Energy Efficiency Website Program

Impact Evaluation

Reviewed for
Duke Energy
139 East Fourth Street
Cincinnati, OH 45201

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This study was conducted via a joint evaluation effort between Duke Energy and TecMarket Works. Duke Energy staff obtained the survey data and estimated the energy savings from the survey responses using the savings calculations developed by the TecMarket Works and Building Metrics analysis team.

TecMarket Works reviewed the survey data and the energy estimation approach to confirm the objectivity and accuracy of the savings estimates and adjusted the findings to account for self selection bias. This report provides the results of that evaluation collaboration.

Summary of Findings

Overall, customers are satisfied or very satisfied with the energy efficiency website (52.7% satisfied), energy efficiency kit (56.8% very satisfied), and the overall energy efficiency program (46.6% satisfied). Customers' reasons for visiting the site were most likely to learn how to reduce their energy costs or to obtain the energy efficiency kit. Suggestions for improving the energy efficiency website and overall program include having a website that is more adaptable to a particular customer's home characteristics, lifestyle and energy usage; making the website content more visible and transparent from the homepage; and add additional links to sections of the website to limit the need to move back through several webpages in order to click the next link in a list. Finally, customers would like to see additional tips and suggestions, and would also be interested in a do-it-yourself section for those customers who are more "handy" and could undertake more labor intensive energy saving measures on their own.

Customers were most likely to have installed the CFLs before receiving the energy efficiency kit, and were most likely to install the CFLs, along with the aerators, after receiving the energy efficiency kit. Customers were least likely to install the window shrink fit.

Of the actions and tips, customers were most likely to follow the "change your furnace filter" tip, although this item did not generate any savings. Customers were also more likely to manage their drapes in summer and winter, and lower their thermostat in winter for energy savings. The tips and actions customers were least likely to follow included installing a heat pump, installing dual heating, and installing doors on the fireplace.

Total savings for the energy efficiency kit installation and website tips and actions are presented in the table below, along with final savings. Total final savings accounting for freeridership and website usefulness are 138.71 kW; 1,253,297 kWh; and 38,152.1 Therm.

Table 1. Final Total Energy Efficiency Savings

	kW	kWh	Therm
Kit Savings	11.88	137,469	5479.2
Actions/Tips Savings	126.83	1,115,828	32,672.9
Total Savings	138.71	1,253,297	38,152.1

Recommendations

1. If cost considerations arise, consider offer kits to site visitors that fit into specific market segments that are more likely to install the kit's measures as the web site becomes more popular. Key demographics can be pinpointed using the information collected for this report.

2. Participation can be increased through advertising of the website. This can be done through bill inserts, targeted emails, or external advertising (radio, TV, newspapers).

Introduction

This document evaluates Duke Energy's Energy Efficiency website program, as administered in Ohio. The program provides energy savings tips through a website and allows the customer to request an energy efficiency starter kit. The program manager is responsible for looking at weekly activity on the website, and submits all requests for the energy efficiency kits to the vendor, and also verifies that the requests are from customers that are eligible to receive a kit.

The evaluation stems from a web-based survey emailed to customers who visited the Duke Energy Efficiency website and requested an energy efficiency kit. The report is divided into four sections: the overall website program, energy efficiency kit measures, installations and repairs made from website tips, and actions taken as a result of website tips.

One aspect of visiting the Energy Efficiency website is using the Home Energy Calculator. The Home Energy Calculator allows customers to input specific information about their home and read an output describing their energy usage. Customers can change their selections on the calculator to determine how lifestyle or technology changes could affect their energy usage. After using the Home Energy Calculator, customers see a link to request an energy efficiency kit to be sent to their home. Customers that used the Home Energy Calculator and then requested the energy efficiency kit were solicited for the online survey.

In the survey, customers were asked to describe their use of the measures from the energy efficiency kit and indicate which measures they installed. Customers were also asked questions regarding appliances they may have purchased, installations/repairs they may have made, or actions they may have taken after reading tips on the website. Customers were also asked questions to determine their overall satisfaction with the Energy Efficiency website and the Energy Efficiency website program.

The survey was developed by Duke Energy, using a sample survey provided by TecMarket Works, as well as a previous Duke Energy Energy Efficiency website survey used in Kentucky. The survey was administered by Duke Energy using an online survey host. Duke Energy also collected and analyzed the data, with assistance from Integral Analytics. TecMarket Works reviewed and approved the final evaluation written by Duke Energy.

