and Low Income Program

The Electric and Gas Program Administrators  
of Massachusetts



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## Executive Summary

Cape Light Compact (CLC) offered a Residential Lighting Controls Initiative between August 2012 and January 2013. Its intent was to analyze the energy-saving potential of replacing traditional dimming switches with new, advanced dimming controls—an emerging technology that is designed to be more compatible with compact fluorescent lamps (CFLs) and light-emitting diode (LED) bulbs than standard dimming controls. These new dimming controls present the opportunity to replace inefficient lamps that could not otherwise be replaced due to performance issues with installing efficient lamps in standard dimming controls. One of CLC's goals with the initiative was to investigate the compatibility of lighting controls with efficient lamp technologies.

Sixteen residential customers across CLC's service territory participated in this initiative. These participants received new dimming controls and had the lamps behind those controls replaced with LED lamps.

Cadmus conducted an impact evaluation and a limited process evaluation of CLC's Residential Lighting Controls Initiative. This report presents Cadmus' findings and conclusions, which are drawn from the following evaluation activities: pre- and post-installation metering, lab testing of dimming controls to determine lamp energy use at various dimmer control levels, and participant surveys.

## METHODS

### Impact Evaluation Methods

To determine gross demand and energy savings, Cadmus employed a complementary approach of field and laboratory data collection.

- **On-site inventory.** Cadmus collected detailed pre- and post-installation information about the fixtures and controls in each participant's room or area of interest. In many cases, Cadmus' final site visit occurred prior to all retrofit work being completed, so our on-site data did not match the implementer's list of installed measures.
- **Pre- and post-installation metering.** Cadmus deployed meters (loggers) at participant sites prior to the installation of dimmer controls (measures) and bulbs. These loggers recorded illuminance levels from the lamps controlled by the dimmers for six to eight weeks before and after measure installation.
- **Lab testing of dimmer controls.** Cadmus used laboratory testing to analyze the relationship between power and illuminance (lumens per square foot [s.f.]) and the dimmer switch settings.
- **Analysis.** Cadmus synthesized the illuminance field data, the power laboratory data, and other supporting information to analyze the energy impacts of the initiative. We calculated operating hours for each group of bulbs attached to a lighting control, both at a gross, on-off level, as well as at each discrete dimmable level. Gross energy savings were calculated by aggregating hours of use at each dimmable level with the energy used at that level. The reported demand impacts



are simply the difference between the pre- and post-installation maximum wattage values. We did not estimate or report coincident peak demand impacts.

**Process Evaluation Methods**

Cadmus conducted limited surveys at the end of the data collection period to assess participants’ satisfaction with the initiative and the technologies and their associated behavioral activities. We also conducted limited interviews with staff from CLC and the initiative implementer, RISE Engineering, to gather their feedback on the implementation process and how the measures performed in the field.

**FINDINGS**

**Impact Evaluation Findings**

The verified savings values presented in Table 1 are relative to the local baseline conditions Cadmus observed and recorded at the time we installed loggers and during the pre-installation period. The lamps that were replaced under the initiative were largely incandescent or halogen bulbs, but there were also a small number of CFLs. The reported savings are largely driven by lamp replacement, but are also affected by changes in the use of the control.

These results are based on eight of the sixteen participating sites. There was not sufficient data available to calculate savings from the other eight sites due to limitations of the program tracking data (see the Findings section for more information). The table shows the total savings and the average savings per site. There were 21 lighting controls and 52 bulbs replaced at the eight sites included in this analysis.

**Table 1. Verified Energy Impacts\***

Savings Category	Total Verified Gross Impacts	Average Impact per Site
Demand Impacts	2.11 kW	0.26 kW
Energy Savings	1,987 kWh/yr	248 kWh/yr

\* n=8 sites

**Process Evaluation Findings**

The majority of participants were satisfied with the new bulbs (14 of 16 participants) and the new dimmer controls (8 of 12 participants) installed through the initiative. Comments from those who were not satisfied with the bulbs, controls, or initiative focused on flickering with the bulbs, dimming limitations, and scheduling limitations with the implementer.

Half of the participants noted behavior changes due to installation of the new bulbs, most notably that they used the dimmer at a lower setting because the lights are brighter. However, other comments indicated participants turned lights on more often because of lower energy use and used the dimming feature less than planned because of performance issues on low dimmer settings.

Feedback from interviews with the CLC manager and RISE staff substantiated that this technology is challenging to implement as a program at this time. The CLC manager noted the compatibility and logistics issues associated with implementation. RISE staff detailed the iterations necessary to achieve customer satisfaction with lamp color, lamp appearance, dimmer switch mechanism, and flickering issues resulting from certain product combinations.

## CONCLUSIONS

- **Compatibility of dimmer technology and LED bulbs.** One goal of this initiative was to investigate the compatibility of lighting controls with efficient lamp technologies. We found that compatibility was an issue. Participants, the CLC manager, and RISE staff all noted having difficulty finding working combinations of dimmers and bulbs. Any effort to replace lamps controlled by dimmer switches will require further research to identify working combinations of controls and efficient lamps. This research could best be conducted in a lab setting. Ideally, multiple control/bulb combinations would be identified to satisfy different customer preferences for factors such as control style and lighting color.
- **Participant behavior.** Survey and metering data revealed that some participants used their lights more after installation of the new dimmers and bulbs; however, substantial savings can still result since any savings are largely driven by the lamp replacement.
- **Program tracking.** In order for an impact evaluation of lighting use with dimmer replacements to be successful, it is important to have detailed tracking of implementation activities, including a detailed equipment inventory with product cut-sheets; a time-stamped contact log of all customer interactions; and a dated tracking matrix showing what equipment was replaced or adjusted at each appointment and the purpose of the appointment.



## Introduction

In 2012, the Massachusetts electric program administrators (PAs) contracted with Cadmus to perform an evaluation of dimmer controls that were installed in 16 homes in the CLC territory. This report presents the results of evaluation activities that assessed the energy-savings potential of these controls.

### OVERVIEW OF THE RESIDENTIAL LIGHTING CONTROLS INITIATIVE

CLC created the Residential Lighting Controls Initiative to investigate the compatibility of lighting controls with efficient lighting and to determine if energy savings can be obtained by replacing standard dimmer controls with controls that are compatible with efficient lighting and by replacing bulbs on dimmable lighting controls with LEDs.

CLC recruited participants for the initiative by posting information and participation requirements on the CLC Website, sending an e-mail blast to customers, and working with Home Energy Services staff to identify potential sites. Requirements for participation were:

- The home must be owner-occupied.
- One room in the home must have a minimum of five dimming fixtures (one room per household allowed).
- Existing lighting must be incandescent bulbs.
- Participant must also participate in the Home Energy Assessment.
- Participant must agree to pre- and post-installation metering.

Twenty-two customers expressed interest in participating. After conducting initial site assessments of all 22 homes, CLC selected 16 households to participate in the Lighting Controls Initiative. There were some deviations from the initial study design; for example, multiple dimming controls per home were included in the study. The participant sites also had an assortment of pre-treatment conditions, including a mix of lighting control types (dimmers and on-off switches), bulb types (incandescent, CFL, or halogen), and bulb wattages.

Cadmus and RISE Engineering visited participant homes a minimum of three times during the initiative.

- **Site visit #1: logger placement.** Cadmus visited homes to place loggers on existing dimmer controls and/or the affected lights to record energy use and participants' lighting behavior before the existing equipment was replaced with new controls and/or bulbs.
- **Site visit #2: dimmer and bulb replacement.** RISE visited homes six to eight weeks after Cadmus placed the loggers to replace existing dimmer controls with new controls that are compatible with energy-efficient lighting, and to replace incandescent, halogen, and CFL bulbs with LEDs. Cadmus participated in five of these site visits to show RISE how to replace the equipment without disturbing the installed loggers.

RISE visited some participant homes multiple times to install additional components or to adjust the controls or bulbs based on customer complaints regarding lighting performance.

- **Site visit #3: logger removal.** Cadmus returned to homes to remove loggers approximately six to eight weeks after RISE installed the new dimmer controls and bulbs.