Methodology

Survey

The online customer surveys were developed from a sample survey developed by TecMarket Works, as well as a previous Energy Efficiency website survey developed by

Duke Energy for use in Kentucky. The survey asked customers a series of questions about each of the items the customer received in the energy efficiency kit to determine how the customer has used the item as well as to determine energy savings as a result of using of the item. The survey also asks customers about any new appliances or installations they may have added to their home as a result of visiting the website and reading the energy efficiency tips. Customers were asked not only if they have installed the item, but also how influential the website was in their decision to install the item. Customers were asked similar questions about any actions they may have taken as a result of reading the energy efficiency tips on the website (such as managing their drapes or lowering their thermostat). Finally, the survey asked questions regarding the website content (including the Home Energy Calculator) as well as overall satisfaction with the Energy Efficiency website. The survey questions are found in a separate document, entitled "Appendix A. Energy Efficiency Website Survey".

Once the survey content was finalized, the survey and skip patterns were coded into Sawtooth software[1]. The survey was then uploaded to be emailed using silverPOP[2]. A random sample of 1000 customers who visited the website and requested the energy efficiency kit was obtained. The customers in the sample were emailed a link and a passcode which would allow them to access the online survey. The survey was "live" online and able to accept customer input for 14 consecutive days.

Survey Response

The survey access information was successfully emailed to 932 customers out of 2,613 that received the energy efficiency kits from September 2007 through end of June 2008, after bounce-backs, duplicates, etc. were removed. 154 surveys were returned, for a 16.5% response rate.

Data Analysis

The survey data was obtained from the software and cleaned and coded into SPSS[3] and Microsoft Excel.

Impact Estimation

Impacts were estimated using survey responses using engineering algorithms developed by TecMarket Works and BuildingMetrics for the Kentucky Personalized Energy Report (PER) impact evaluation. The Kentucky PER offers an identical energy efficiency kit as a part of the program, and the energy efficiency tips offered on the website are similar to those offered by the PER, so the Energy Efficiency kit impacts as well as the impacts of utilizing the tips and taking the actions recommended on the website are calculated directly using the algorithms developed by the TecMarket Works/BuildingMetrics Team and customer characteristics and responses from the Energy Efficiency website survey.

[1] Sawtooth Software SSI Web version 6.
[2] silverPOP Marketer, version 7.
[3] Statistical Package for the Social Sciences, version 15.0.

The engineering algorithms developed by the TecMarket Works/BuildingMetrics Team are described in Appendix B, which is a separate document entitled "Appendix B. Impact Estimation Algorithms". The algorithms use DOE-II residential software modeling algorithms and location-based weather data[4].

[4] The weather data found in the Appendix references the city of Covington, KY for local weather data. This location is used for all local area weather data for Ohio and Kentucky and is an accurate source for weather data in the Ohio and Kentucky service territories.

Overall Website Program Satisfaction

Customers were asked to assess their overall experiences with the content of the Energy Efficiency website by answering questions both at the beginning and end of the survey. Overall, only 3.9% of customers did not recall visiting the Energy Efficiency website to request the energy efficiency kit. Reasons for not recalling receipt of the energy efficiency kit may be that the customer who received the survey was not the same person who installed the energy efficiency kit in their home, or that the customer did not request the energy efficiency kit. Customers who responded that they do not recall their visit to the website were directed by a skip pattern to answer only the Home Profile Questions at the end of the survey.

Do recall visiting the Duke Energy website to request an energy efficiency kit?

Yes	No	Total
148	6	154
96.1%	3.9%	100.0%

Overall Motivations

Motivations for visiting the website included wanting to reduce energy costs or to receive the energy efficiency kit offered (56.8% and 50.7%, respectively). The least motivating factor for consumers was recommendations from other utility programs (0.7%), followed closely by advertisement in newspaper and past experience with another Duke Energy program (2%). Other motivating factors that customers listed included other forms of advertisement (television, booth at an event/fair, another website) and wanting to "be green". Although the percentages for these other responses are also small compared to the most highly motivating factors, Duke Energy may want to consider addressing other forms of advertisement, as well as the other environmentally-related advantages of participating in the program to the consumer, besides reducing energy costs.

What factors motivated you to visit this site and request the energy efficiency kit?

Motivation	Motivating factor	Non-Motivating factor	Total
The energy efficiency kit offered	75	73	148
	50.7%	49.3%	100.0%
Wanted to reduce energy costs	84	64	148
	56.8%	43.2%	100.0%
The information provided by the website	32	116	148
	21.6%	78.4%	100.0%
Because of past experience with another Duke Energy program	3	145	148
	2.0%	98.0%	100.0%

Recommendation from other utility programs	1	147	148
	.7%	99.3%	100.0%
Recommendation of family/friend/neighbor	43	105	148
	29.1%	70.9%	100.0%
Advertisement in newspaper	3	145	148
	2.0%	98.0%	100.0%
Radio advertisement	2	146	148
	1.4%	98.6%	100.0%
Information from my bill	26	122	148
	17.6%	82.4%	100.0%
Don't know	4	144	148
	2.7%	97.3%	100.0%

Other motivating factors for visiting the website and requesting the energy efficiency kit:

Motivation	Count	Col %
None	145	94.2%
Another website	2	1.2%
Wanted to give as a gift	1	.6%
Interested in alternative energy/ sustainability/"being green"	3	1.8%
School project	1	.6%
Speaking of Women's Health booth info	1	.6%
Television program	1	.6%
Total	154	100.0%

Usefulness of Website Components

Customers overwhelmingly rated the usefulness of the Energy Efficiency website's information about energy use in their home at a 3 or above on a 5-point scale, with 68.3% of customers rating the Energy Efficiency website at a 4 or above in this category. The component of the website customers were least likely to visit was the "For Kids" section, while customers were most likely to visit the Home Energy Calculator, which was expected given that customers had to use the Home Energy Calculator in order to request the energy efficiency kit. Interestingly, however, only 86.5% of customers recall visiting the Home Energy Calculator, suggesting that customers may not associate the name "Home Energy Calculator" with the web tool they used to request their energy efficiency kit. The next most visited portion of the website was the Appliance Calculator, with 77.0% of customers visiting that component of the website.

The component of the website customers found the most useful were the Home Energy Calculator and the Appliance calculator (both 23.0% "very useful"). Most of the time, customers rated a component of the website they visited at least "somewhat useful" but not as high as "very useful".

Overall, how useful was the website in providing you with information about energy use in your home?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
0	4	43	60	41	148
.0%	2.7%	29.1%	40.5%	27.7%	100.0%

Which components in the website did you review and how useful were they?

Component	Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Did Not Visit	Total Visits to Component	Total
Home energy calculator	2	4	43	45	34	20	128	148
	1.4%	2.7%	29.1%	30.4%	23.0%	13.5%	86.5%	100.0%
Appliance calculator	2	5	42	31	34	34	114	148
	1.4%	3.4%	28.4%	20.9%	23.0%	23.0%	77.0%	100.0%
Lighting calculator	2	3	32	41	33	37	111	148
	1.4%	2.0%	21.6%	27.7%	22.3%	25.0%	75.0%	100.0%
Interactive home	3	13	31	29	15	57	91	148
	2.0%	8.8%	20.9%	19.6%	10.1%	38.5%	61.5%	100.0%
Energy library: Home energy system	4	9	24	36	10	65	83	148
	2.7%	6.1%	16.2%	24.3%	6.8%	43.9%	56.1%	100.0%
Energy library: Fundamentals of electricity	6	6	27	31	9	69	79	148
	4.1%	4.1%	18.2%	20.9%	6.1%	46.6%	53.9%	100.0%
For kids	17	6	17	11	3	94	54	148
	11.5%	4.1%	11.5%	7.4%	2.0%	63.5%	36.5%	100.0%

Home Energy Calculator Usefulness and Satisfaction

In order to receive the energy efficiency kit as a part of the website program, customers had to visit and use the Home Energy Calculator on the website. Customers were asked in more detail about their visit to the Home Energy Calculator. Most customers stated that they looked at the Home Energy Calculator report details and felt that the details reasonably reflected their usage. Similarly to the component as a whole, a majority of customers rated the Home Energy Calculator report at least somewhat useful, but not as

high as "very useful".

Did you look at the Home Energy calculator report details?	Yes	No	Total
	114	14	128
	89.1%	10.9%	100.0%
Did you feel that the estimate from the home energy calculator reasonably reflected your usage?	Yes	No	Total
	95	19	114
	83.3%	16.7%	100.0%

Was the [Home Energy Calculator] report very useful?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
4	5	44	37	24	114
3.5%	4.4%	38.6%	32.5%	21.1%	100.0%

Overall Website Usefulness and Satisfaction

Overall, customers found the Energy Efficiency website easy to navigate to get the information they wanted. Even so, a few customers had recommendations to make the energy efficiency website better. In general, the suggestions included content more generalized to the user, and some website navigation changes. These changes should be taken into consideration as future website upgrades and content updates are made.

Was the site easy to navigate to get to the information you wanted?