### EVALUATION OBJECTIVES

Cadmus conducted an impact evaluation and a limited process evaluation on the Residential Lighting Controls Initiative. These evaluations are described as follows:

- The ***impact evaluation*** was designed to quantify electrical demand and energy savings that resulted from the initiative. Impact activities centered on metering lighting controls during two periods: pre-measure installation and post-measure installation.
- The ***process evaluation*** was designed to measure participant satisfaction and behavior. As agreed upon by CLC and Cadmus, the process evaluation consisted solely of a short participant survey that was administered when the evaluation team removed loggers from participant homes. Upon request, Cadmus also conducted limited interviews with the CLC manager and staff at the initiative implementer, RISE Engineering.



## Methodology

The following sections describe the data collection activities, data analysis methods, calculations for energy and demand savings parameters, and process analysis for evaluation of the initiative.

### IMPACT EVALUATION METHODOLOGY

Cadmus conducted an impact evaluation based on information from the following data sources:

- **Participant contact information.** CLC provided Cadmus with participants' contact information for coordination of site visits.
- **Generic participant site details.** These data were obtained by CLC as part of the initiative's vetting process. Questions were posed to potential participants about their involvement in past programs and whether they currently had an existing dimmer control operating with less-efficient (incandescent/halogen) lamps. Also included were questions about the proposed room where the measure would be installed and the socket count for this room.
- **Limited lighting inventories.** Cadmus collected these data at the time of logger installation, at the time of measure installation for a limited number of sites, and upon logger removal. We used these inventories to calculate demand values (lamp wattages and counts) and as a quality check for data provided by the customer or the implementer. These lighting inventories were instrumental in identifying some issues with the list of installed measures provided by RISE, which are discussed further below.
- **List of installed measures.** This list was provided by the implementation contractor, RISE Engineering.<sup>1</sup> It included a count of installed lamps and dimmer controls, along with RISE's installation dates. In many cases, RISE's reported installation dates were not consistent with observations made by Cadmus during our site visits. The list was also limited to reporting two site visits per home; however conversations with customers and implementation staff indicated that RISE visited a number of sites more than twice to install additional measures or change out new measures to address issues around product compatibility, product performance, and customer preference. Cadmus was unable to determine from the list of installed measures when RISE's additional site visits occurred, or what was installed during those visits.

Cadmus merged RISE's list of installed measures with more detailed inventories that we collected during our site visits. These combined data served as the basis of the post-installation conditions.

- **Pre-measure installation logging data.** Cadmus collected these data from loggers deployed prior to measure installation. Interval-based loggers recorded the illuminance incident on the meter placed by the lamp of interest. Data were logged at one-minute intervals, and light levels were calibrated for a given logger installation position relative to the lamp of interest. Ambient light

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<sup>1</sup> "RISE installed Dimmer-LED list 2nd visit.xlsx," provided January 16, 2013.

levels and occupancy data were also collected to assist with quality control and data analysis.<sup>2</sup> This data period spanned from the day following the logger installation to the day preceding the measure installation (or the day preceding the first measure installation visit).

- **Pre-measure installation dimmer calibration curves.** Cadmus created a map at the time of logger installation (first visit) to align dimmer position (0% to 100%) with illuminance observed by the logger. These data were used to map field logging values of illuminance to laboratory results for power demand.
- **Post-measure installation dimmer calibration curves.** Cadmus created a similar map at the time of logger removal (third visit) to align dimmer position with logger illuminance data. This second mapping was necessary since the equipment configuration had changed (new controls and/or new lamps were installed).. We used these data to map the field logging values to the laboratory testing results for the post-installation period.
- **Post-measure installation logging data.** These data were collected by Cadmus from the same meters deployed during the pre-installation period. Since the dimmer calibration maps changed with the installation of new equipment, the data collected during this period was retroactively mapped when the logger was removed. This data period spanned from the day following the final measure installation visit to the day preceding the logger removal visit. For eight of 16 sites, additional measure installation visits occurred after the logger was removed or was planned to be removed. In these cases, Cadmus was not able to calculate post-installation operating profiles and resultant savings.
- **Laboratory testing data.** Residential lighting circuits are difficult to isolate and can be unsafe to power-meter directly. Cadmus created a custom test bed with various combinations of lamps and dimmer controls. We used this test apparatus to create detailed profiles of equipment operation, with recorded values of illuminance, demand (watts), power factor, voltage, and dimmer position (0% to 100%). Each permutation of equipment in the laboratory was mapped to its closest match in the participant's home. This laboratory testing produced equations relating illuminance, power, and dimmer position for a given equipment combination. The graphs and regressions resulting from the process were used to calculate demand at any given point during the observed period and for any given configuration of customer lighting equipment.

Information and data from the above sources were analyzed to assess conditions, calculate savings, and determine initiative impacts. Calculation of demand was determined by the maximum observed power draw during the period, which typically equated to the sum of the nominal wattage of the lamps on the circuit. We determined energy consumption by the hours-of-use at a given dimming level (say, 75% of the dimmer position range), multiplied by the calculated power consumption at the given dimming level.

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<sup>2</sup> These data were used to cross-check the viability of certain loggers and determine if tampering or failure had occurred. If it was determined that a logger was removed from its calibrated, installed position, the data from this logger was cropped to exclude the period after this event occurred.



These two power consumption values, as discussed above, were calculated by mapping field illuminance data to laboratory regressions.

Table 2 shows examples of this mapping.

**Table 2. Laboratory Data, Analog Dimmer with LED**

Percentage of Dimmer Dial (Percent On)	Illuminance (Lumens /s.f.)	Amps	Volts	Watts	Power Factor
0	Poor Performance	-	-	-	-
10	Poor Performance	-	-	-	-
20	Poor Performance	-	-	-	-
30	5	0.331	121.97	14	0.35
40	29	0.421	121.75	28	0.54
50	76	0.479	121.38	40	0.69
60	138	0.527	122.06	52	0.81
70	200	0.556	121.71	60	0.89
80	252	0.576	121.28	67	0.95
90	299	0.591	121.94	72	0.99
100	304	0.592	121.79	72	0.99

Below is an example of the resulting equations, illustrating three of the nine permutations tested in the lab.

- Analog dial dimmer with incandescent lamp:  

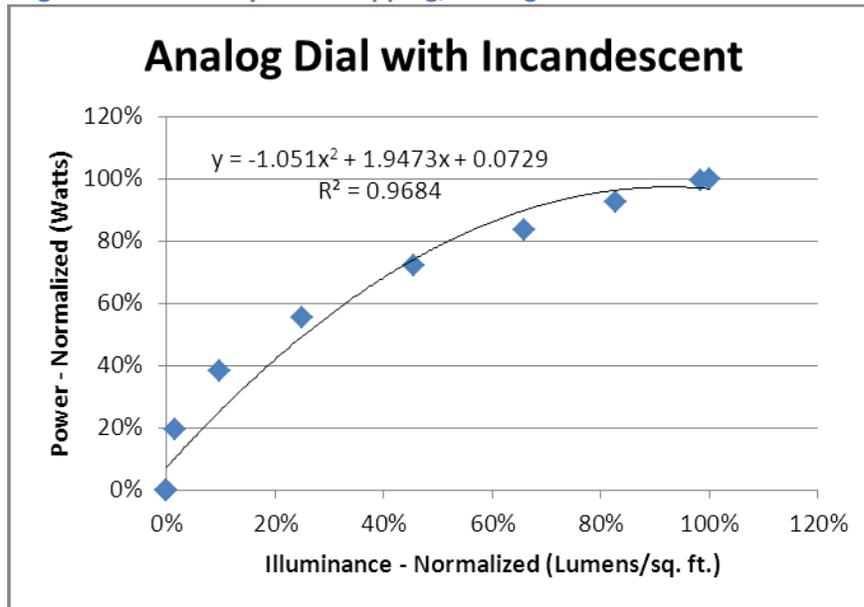
$$y = -1.051x^2 + 1.9473x + 0.0729$$
- Analog dial dimmer with CFL:  

$$y = 0.4627x^2 + 0.4777x + 0.0005$$
- Analog dial dimmer with LED lamp:  

$$y = 0.1382x^2 + 0.9457x - 0.0164$$

Where y is equal to percent of demand range and x is equal to percent of illuminance range. Figure 1 is an example plot where these equations were derived.