Yes	No	Total
142	6	148
95.9%	4.1%	100.0%

What changes would you recommend to make the site better? (Responses are summarized)

Changes	Count	%
None	150	87.00%
Relate site content directly to customers' energy consumption; inform how much energy each appliance/light is using each month.	1	0.60%
Links to programs across submenus; remove need to return to main menu and enter another submenu to find a	1	0.60%

different program		
More information with specific tips and actions to be taken.	1	0.60%
Would prefer highly visible navigator at Home Page.	1	0.60%
Total	154	100.00%

Overall, the website does a "satisfactory" job of causing consumers to take energy conservation actions that had not occurred to them in the past (41.2% rated the website as between "somewhat" and "very effective"), and over half of customers give the website a 4 or above (on a 5-point scale) in this category. Additionally, over half of customers stated that the website was "very effective" in confirming actions they had already taken were the correct thing to do. This suggests that the current Energy Efficiency website contains a good mix of tips and suggestions that customers have heard of through other sources of information and can confirm on Duke Energy's website, as well as tips that customers are interested in implementing but may not have heard of in the past.

Overall, how much did the website alone cause you to take energy conserving actions that you had not thought of prior to visiting the site?

Not at All 1	2	Somewhat 3	4	Very Much 5	Total
10	12	50	61	15	148
6.8%	8.1%	33.8%	41.2%	10.1%	100.0%

If you had energy conserving actions that you did before visiting the website, how effective was the website in confirming that these actions were the correct thing to do?

N/A	Not at all Effective 1	2	Somewhat 3	4	Very Effective 5	Total
3	4	2	19	46	74	148
2.0%	2.7%	1.4%	12.8%	31.1%	50.0%	100.0%

Did the website inspire you to take these actions sooner?

Yes	No	No, but plan to	N/A	Total
106	33	5	1	145
73.1%	22.8%	3.4%	.7%	100.0%

Customers found the kit to be similar in usefulness to the website, stating that the kit was between "somewhat" and "very much" an influence in customers taking actions they had not thought of in the past. Looking at the installation rates of the kit items in more detail

in the next section will determine which items consumers have most frequently not installed in the past, but did implement after receiving the kit.

How much did the addition of the kit cause you to take energy conserving actions that you had not thought of prior to visiting the site?

Not at All 1	2	Somewhat 3	4	Very Much 5	Total
6	8	33	60	41	148
4.1%	5.4%	22.3%	40.5%	27.7%	100.0%

Overall Satisfaction with Energy Efficiency website and kit

Overall, half of customers strongly agreed that the items from the energy efficiency kit were of satisfactory quality, while over 80% of consumers rated the kit items at a 4 or above.

The items I installed from the energy efficient website were of satisfactory quality?

Strongly Disagree 1	2	Somewhat 3	4	Strongly Agree 5	Total
4	3	15	52	74	148
2.7%	2.0%	10.1%	35.1%	50.0%	100.0%

Overall, a majority of the customers were satisfied with both components of the Energy Efficiency website program, as well as the overall energy efficiency program itself. The energy efficiency kit received the most "very satisfied" ratings, at 56.8%. The most frequent rating for the Energy Efficiency website was a 4 (52.7%), while the most frequent rating for the overall program was also a 4 (46.6%).

Overall, how satisfied are you with the following?

	Not Satisfied 1	2	Somewhat 3	4	Very Satisfied 5	Total
Energy efficiency website	3 2.0%	3 2.0%	26 17.6%	78 52.7%	38 25.7%	148 100.0%
Energy efficiency kit	4 2.7%	3 2.0%	14 9.5%	43 29.1%	84 56.8%	148 100.0%
Overall energy efficiency program	3 2.0%	1 .7%	21 14.2%	69 46.6%	54 36.5%	148 100.0%

If a customer answered three or below for the website, kit, or program, they were asked to state why they were not satisfied and to identify additional factors that may make the website more useful or helpful to customers. They were also asked to state, overall, any

additional comments they had. Many customers had multiple comments/suggestions.

Please explain why you were not satisfied:

Comment	Count
Already knew website tips/website recommendations are common sense	3
Actions described on website I have already taken or do not apply to me	1
Availability of products described on site not in store	1
Kit items were broken/ kit was of unsatisfactory quality	7
Kit never received	3
Didn't like kit items	3
Website too general with actions/tips	2
Website layout is awkward or confusing	2
N/A	2

Please let us know if you have any additional comments:

Comments
Update the website with an advanced DIY section for those who are handy or have technical skills
Great program
I am interested in other programs Duke offers
Provide a list of companies who offer home energy audits
No comments

Energy Efficiency Kit Measures

The energy efficiency kit the customer received contained the following items to install:

- energy efficient showerhead,
- kitchen faucet aerator,
- bathroom faucet aerator,
- 15W mini compact fluorescent bulb,
- 20W mini compact fluorescent bulb,
- weather stripping,
- window shrink fit kit, and
- insulating gaskets for outlet boxes or wall switches.