Figure 1. Laboratory Data Mapping, Analog Dimmer with Incandescent



To illustrate the relationship between illuminance and power consumption, consider that at 60% of the illuminance range, the fixture illustrated above will draw approximately 90% of its power range. More precisely, inserting 0.60 as 'x' in the equation above results in a 0.86 'y.' Converting these numbers to specific applied values, the maximum illuminance for this fixture is 304 lumens/s.f.

The maximum demand observed with this fixture was 72 watts (100% of the power). Both of these conditions occurred when the dimmer was set to its maximum position (100% on). Therefore, for a given dimmer position that produces 60% of its maximum illuminance, or 182.4 lumens/s.f. (0.6\*304 lumens/s.f.), we can expect the dimming level to consume 86% of its maximum power, or 62 watts (0.86\*72 watts).

In a rough interpolation of Figure 1 **Error! Reference source not found.**, we can see that 182.4 lumens/s.f. is closest to the line item for "70% On," which produces 200 lumens/s.f. and draws 60 watts. These values approximately match the calculated values above, thereby confirming our result. To summarize, turning this fixture on at approximately 70% on the dimmer will result in approximately 60% of its maximum light levels, at a cost of approximately 86% of its maximum demand.

In the three equations above, we used normalized data across the observed range of operation (percent of illuminance range or percent of demand range), because this approach resulted in a slightly better regression fit and a simple interpolation scheme. We modeled control circuits without existing dimmer controls as a simple on/off, at 0% or 100%.

Cadmus did not calculate coincidence factors or demand curves, so any demand values reported reflect the total demand reduction at use and not the demand reduction coincident with peak.



## PROCESS EVALUATION METHODOLOGY

Cadmus conducted a process evaluation to gain insight into participants' satisfaction with their new lighting controls and their perceptions of the initiative. As agreed by CLC and Cadmus at the onset of the initiative, the process evaluation activities were limited to an analysis of a participant survey. We conducted a brief survey of all 16 participants at their homes when we removed the loggers.

The survey involved a series of questions around three key areas of interest:

- Customer satisfaction with the new technology and/or new lights (for example, operability and lighting quality).
- Customer satisfaction with the initiative to predict future marketability (for example, ease of scheduling and satisfaction with process).
- Customer behavior (for example, on/off frequency and use of dimming option).

Upon request by CLC, Cadmus also conducted limited interviews with the initiative manager at CLC and staff at RISE Engineering. Insights from the survey and interviews helped identify both successful aspects of the initiative and areas that are less effective.

## Findings

The following sections provide detailed information about findings from the impact and process evaluation activities.

### IMPACT EVALUATION FINDINGS

#### Energy Savings

Based on the implementation data available and the timing of final bulb/control installations, Cadmus was able to estimate savings for eight of 16 sites, for a total of 52 bulbs on 21 dimmer controls. These installations resulted in an average demand savings of 67% and an average energy savings of 53%, relative to baseline conditions.

Table 3 lists savings for the measures for which Cadmus was able to complete the measurement and verification (M&V) efforts. The reported savings are a result of both the new controls and bulbs; however, savings are largely driven by lamp replacement, while the control replacement provided the customer with an opportunity to upgrade to a high-efficiency bulb.

**Table 3. Verified Savings for Partial Population\***

Savings Category	Total Verified Gross Impacts	Average Impact per Site
Demand Impacts	2.11 kW	0.26 kW
Energy Savings	1,987 kWh/yr	248 kWh/yr

\* n=8 sites

### Usage Profile Data

Incorporated in the demand and energy findings are the usage profile data. Although these data are not the main directive of the evaluation, they may provide useful information to CLC and implementation staff.

Across fully evaluated measures, Cadmus found an average increase in operating hours from baseline to post-installation. Gross usage (not usage at any discrete dimming level, but any usage at any dimming level) increased an average of 48 hours per year, or 18% of baseline levels. There was high variability in these data, however. The spread of change in operating hours ranged from -730 hours per year to +737 hours per year, relative to an average metered runtime of 862 hours per year. Percentages relative to baseline ranged from -62% to +171%.

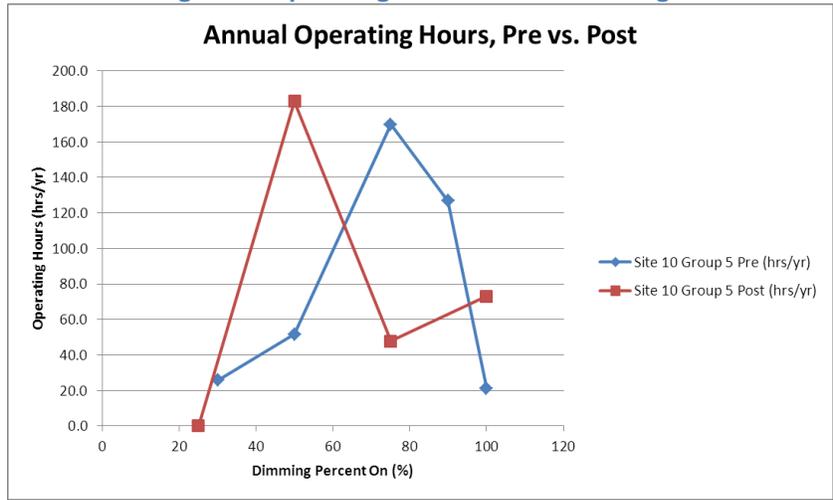
Below are four figures that illustrate this variability. Figure 2 shows an example of reduced usage. Annual operating hours are plotted on the “y” or vertical axis. Dimmer position, or the physical position of the dimming control, is plotted on the “x” or horizontal axis. Each data point represents the number of annual hours this control group was on at the corresponding dimmer position. Totaling the y-axis value for each data point would provide the annual gross (any usage at any dimming level) operating hours for this control group.

In this case, gross usage changed from an initial 395 annual hours to 304 annual hours. Pre-installation operation skews to the high side of the dimming range, with the majority of operating hours showing the dimmer set at 80% on, while after installation the majority of the operating hours were with the dimmer set at less than 60% on. This behavioral change contributes to the energy savings that result from this measure. Pre-installation annual energy usage was calculated to be 18,777 Watt-hours, and post-installation energy usage was calculated to be 2,056 Watt-hours. There are a number of possible explanations for this behavioral change, such as poor performance of the original lighting at lower dimmer settings and/or better lighting performance of the new LED bulbs installed.

Figure 3 shows the same site’s results with energy consumption plotted on the vertical axis and dimmer position plotted on the horizontal axis. This illustrates the weighted shift and reduction of energy consumption that result from the installed measures.