Customers were asked if they had installed any of the measures included in the kit before visiting the website and receiving their kit. The most common items that customers had previously installed were the 15W and 20W bulbs (62.8% and 60.8%), while half of customers requesting the kit had installed weather stripping in the past. The higher incidence of CFL bulbs being installed previously compared to other items suggests more frequent exposure to CFLs as an energy saving item, whether through Duke Energy's EnergyStar programs or other information resources.

Table 2. Frequency of kit item pre-installation.

	Yes	No	Total
Energy efficient (low flow) showerhead	58 39.2%	90 60.8%	148 100.0%
Kitchen faucet aerator	65 43.9%	83 56.1%	148 100.0%
Bathroom faucet aerator	47 31.8%	101 68.2%	148 100.0%
15 Watt mini compact fluorescent lights	93 62.8%	55 37.2%	148 100.0%
20 Watt mini compact fluorescent lights	90 60.8%	58 39.2%	148 100.0%
Weather stripping	74 50.0%	74 50.0%	148 100.0%
Window shrink fit	25 16.9%	123 83.1%	148 100.0%
Insulating gaskets on outlet boxes or wall switches	56 37.8%	92 62.2%	148 100.0%

Installation of Kit Items

The following sections describe the installation and related savings for each kit item. As mentioned previously, savings are calculated using the engineering algorithms developed for the KY Energy Efficiency website and KY Personalized Energy Report programs. The table below summarizes the kit installations made by customers who visited the website. The most frequently installed item was the 15W bulb, followed by the 20W bulb, and the kitchen faucet aerator. The least installed item was the window shrink fit, with almost half of customers not installing. Most customers who planned to install items later planned to install the weather stripping or the insulating gaskets.

Table 3. Frequency of kit item installation.

	Yes	No	No, but plan to	N/A	Total
Energy efficient (low flow) showerhead	78 52.7%	35 23.6%	31 20.9%	4 2.7%	148 100.0%
Kitchen faucet aerator	89 60.1%	27 18.2%	25 16.9%	7 4.7%	148 100.0%
Bathroom faucet aerator	74 50.0%	35 23.6%	30 20.3%	9 6.1%	148 100.0%
15 Watt mini compact fluorescent lights	121 81.8%	7 4.7%	15 10.1%	5 3.4%	148 100.0%
20 Watt mini compact fluorescent lights	118 79.7%	8 5.4%	17 11.5%	5 3.4%	148 100.0%
Weather stripping	58 39.2%	38 25.7%	40 27.0%	12 8.1%	148 100.0%
Window shrink fit	30 20.3%	71 48.0%	32 21.6%	15 10.1%	148 100.0%
Insulating gaskets on outlet boxes or wall switches	73 49.3%	24 16.2%	40 27.0%	11 7.4%	148 100.0%

Kit Item Savings

Savings for kit items were calculated using the impact algorithms mentioned previously in the report. Savings were calculated for each install of the kit items that qualified for savings for that measure, taking into account HVAC characteristics and characteristics of the kit item installed. The estimated total savings for each of the kit items are described below.[5] Final savings are described in the summary table later in the report.

Low-Flow Showerhead

52.7% of customers installed the low-flow showerhead. For a majority of customers, 5 to 15 showers are taken per week using the low-flow showerhead, with most customers stating they take between 5 and 10 showers per week. Customers who stated they take zero showers per week were not included in the savings calculations. A majority of customers state that the length of their showers is about the same as before installing the low-flow unit. Nearly 75% of customers who installed the showerhead state that they were not planning on installing a low flow showerhead before receiving the kit, suggesting the showerhead is a useful kit item that generates new energy savings for the customer.

[5] Savings for the four customers who installed the dual heating system were not calculated due to lack of detail.

Installed Showerhead		
Yes	78	52.7%
No	35	23.6%
No, but plan to	31	20.9%
N/A	4	2.7%
Total	148	100.0%
Number of Showers		
0-4	10	12.8%
5-10	29	37.2%
11-15	26	33.3%
16-20	6	7.7%
21+	7	9.0%
Total	78	100.00%
Length of Showers		
Longer	4	5.1%
Shorter	8	10.3%
About the same	66	84.6%
Total	78	100.0%
Were you already planning on installing an energy efficient (low flow) showerhead before you visited the website to get your free kit?		
Yes	16	20.5%
No	58	74.4%
No, already have them installed in all showers	4	5.1%
Total	78	100.0%

Energy savings are presented below. Overall, installation of the showerhead created a total savings of over 15000 kWh and over 1300 therm. A savings of 1.72 kW was also realized. On average, the installations of this item produced first-year savings of 207.04 kWh and 17.46 Therm per install.