**Figure 2. Operating Profile - Reduced Usage**



**Figure 3. Energy Consumption – Reduced Usage**

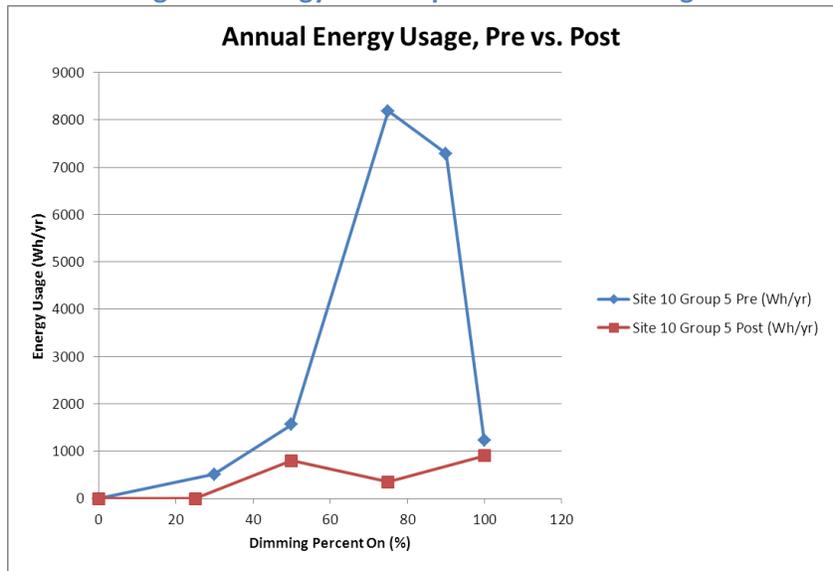
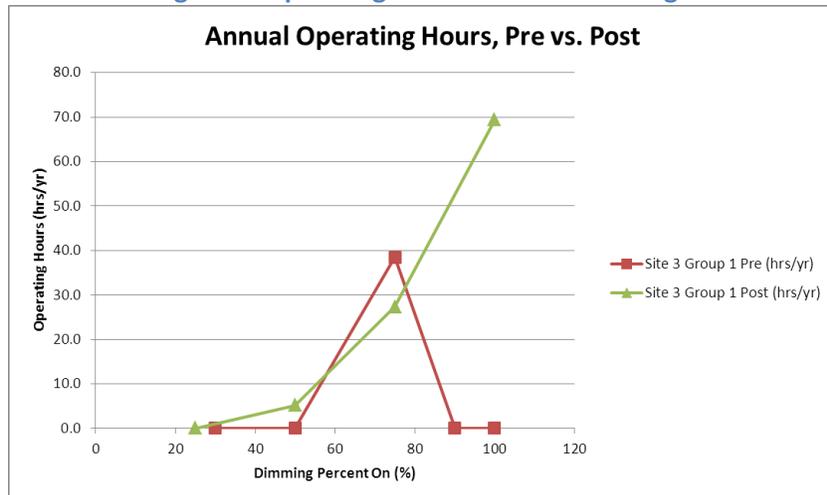


Figure 4 illustrates an example of increased usage after the measure installation for one participant. For this participant, gross usage changed from 38 annual hours to 102 annual hours. Pre-installation operation hours crest closer to the middle of the dimming range (near 70%), and post-installation operating hours peak closer to the high side of the range (100%). This behavioral change contributes to the energy savings that result from this measure in a negative way. Pre-installation annual energy usage was calculated to be 4,409 Watt-hours, and post-installation energy usage was calculated to be 2,661 Watt-hours. The behavioral change was actually an energy penalty, meaning savings would have been higher had the baseline operating profile continued unchanged.

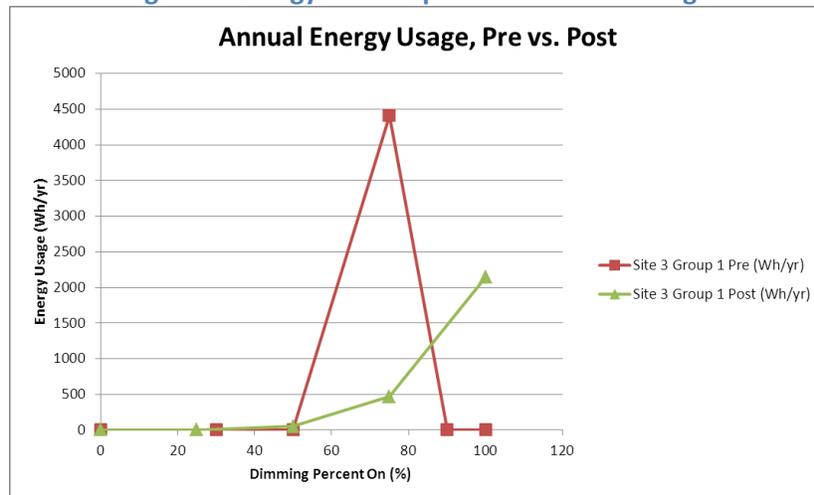
Figure 5 shows energy consumption plotted on the vertical axis and dimmer position on the horizontal axis. This graph illustrates the reduction of energy consumption from the installed measures, but also shows the mitigated savings caused by the increased operating hours at the highest dimmer position.

It is possible that this participant finds the new lighting provides insufficient light levels. Other possible explanations for this behavior are that the participant was using the new lighting more frequently instead of other, less-efficient lighting, unreported performance issues, or the snapback effect (where a new energy-efficient product is used more frequently and in a different way than its predecessor, but the product does not replace other, less-efficient lighting).

**Figure 4. Operating Profile - Increased Usage**



**Figure 5. Energy Consumption – Increased Usage**



These results of this initiative are inconclusive due to the small sample of the initiative and the limited scope of the process survey. Given the positive performance of the initiative savings, these behavioral topics are researchable questions that could be investigated if these measures are offered in future CLC programs or initiatives.

## PROCESS EVALUATION FINDINGS

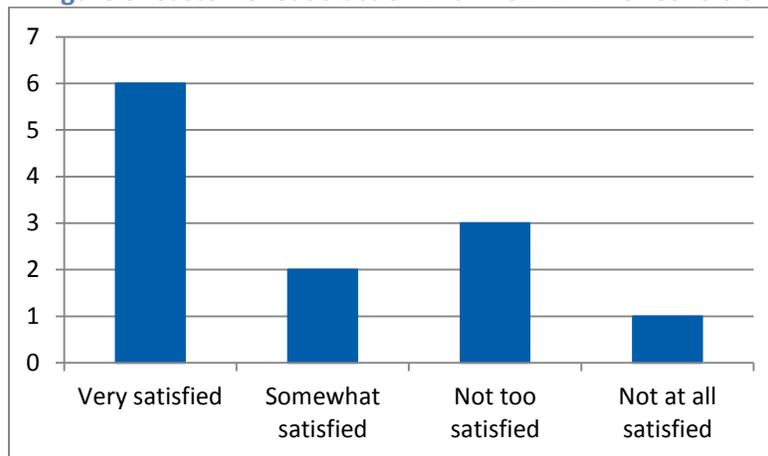
Cadmus conducted a brief survey with all 16 participants during the third site visit. The following subsections discuss survey findings that pertain to the three key objectives for the process evaluation (discussed above in the Process Evaluation Methodology section).

### Participant Satisfaction with the New Dimmer Controls and New Bulbs

Before their involvement with the initiative, half of the 16 participants had some familiarity with dimmer controls and none of the 16 participants had used a dimmer control that was compatible with energy-efficient bulbs.

At the time of the survey, 12 participants had their existing dimmer controls replaced with a new dimmer control. Of those 12 participants, eight respondents reported satisfaction with the new dimmer control and four were not satisfied due to flickering and limited dimming abilities (Figure 6). The eight respondents who were satisfied with the control also said they were likely to recommend the dimmer controls to a friends, family, or colleagues, while the four unsatisfied participants reported they were not too likely to recommend the controls.

Figure 6. Customer Satisfaction with New Dimmer Controls

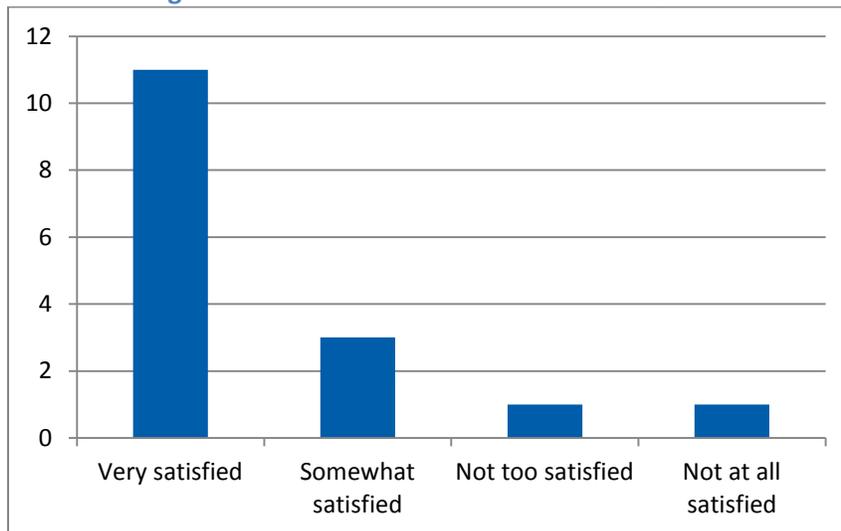


Prior to the initiative, all 16 participants had some familiarity with CFLs and LEDs, and nearly all (n=14) used CFLs in their homes and five used LEDs in their homes.