Table 4. Low Flow Showerhead Savings

Low-Flow showerhead	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	76	1.72	15734.87	1327.27
Mean (per install)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.02	207.04	17.46

Most customers (88.5%) have not purchased any additional energy efficient showerheads since receiving the kit from the website. Of those that have, two thirds have purchased 2 showerheads, while one third of customers have purchased 1 showerhead. The frequency

of additional showerhead purchases is likely to be dependent on the number of showers in the customer's home.

Have you purchased any additional energy efficient (low flow) showerheads since receiving the kit from the website?		
Yes	9	11.5%
No	69	88.5%
Don't know	0	0.0%
Total	78	100.0%
How Many?		
1	6	66.7%
2	3	33.3%
Total	9	100.0%

Kitchen and Bathroom Faucet Aerators

Of the customers who installed the kitchen faucet aerator, just over half of customers stated they had to remove an aerator to install the new one (50.6%), while just under half of customers installing the bathroom aerator had to remove an old one (47.3%). Most of these customers that installed both the kitchen and bathroom faucet aerators stated the aerators were working well when they removed them. About half of customers stated the amount of water coming out of either new aerator was less than the old unit (53.3% kitchen, 57.1% bathroom).

Was there an aerator on your faucet you had to remove?			
Kitchen Aerator	Yes	45	50.6%
	No	44	49.4%
	Total	89	100.0%
Bathroom Aerator	Yes	35	47.3%
	No	39	52.7%
	Total	74	100.0%
Was the old aerator working well when you removed it?			
Kitchen Aerator	Yes	33	73.3%
	No	12	26.7%
	Total	45	100.0%
Bathroom Aerator	Yes	26	74.3%
	No	9	25.7%
	Total	35	100.0%
Would you estimate that the amount of water coming through the new aerator is:			
Kitchen Aerator	Less than the old unit	24	53.3%
	About the same	17	37.8%

	More than the old unit	4	8.9%
	Total	45	100.0%
Bathroom Aerator	Less than the old unit	20	57.1%
	About the same	15	42.9%
	More than the old unit	0	0.0%
	Total	35	100.0%

A high majority of customers were not planning on installing a faucet aerator before receiving the kit, suggesting that customers were either satisfied with the aerator they already had, or had not considered an aerator as an energy efficiency item.

Were you already planning on installing a new faucet aerator before you visited the website?			
Kitchen Aerator	Yes	14	15.7%
	No	73	82.0%
	No, already have them installed in all available faucets	2	2.2%
	Total	89	100.0%
Bathroom Aerator	Yes	6	8.1%
	No	67	90.5%
	No, already have them installed in all available faucets	1	1.4%
	Total	74	100.0%

For both the kitchen and bathroom aerators, installations for which the customer had to remove an old aerator to install the new aerator are not counted in the energy savings estimates, unless the customer stated that the old aerator was not working well. Customers who had installed an aerator previously are included in the calculation, as long as they did not have to remove an aerator to install the new one. Overall, total first-year energy savings for the aerators are over 1600 kWh and about 90 Therm.

Table 5. Aerator Savings

	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
Kitchen Aerator	53	0.01	946.92	43.19
Bathroom Aerator	47	0.009	757.54	46.52
Mean (per install)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
Kitchen Aerator		0.0002	17.87	0.81
Bathroom Aerator		0.0002	16.12	0.99

Nearly all customers have not purchased additional kitchen faucet aerators since visiting the website. This may reflect that many kitchens only have one faucet. In addition, less

than 18% of customers have purchased additional bathroom faucet aerators since receiving the kit from the website.

Have you purchased any additional kitchen faucet aerators since receiving the kit from the web site?		
Yes	2	2.3%
No	84	96.6%
Don't Know	1	1.1%
Total	87	100.0%
How many kitchen faucet aerators?		
1	1	50.0%
3	1	50.0%
Total	2	100.0%
Have you purchased any additional bathroom faucet aerators since receiving the kit from the website?		
Yes	13	17.6%
No	61	82.4%
Total	74	100.0%
How many bathroom faucet aerators?		
1	6	46.2%
2	6	46.2%
3	1	7.7%
Total	13	100.0%

15W and 20W Mini CFL Light Bulbs

The tables below describe customers who installed the 15 and 20 watt CFL bulbs included in the kit. Customers installing the 15W and 20W CFL bulb from the kit most frequently removed a 45-70W bulb. Customers who installed the 15W bulb stated the bulb was used 5-10 hours per day (51.2%), and was still in place (97.5%). Customers installing the 20W bulb stated that they use the bulb 5-10 hours per day (48.3%) and that the bulb is still in place (94.1%).

15W CFL		
Wattage of bulb removed		
<= 44	7	5.8%
45 – 70	70	57.9%
71 – 99	28	23.1%
>= 100	16	13.2%
Total	121	100.0%
Hours of Use per Day		

1-2	17	14.1%
3-4	32	26.4%
5-10	62	51.2%
11-12	2	1.7%
13-24	8	6.6%
Total	121	100.0%
Is the 15W CFL still in place?		
Yes	118	97.5%
No	3	2.5%
Total	121	100.0%

20W CFL		
Wattage of bulb removed		
<= 44	4	3.4%
45 – 70	52	44.1%
71 – 99	34	28.8%
>= 100	28	23.7%
Total	118	100.0%
Hours of Use per Day		
1-2	17	14.4%
3-4	37	31.4%
5-10	57	48.3%
11-12	3	2.5%
13-24	4	3.4%
Total	118	100.0%
Is the 20W CFL still in place?		
Yes	111	94.1%
No	7	5.9%
Total	118	100.0%

Savings calculations for the 15 and 20 watt CFL bulbs are presented below. Customers who have removed the bulb are not included in the savings calculations. The total savings for the 15W CFL are nearly 12,300 kWh, while the total savings for the 20W CFL are just over 11,700 kWh.

Table 6. CFL Savings

15W CFL	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	102	0.56	12287.71	-17.94
Mean (per install)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.0055	120.47	-0.18
20W CFL	Number	Total kW Savings	Total kWh Savings	Total Therm Savings

	of Installs			
	95	0.58	11709.42	-17.63
Mean (per install)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.0061	123.26	-0.19

Overall, about 60% of customers were planning on purchasing a CFL before they received the kit from the website. Customers who installed the 15W CFL stated that they were most frequently planning on purchasing 6-10 CFL bulbs, while customers installing the 20W stated they were planning on purchasing 3-5 bulbs.

15W CFL: Were you already planning on purchasing a CFL before you received the kit from the website?		
Yes	77	63.6%
No	41	33.9%
No, already have them installed in all available sockets	3	2.5%
Total	121	100.0%
How many were you planning on purchasing?		
1-2	4	5.2%
3-5	23	29.9%
6-10	33	42.9%
11+	17	22.0%
Total	77	100.0%

20W CFL: Were you already planning on purchasing a CFL before you received the kit from the website?		
Yes	70	59.3%
No	42	35.6%
No, already have them installed in all available sockets	6	5.1%
Total	118	100.0%
How many were you planning on purchasing?		
1-2	7	10.0%
3-5	32	45.7%
6-10	22	31.4%
11+	9	12.9%
Total	70	100.0%

Additional CFLs:

Customers were also asked if they had purchased and installed any additional CFLs since installing the bulbs from the kit. Almost two-thirds of customers stated they had purchased and installed additional bulbs, with most customers purchasing and installing 6-10 bulbs. This statement is similar to the bulbs that customers estimated they were planning on purchasing before they received the energy efficiency kit. The statistics for number of bulbs purchased and hours of use are also similar to those of the kit bulbs installed. Finally, most customers did not install the additional CFLs as a part of a major renovation to their home.

Have you purchased and installed additional CFLs since receiving the kit from the website?		
Yes	84	71.2%
No	33	28.0%
Don't know	1	0.8%
Total	118	100.0%
How many did you purchase?		
1-2	11	13.1%
3-5	21	25.0%
6-10	52	61.9%
11+	0	0.0%
Total	84	100.0%
Wattage of bulb removed		
<=44	5	6.0%
45-70	41	48.8%
71-99	28	33.3%
>=100	10	11.9%
Total	84	100.0%
Hours of Use per Day		
1-2	8	9.5%
3-4	16	19.0%
5-10	50	59.5%
11-12	3	3.6%
13-24	7	8.4%
Total	84	100.0%
Did you do this as part of a major renovation of your home?		
Yes	15	17.9%
No	69	82.1%
Total	84	100.0%

Weather Stripping

Customers were asked to list the feet of weather stripping used and number of doors the weather stripping was installed on. Customers who installed the weather stripping and

stated feet used most of the roll (68.6%), and those who stated number of doors most frequently used it on one door. Some customers stated both feet and doors.