RISE Engineering replaced incandescent, halogen, and CFL bulbs with LEDs at all participants' homes. At the time of the survey, 14 participants said they were satisfied with the new bulbs, while the remaining two said they were unsatisfied (Figure 7). The two participants who reported dissatisfaction said they did not like the look and excessive brightness of the bulbs.

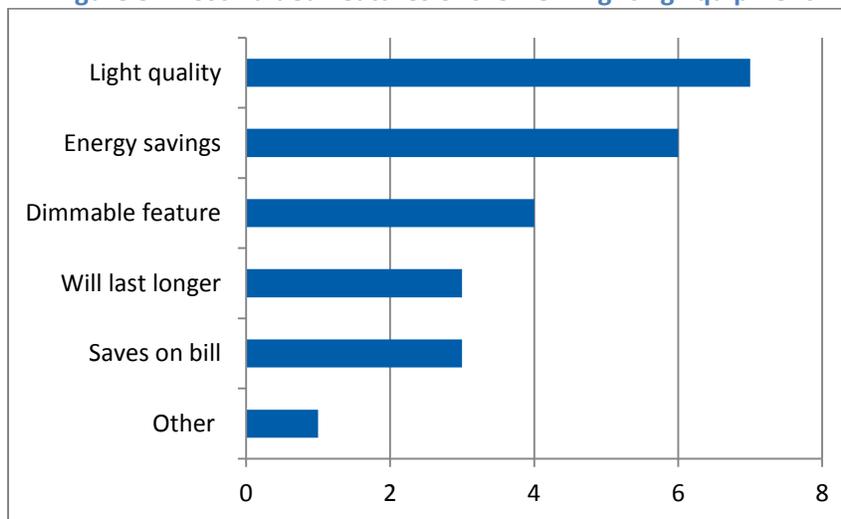
Nearly all of the participants (n=15) were likely to recommend the LEDs that were installed through the initiative. Of these 15, two said they would recommend them for use with a non-dimmable control and one said he would make the recommendation as long as the price continues to drop. The remaining participant said he was not too likely to recommend the bulbs.

Figure 7. Customer Satisfaction with New Bulbs



When asked what features of the new bulbs they liked most, the majority of participants said the lighting quality (n=7) and energy savings (n=6), as shown in Figure 8. One respondent refused to answer the question because he was dissatisfied with the look and operation of the new bulbs and intended to switch back to halogen lamps.

Figure 8. Most Valued Features of the New Lighting Equipment



Note: The “Other” response was that the bulbs do not give off excess heat.

Nine respondents reported that they have not experienced any difficulties with the new lighting controls and bulbs. The seven respondents who indicated that they had problems noted difficulties with flickering, humming, or the bulbs not dimming well. According to survey respondents, RISE was able to return to two of these homes to fix the problem or replace the problem bulb.



### Participant Satisfaction with the Initiative

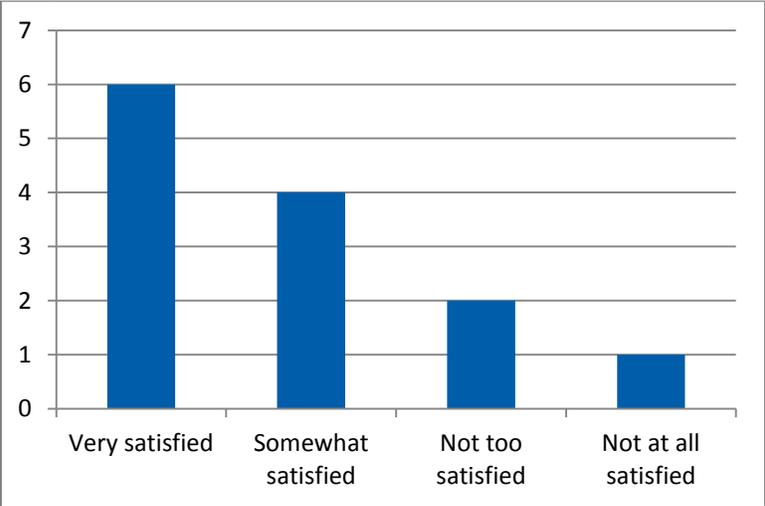
When asked if they would recommend the Lighting Controls Initiative, all but one participant said they would be likely to recommend it. One of these respondents said he would recommend the initiative if it was a straightforward bulb-replacement effort, but he would not necessarily recommend it with its current focus on dimming. Another respondent said he did not think the dimming technology was where it needed to be to offer a program like this to the entire population, but he said he would recommend it to people who are experienced with dimmers and “have realistic expectations for where the technology is.”

One of the participants who would not recommend the initiative said that he thought the initiative was a good idea, but it did not work for him and would be better for commercial spaces.

When asked about their satisfaction with the scheduling options to install the new dimmer controls and bulbs, 15 respondents reported being satisfied. Two participants (including one who was “somewhat satisfied”) said that RISE did not have many scheduling options available.

Ten participants reported being satisfied with the installation process for their new lighting controls and three were unsatisfied (Figure 9). Two respondents noted that the electrician did not have the right dimmers at the first visit and two stated that the electrician was not very familiar with the technology. At the time of the survey, one participant who expected to receive a new dimmer was still waiting for RISE to return to install the control at his home.

Figure 9. Customer Satisfaction with the Installation Process



When asked about suggestions to improve the installation process, eleven respondents did not offer any suggestions. Of the five participants who offered feedback, four recommended that the installing electricians carry a wider variety of bulb sizes and bulb types because the technicians did not have the appropriate bulbs at their first visit. Other suggestions from participants’ included having CLC provide clearer information about what to expect in the study, expanding the scheduling availability, offering a variety of dimmer control options, and providing additional bulbs for future replacement.

## Participant Behavior

Half of the participants said they changed the way they use lighting in the room where RISE installed the new equipment. Behavior changes in seven participants included:

- Using the new lights at a lower setting because of the improved light quality (n=3)
- Using fewer lights because of the new bulbs' brightness (n=1)
- Using the lights more because of the improved light quality (n=2)
- Using the lights more because of reduced concern about the electricity use and cost (n=1)

The remaining respondent said that he used the dimming feature less than he had hoped because there were performance issues when it was dimmed low.

When asked if participating in the initiative changed the way they use other energy-using equipment in their homes, fourteen participants said no. The remaining two reported that their behavior change was to consider the purchase of additional LED bulbs for other rooms in their homes.

## Conclusions

Cadmus provides the following conclusions based on findings from the impact and process evaluation efforts.

### CONCLUSION: COMPATIBILITY OF DIMMER TECHNOLOGY AND LED BULBS

One goal of this initiative was to investigate the compatibility of lighting controls with efficient lamp technologies. We found that compatibility was an issue. Participants, the CLC manager, and RISE staff all noted having difficulty finding working combinations of dimmers and bulbs. Any effort to replace lamps controlled by dimmer switches will require further research to identify working combinations of controls and efficient lamps. This research could best be conducted in a lab setting. Ideally, multiple control/bulb combinations would be identified to satisfy different customer preferences for factors such as control style and lighting color.

### CONCLUSION: PARTICIPANT BEHAVIOR

Participant behavior is a dynamic aspect of the savings available from this initiative. The fashion in which customers operate their lights can change drastically—and in various ways—based on these installations. The dimmer measure for this initiative can be seen as a catalyst to remove the barrier to lamp replacement. Although surveys and metering data revealed that some customers used their lights more after installation of the new dimmers and bulbs, substantial savings can still result because any savings are largely driven by the lamp replacement.

### CONCLUSION: PROGRAM TRACKING

In order for an impact evaluation of lighting use with dimmer replacements to be successful, it is important to have detailed tracking of implementation activities, including a detailed equipment inventory with product cut-sheets; a time-stamped contact log of all customer interactions; and a dated tracking matrix showing what equipment was replaced or adjusted for each appointment, including the purpose of the appointment.

## Appendix A: Participant Survey



### A. Awareness

- A1. How did you hear about Cape Light Compact's Lighting Controls Initiative?
1. Advertisement
  2. Website
  3. Other [Specify \_\_\_\_\_]
  - 98. REFUSED [DO NOT READ]
  - 99. DON'T KNOW [DO NOT READ]
- A2. Before participating, how familiar were you with energy-efficient lighting [CFLs/LEDs]? Would you say...
1. Very familiar
  2. Somewhat familiar
  3. Not too familiar
  4. Not at all familiar
  - 98. REFUSED [DO NOT READ]
  - 99. DON'T KNOW [DO NOT READ]
- A3. Before participating, how familiar were you with dimming controls that are compatible with high-efficiency lighting (CFLs/LEDs)? Would you say...
1. Very familiar
  2. Somewhat familiar
  3. Not too familiar
  4. Not at all familiar
  - 98. REFUSED [DO NOT READ]
  - 99. DON'T KNOW [DO NOT READ]
- A4. Before participating, did you use CFLs in your home?
1. Yes  
A4a. How many? [Record # CFLs \_\_\_\_\_]
  2. No
  - 98. REFUSED
  - 99. DON'T KNOW
- A5. Before participating, did you use LEDs in your home?
1. Yes  
A4a. How many? [Record # LEDs \_\_\_\_\_]
  2. No
  - 98. REFUSED
  - 99. DON'T KNOW

A6. What considerations were important in your decision to participant and upgrade your lighting? [Do not read. Record all that apply]

1. Save energy
2. Save money on bill
3. Seemed like a good deal
4. Want efficient lighting for all sockets in home
5. Interested to try something new
6. Old lighting was bad/needed replacement
7. Have better control of lighting levels
8. Other [Specify \_\_\_\_\_]
- 98. REFUSED [DO NOT READ]
- 99. DON'T KNOW [DO NOT READ]

## B. Installation Process

B1. How satisfied were you with the scheduling options to install your new lighting [dimmer] controls/bulbs? Would you say...

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied [Go to B1a]
4. Not at all satisfied [Go to B1a]
- 98. REFUSED [DO NOT READ]
- 99. DON'T KNOW [DO NOT READ]

B1a. [Ask If B1 = 3 or 4] Why do you say that?

[Record Response \_\_\_\_\_]

B2. How satisfied were you with the installation of your lighting [dimmer] control? Would you say...

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied [Go to B2a]
4. Not at all satisfied [Go to B2a]
- 98. REFUSED [DO NOT READ]
- 99. DON'T KNOW [DO NOT READ]

B2a. [Ask If B2 = 3 or 4] Why do you say that?

[Record Response \_\_\_\_\_]

B3. [If appropriate] Overall, how satisfied are you with the new light [CFL/LED] bulbs?



- 1. Very satisfied
- 2. Somewhat satisfied
- 3. Not too satisfied [Go to B4a]
- 4. Not at all satisfied [Go to B4a]
- 98. REFUSED [DO NOT READ]
- 99. DON'T KNOW [DO NOT READ]

B4a. [Ask If B4 = 3 or 4] Why do you say that?

[Record Response \_\_\_\_\_]

B4. Overall, how satisfied are you with the new lighting [dimmer] control?

- 1. Very satisfied
- 2. Somewhat satisfied
- 3. Not too satisfied [Go to B3a]
- 4. Not at all satisfied [Go to B3a]
- 98. REFUSED [DO NOT READ]
- 99. DON'T KNOW [DO NOT READ]

B3a. [Ask If B3 = 3 or 4] Why do you say that?

[Record Response \_\_\_\_\_]

B5. Is there anything that could have made the lighting controls installation process better for you?

[Record Response \_\_\_\_\_]

### C. Lighting Use/Experience

C1. What features of the new lighting equipment do you like most?

- 1. Energy savings
- 2. Saves on bill
- 3. Dimmable feature
- 4. Light quality
- 5. Will last longer
- 6. Other [Specify \_\_\_\_\_]
- 98. REFUSED [DO NOT READ]
- 99. DON'T KNOW [DO NOT READ]

C2. Have you experienced any difficulties in using the new lighting controls and bulbs?

- 1. Yes [Go to C3]
- 2. No [Go to C4]
- 98. REFUSED [DO NOT READ]
- 99. DON'T KNOW [DO NOT READ]

- C3. [If C2=yes] What difficulties have you experienced? \_\_\_\_\_
- C4. As a result of your experience with Cape Light Compact's Lighting Controls Initiative, have you changed the way you use lighting in this room?
1. Yes [Go to C5]
  2. No [Go to C6]
  - 98. REFUSED [DO NOT READ]
  - 99. DON'T KNOW [DO NOT READ]
- C5. [If C4=yes] Please describe the changes you have made \_\_\_\_\_
- C6. As a result of your experience with Cape Light Compact's Lighting Controls Initiative have you changed the way you use any other energy-using equipment in your home?
1. Yes [Go to C7]
  2. No [Go to C8]
  - 98. REFUSED [DO NOT READ]
  - 99. DON'T KNOW [DO NOT READ]
- C7. [If C6=yes] Please describe the changes you have made \_\_\_\_\_

## D. Satisfaction

- D1. How likely would you be to recommend [CFL/LEDs] to a friend, family member, or colleague?
1. Very likely
  2. Somewhat likely
  3. Not too likely
  4. Not at all likely
  - 98. REFUSED [DO NOT READ]
  - 99. DON'T KNOW [DO NOT READ]
- D2. How likely would you be to recommend the lighting [dimmer] controls to a friend, family member, or colleague?
1. Very likely
  2. Somewhat likely
  3. Not too likely
  4. Not at all likely
  - 98. REFUSED [DO NOT READ]
  - 99. DON'T KNOW [DO NOT READ]



- D3. How likely would you be to recommend Cape Light Compact’s Lighting Controls Initiative to a friend, family member, or colleague?
- 1. Very likely
  - 2. Somewhat likely
  - 3. Not too likely
  - 4. Not at all likely
  - 98. REFUSED [DO NOT READ]
  - 99. DON’T KNOW [DO NOT READ]

**E. Customer Demographics**

- E1. How many years have you lived in this home?
- 1. \_\_\_\_\_ Years [RECORD RESPONSE]
  - 98. REFUSED [DO NOT READ]
  - 99. DON’T KNOW [DO NOT READ]
- E2. What type of home is it? [READ RESPONSES 1-5, THEN 6; SELECT ONE RESPONSE]
- 1. Detached single-family home
  - 2. Townhouse or duplex which share adjacent walls
  - 3. Apartment or condo in a two, three, or four unit building
  - 4. Apartment or condo in a building with 5 or more units
  - 5. Mobile home or manufactured home
  - 6. Other
- E2a. SPECIFY: \_\_\_\_\_
- 98. REFUSED [DO NOT READ]
  - 99. DON’T KNOW [DO NOT READ]
- E3. Including you, how many people live in your home on a full-time basis?
- 1. \_\_\_\_\_ Range = 1 to 10, 10 = 10 or more [RECORD RESPONSE]
  - 98. REFUSED [DO NOT READ]
  - 99. DON’T KNOW [DO NOT READ]
- E4. Which of the following categories best describes your age? Is it...
- 1. 18 to 24
  - 2. 25 to 34
  - 3. 35 to 44
  - 4. 45 to 54
  - 5. 55 to 64
  - 6. 65 or over
  - 98. REFUSED [DO NOT READ]
  - 99. DON’T KNOW [DO NOT READ]
- E5. What are the best ways for you to receive information about energy-efficient options for your home?

1. Bill insert
2. Phone call from program representative (to respondent)
3. Respondent call to CLC
4. Email
5. Advertisement
6. Website
7. Other [Specify \_\_\_\_\_]
- 98. REFUSED [DO NOT READ]
- 99. DON'T KNOW [DO NOT READ]

This completes the survey. Thank you for your time.



## Appendix B: Participant Survey Results

Participant	A1. How did you hear about Cape Light Compact's Lighting Controls Initiative?	A1_Notes	A2. Before participating, how familiar were you with energy-efficient lighting [CFLs/LEDs]? Would you say...	A3. Before participating, how familiar were you with dimming controls that are compatible with high-efficiency lighting (CFLs/LEDs)? Would you say...	A3_Notes
1	Other	Email from CLC	Somewhat familiar	Not too familiar	
2	Other	Email from CLC	Not too familiar	Not at all familiar	
3	Website		Somewhat familiar	Not at all familiar	
4	Website, Other	"RISE newsletter - we had participated in their other programs."	Very familiar	Somewhat familiar	
5	Other	"Used to work for CLC and continue to consult for them on lighting and other projects."	Very familiar	Somewhat familiar	
6	Website		Very familiar	Very familiar	
7	Other	Board member of CLC	Very familiar	Very familiar	
8	Other	Email from CLC	Very familiar	Not too familiar	
9	Other	"Friend in industry [Onset] suggested we participate."	Not too familiar	Not too familiar	
10	Email		Somewhat familiar	Not too familiar	
11	Other	"Member of the Energy Committee and saw a presentation."	Very familiar	Somewhat familiar	"Aware there was a problem with current dimmers on the market, not so familiar with any solutions."
12	Website		Very familiar	Somewhat familiar	
13	Other	"Invited by CLC directly because I had participated in other energy programs."	Very familiar	Not at all familiar	
14	Other	Other: "Invited by CLC directly because I had participated in their energy auditing program."	Somewhat familiar	Very familiar	
15	Other	"We were contacted directly by CLC."	Very familiar	Not too familiar	
16	Website		Somewhat familiar	Somewhat familiar	

Participant	A4. Before participating, did you use CFLs in your home?	A4_Notes	A4a. Number of CFLs	A5. Before participating, did you use LEDs in your home?	A5_Notes	A5a. Number of LEDs
1	Yes		10	Yes		1
2	Yes		2	No		0
3	Yes	"CFLs were put in after an energy audit, also done by RISE."	17	No		0
4	Yes		7	No		0
5	Yes	"Changed all lights in home to CFL."	50	Yes		1
6	Yes		40	Yes		4
7	Yes		20	Yes		7
8	Yes	"CFLs used in every non-dimmable fixture."	30	No	"Felt LEDs were too expensive."	0
9	No		0	No		0
10	Yes	"CFLs were put in after an energy audit."	25	No		0
11	Yes		20	Yes		6
12	Yes		10	No		0
13	Yes		30	No		0
14	Yes	"Everything was changed to CFL after the energy audit."	20-30	No		0
15	Yes		40	No		0
16	Yes		6	No		0



Participant	A6. What considerations were important in your decision to participant and upgrade your lighting?	A6_Considerations in Decision to Participate2	A6_Considerations in Decision to Participate3	A6_Notes	B1. How satisfied were you with the scheduling options to install your new lighting [dimmer] controls/bulbs? Would you say...	B1a. [Ask if B1 = not satisfied] Why do you say that?
1	Save energy	Save money on bill	Want efficiency lighting for all sockets in home	Other - "Better light quality"	Somewhat satisfied	"Took a while to schedule. Not a lot of options for when to have electrician come out. Tried a few times, then heard back after a while."
2	Save money on bill				Very satisfied	[No response]
3	Seemed like a good idea				Very satisfied	[No response]
4	Save money on bill	Interested to try something new			Very satisfied	[No response]
5	Other			"Something of an industry expert and wanted to participate and give feedback."	Very satisfied	[No response]
6	Want efficiency lighting for all sockets in home				Very satisfied	[No response]
7	Have better control of lighting levels			"The fact that this program focused on dimmable lighting, an area I feel hasn't been addressed much."	Very satisfied	[No response]
8	Save energy			"I am in the solar business, so always try to help out with energy or efficiency related efforts."	Very satisfied	[No response]
9	Seemed like a good idea				Very satisfied	[No response]
10	Save energy	Want efficiency lighting for all sockets in home	Old lighting was bad/needed replacement		Somewhat satisfied	[No response]
11	Interested to try something new			"General interest in energy and efficiency initiatives."	Very satisfied	[No response]
12	Save money on bill	Interested to try something new			Very satisfied	[No response]
13	Want efficiency lighting for all sockets in home	Interested to try something new		"Interested specifically in trying out LEDs"	Very satisfied	[No response]
14	Save energy	Want efficiency lighting for all sockets in home		"Interested specifically in trying out LEDs"	Very satisfied	[No response]
15	Save energy				Not at all satisfied	"RISE did not have many scheduling options available."
16	Save energy	Interested to try something new		"Interested specifically in trying out LEDs for free."	Very satisfied	[No response]

Participant	B2. How satisfied were you with the installation of your lighting [dimmer] control? Would you say...	B2a. [Ask if B2 = not satisfied] Why do you say that?	B3. Overall, how satisfied are you with the new light [CFL/LED] bulbs?	B3a. [Ask if B3 = not satisfied] Why do you say that?
1	Very satisfied	"In the end very satisfied but took a while to get there. Had to try a lot of different fixtures first."	Very satisfied	"Took awhile to get the right combination"
2	Very satisfied	[No response]	Very satisfied	[No response]
3	N/A	[Cadmus note: This house did not have a dimmer control originally, so RISE did not install one.]	Very satisfied	[No response]
4	Very satisfied	[No response]	Very satisfied	[No response]
5	Not too satisfied	"The electrician didn't have the right variety of dimmer and didn't seem to have much experience with the different types."	Somewhat satisfied	[No response]
6	Somewhat satisfied	[No response]	Very satisfied	[No response]
7	Very satisfied	[No response]	Very satisfied	[No response]
8	Somewhat satisfied	"The living room install went well, the electrician didn't have the right dimmer for the dining room." [Cadmus note: the dining room fixture was on a 3-way switch.]	Very satisfied	[No response]
9	N/A	[Cadmus note: RISE did not change out any dimmer controls at this home.]	Very satisfied	[No response]
10	Not too satisfied	"The dimmer itself was never replaced and we've had a hard time getting back in touch with RISE."	Very satisfied	[No response]
11	Somewhat satisfied	[No response]	Not too satisfied	"The bulbs are too bright- I had requested a lower wattage but so far they have not been provided."
12	Very satisfied	[No response]	Very satisfied	[No response]
13	Somewhat satisfied	"The electrician didn't seem very familiar with the different types of dimmers."	Very satisfied	[No response]
14	N/A	[Cadmus note: RISE did not change out the dimmer switches at this house.]	Somewhat satisfied	[No response]
15	Not at all satisfied	"The dimmer is not compatible with the LED bulbs, there is still a lot of flickering."	Not at all satisfied	"I didn't like the aesthetics and color of the LED bulbs."
16	Very satisfied	[No response]	Somewhat satisfied	"One of the LEDs blew out already, and there is still some flickering in one circuit."



Participant	B4. Overall, how satisfied are you with the new lighting [dimmer] control?	B4a. [Ask if B4 = not satisfied] Why do you say that?	B5. Is there anything that could have made the lighting controls installation process better for you?
1	Very satisfied	[No response]	[No response]
2	Very satisfied	[No response]	[No response]
3	N/A	[Cadmus note: This house did not have a dimmer control originally, so RISE did not install one.]	[No response]
4	Very satisfied	[No response]	[No response]
5	Not too satisfied	"RISE didn't install a compatible controller- I had to go out and buy a better one myself. This one is still not perfect, since I need something compatible with 3-way switches."	"None, the dimmers themselves still need work but RISE did a fine job under the circumstances."
6	Not too satisfied	"It doesn't hold the dim below about 50%, there is lots of flickering and 'popping'"	"The coordination between CLC and RISE could have been better. They gave conflicting information about the qualifications for the program, its purpose, and so on."
7	Very satisfied	[No response]	[No response]
8	Somewhat satisfied	"The living room install went well, the electrician didn't have the right dimmer for the dining room." [Cadmus note: the dining room fixture was on a 3-way switch]	[No response]
9	N/A	[Cadmus note: RISE did not change out any dimmer controls at this home.]	[No response]
10	N/A	[Cadmus note: RISE did not change out any dimmer controls at this home.]	"The electrician could have been better prepared with a variety of bulb sizes. It would be nice if they provided extra bulbs for replacements."
11	Somewhat satisfied	[No response]	"The electrician could have been better prepared with a variety of bulb sizes. I have also had trouble getting them to make a return visit with the correct bulb sizes."
12	Very satisfied	[No response]	[No response]
13	Very satisfied	[No response]	"The electrician could have been better prepared with different bulb types. The candelabra bulbs he had specifically said that they shouldn't be used with dimmers."
14	N/A	[Cadmus note: RISE did not change out the dimmer switches at this house.]	[No response]
15	Not at all satisfied	"The dimmer is not compatible with the LED bulbs, there is still a lot of flickering."	"They could have more options for scheduling, as well as a variety of dimmers and bulbs available."
16	Not too satisfied	"The new dimmer doesn't work that well- there is a limited dimming range and the lights on it sometimes flicker."	[No response]

Participant	C1. What features of the new lighting equipment do you like most?	C1_Most liked features_2	C1_Notes	C2. Have you experienced any difficulties in using the new lighting controls and bulbs?	C2_Notes	C3. [If C2=yes] What difficulties have you experienced?
1	Energy savings		"Energy efficiency"	Yes	"Initially, but the problems were resolved."	"There was an intermittent flicker, but this was resolved. Also, the lights didn't get very dim at first, now they are better but still don't dim as much as incandescents."
2	Will last longer			No	"LED lamp in living room is not quite bright enough for reading."	[No response]
3	Saves on bill	Light quality		No		[No response]
4	Saves on bill	Dimmable feature		No		[No response]
5	Dimmable feature	Light quality		Yes		"Had to replace dimmer once, and still notice 'strobing' effects at lower levels."
6	Energy savings	Light quality	All of the above	Yes		"The dimmer only works from 100% down to about 75%, it doesn't dim well below that."
7	Dimmable feature			No		[No response]
8	Energy savings	Light quality		Yes		"There is some flickering when using the dining room fixture."
9	Saves on bill	Other	All of the above	Yes		"There is some flickering. It seems to happen randomly, but especially with the middle circuit."
10	Light quality		All of the above	No		[No response]
11	Energy savings		Other - "Personal interest in new energy technology."	No	[Cadmus note: The customer answered "no" but did mention poor dimming range in kitchen during the site visit.]	[No response]
12	Dimmable feature	4	Other - "No excess heat given off."	No	"I notice a slight delay when the lights are turned on, but not enough to be an issue."	[No response]
13	Light quality			No		[No response]
14	Energy savings	Will last longer		Yes		"Some of the new bulbs caused a humming sound. I had to have RISE return and replace the problem bulbs."
15	Refused		[Cadmus note: The customer was overall dissatisfied with the way the new lights look and operate and is planning to switch back to halogen lighting. He did not feel this question was applicable.]	Yes		"The new lights flickered often and the color & temperature was not right for the room."
16	Energy savings	Will last longer		No	[Cadmus note: The customer answered "no" but had earlier mentioned one of the LED bulbs burning out.]	[No response]



Participant	C4. As a result of your experience with Cape Light Compact's Lighting Controls Initiative, have you changed the way you use lighting in this room?	C5. [If C4=yes] Please describe the changes you have made	C6. As a result of your experience with Cape Light Compact's Lighting Controls Initiative have you changed the way you use any other energy-using equipment in your home?	C6_Notes	C7. [If C6=yes] Please describe the changes you have made
1	No	[No response]	No	"We are already ahead of the curve in energy efficiency."	[No response]
2	No	[No response]	No		[No response]
3	Yes	"Often only need to use left row of lights because they are brighter." [There are two circuits/rows of lights in the room.]	No	"I did notice a drop in heat in the room, but haven't used the heat to make up for it."	[No response]
4	Yes	"We put more lights on at night because we're not as concerned about the electricity bill."	Yes		"I was motivated to buy more LEDs for use in other rooms."
5	No	[No response]	No		[No response]
6	Yes	"I have to keep the lights at about 75% all of the time, because of the performance issues below that. I am using less of the dimming feature than I would like to."	Yes		"Motivated to seek out LEDs for use in other rooms."
7	Yes	"The lights get dimmed more often instead of being fully on."	No	"Considering purchasing more LEDs for other rooms."	[No response]
8	Yes	"In the living room, we use the ceiling [dimnable] lights more now rather than the table lamps."	No		[No response]
9	Yes	"We often put them on a lower setting since the new bulbs are brighter."	No	"Considering purchasing more LEDs for other rooms."	[No response]
10	Yes	"We usually do not have to turn the lights all the way up now."	No		[No response]
11	Yes	"We are using the living room lights more because the light quality is better."	No		[No response]
12	No	[No response]	No		[No response]
13	No	[No response]	No	"May seek out LEDs for other rooms."	[No response]
14	No	[No response]	No		[No response]
15	No	[No response]	No		[No response]
16	No	[No response]	No		[No response]

Participant	D1. How likely would you be to recommend [CFL/LEDs] to a friend, family member, or colleague?	D1_Notes	D2. How likely would you be to recommend the lighting [dimmer] controls to a friend, family member, or colleague?	D2_Notes	D3. How likely would you be to recommend Cape Light Compact's Lighting Controls Initiative to a friend, family member, or colleague?	D3_Notes
1	Somewhat likely		Very likely		Very likely	
2	Very likely		Very likely		Very likely	
3	Very likely		N/A	[Cadmus note: This house did not have a dimmer control originally, so RISE did not install one.]	Very likely	
4	Very likely		Very likely		Very likely	
5	Very likely	"Would definitely recommend for non-dimmable applications."	Not too likely	"I don't think the dimming technology is where it needs to be to roll out a program like this quite yet."	Somewhat likely	"I would recommend it for those who have experimented with dimmers and realize they need to have realistic expectations for where the technology is."
6	Very likely		Not too likely		Somewhat likely	
7	Very likely		Very likely		Very likely	
8	Very likely		Somewhat likely		Very likely	
9	Very likely		Very likely	[Cadmus note: RISE did not change out any dimmer controls at this home.]	Very likely	
10	Very likely		Somewhat likely	[Cadmus note: RISE did not change out any dimmer controls at this home.]	Very likely	
11	Somewhat likely	"I will be very likely to recommend them as the price continues to come down."	Very likely		Somewhat likely	"Again, I would be more likely to recommend knowing the program would offer a variety of bulb sizes/styles."
12	Very likely		Very likely		Very likely	
13	Very likely		Very likely		Very likely	
14	Very likely		N/A	[Cadmus note: RISE did not change out any dimmer controls at this home.]	Somewhat likely	
15	Not too likely		Not too likely		Not too likely	"The program didn't really work for me. It may work for others based on the room they want changed and their aesthetic preferences. It would be great for commercial buildings. But I wouldn't recommend it based on my personal experience. The program is a good idea that just didn't pan out."
16	Somewhat likely	"I would recommend them with caution, and would suggest NOT putting these bulbs on dimmers."	Not too likely		Somewhat likely	"I would recommend it as a straightforward bulb retrofit program; I'm not sure I would recommend focusing on dimmers."



Participant	E1. How many years have you lived in this home?	E1_Notes	E2. What type of home is it?	E3. Including you, how many people live in your home on a full-time basis?	E4. Which of the following categories best describes your age? Is it...	E5. What are the best ways for you to receive information about energy-efficient options for your home?	E5_Notes
1	12		Detached single-family home	4	45 to 54; under 18	Email	
2	22		Detached single-family home	2	65 or over	Email, website	
3	12		Detached single-family home	5	35 to 44; under 18	Website	
4	23		Detached single-family home	3	18 to 24; 45 to 54	Bill insert, email	
5	12	"Twelve years full time, closer to thirty years as a part-time/vacation home."	Detached single-family home	2	65 or over	Other	"Still do work with CLC, tend to be pretty connected to their programs already."
6	21		Detached single-family home	3	55 to 64; under 18	Email	
7	40		Detached single-family home	2	65 or over	Email	
8	9		Detached single-family home	3	45 to 54; under 18	Email	
9	15		Detached single-family home	4	45 to 54; under 18	Email	
10	11		Detached single-family home	2	65 or over	Phone call from program rep; Email	
11	12		Detached single-family home	2	65 or over	Bill insert, email	
12	50		Detached single-family home	2	55 to 64; 65 or over	Website	
13	11		Detached single-family home	4	45 to 54; under 18	Email	
14	21		Detached single-family home	3	18 to 24; 45 to 54; 55 to 64	Email	
15	7	[Cadmus note: This is a part-time residence.]	Detached single-family home	2	45 to 54; 55 to 64	Email	
16	8		Detached single-family home	4	45 to 54; under 18	Email	