How many feet of the 17 feet of weather stripping did you use?		
0	2	3.9%
1-5	6	11.8%
6-10	8	15.7%
11-17	35	68.6%
Total	51	100.0%
How many doors did you install the weather stripping on?		
0	2	4.5%
1	28	62.2%
2	12	26.7%
3	1	2.2%
4	1	2.2%
10	1	2.2%
Total	45	100.0%

Savings were estimated using feet of weather stripping used. When customers listed only number of doors, the average feet installed per door by customers who listed both feet and doors was used to estimate the number of feet used. Total savings for weather stripping were over 600 kWh and nearly 10 Therm.

Table 7. Weather Stripping Savings

Weather Stripping	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	51	0.18	607.45	9.47
Mean (per install)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.0035	11.91	0.19

Customers were divided almost equally regarding whether or not they had planned on installing weather stripping before receiving the weather stripping in the kit. Exactly half of customers stated “yes”, while 48.3% stated “no”. 1.7% of customers had a qualified “no” response, stating that they were not planning to install because weather stripping was already installed on all doors.

Two thirds of customers (66.7%) stated that they have not purchased any additional weather stripping since installing the weather stripping from the kit. Those that did purchase additional tended to purchase between 1 and 20 feet, and installed it on one door.

Were you already going to install weather stripping before you visited the website?		
Yes	29	50.0%
No	28	48.3%

No, already have them installed around all available doors	1	1.7%
Total	58	100.0%
Have you purchased any additional weather stripping since receiving the kit from the website?		
Yes	19	33.3%
No	38	66.7%
Total	57	100.0%
Feet		
1-20	8	44.5%
21-40	4	22.2%
41-60	6	33.3%
Total	18	100.0%
Doors		
1	5	35.7%
2	4	28.6%
3	3	21.4%
4	2	14.3%
Total	14	100.0%

Window Shrink Fit

Window characteristics of customers installing the window shrink fit kit are described below. Nearly two thirds of customers installing the kit (63.3%) installed the shrink kit on an average sized window. This window was likely to be a double pane window, with over half of customers listing this window type (53.3%).

Size of window		
Small	7	23.3%
Average	19	63.3%
Large	4	13.3%
Total	30	100.0%
Type of window		
Single pane window	8	26.7%
Single pane window w/ storm	6	20.0%
Double pane window	16	53.3%
Total	30	100.0%

Customer savings for installing the window shrink fit kit are below. Total savings were over 650 kWh and over 4 Therm .

Table 8. Window Shrink Fit Savings

Window Shrink Fit	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	26	0.34	675.14	4.71
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.01	25.97	0.18

Customers were almost equally divided regarding whether or not they were planning on installing a window shrink fit kit previously, with slightly fewer customers saying they had been planning on installing a kit. Customers who did plan on installing a kit previously were planning to install it most frequently on one to two windows. Two-thirds of customers who installed the window kit have not purchased additional kits since installing the kit they received from the website, suggesting that customers who had not been planning on installing shrink fit before were not always persuaded to use additional kits after installing the shrink fit they received from the website.

Were you already planning to install a window shrink fit kit before you visited the website?		
Yes	14	46.7%
No	16	53.3%
No, already have them installed in all available windows	0	0.0%
Total	30	100.0%
For how many windows?		
1-2	5	35.7%
3-4	2	14.3%
5-6	2	14.3%
7-8	2	14.3%
9-10	3	21.4%
Total	14	100.0%
Have you purchased additional window shrink fit kits since receiving the kit from the website?		
Yes	10	33.3%
No	20	66.7%
Total	30	100.0%
For how many windows?		
1-2	1	10.0%
3-4	5	50.0%
5-6	1	10.0%
7-8	1	10.0%
9-10	2	20.0%

Total	10	100.0%

Insulating Gaskets

Customers received 8 gaskets in the energy efficiency kit. Most customers installed 1-2 gaskets (40.0%), but nearly all the customers installed the majority of gaskets received in the energy efficiency kit.

Number Installed		
1-2	26	40.0%
3-4	20	30.8%
5-6	14	21.5%
7-8	5	7.7%
Total	65	100.0%

Total savings for the gaskets are listed below, and include over 650 kWh savings and over 10 Therm savings.

Table 9. Insulating Gaskets Savings

Insulating Gaskets	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	64	0.23	658.65	13.18
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.0011	3.06	0.06

Over half of customers (57.5%) had not been planning on installing gaskets before visiting the website, suggesting that this item is useful for customers who are looking for new/additional ways to create energy savings. However, a majority of customers (80.6%) have not purchased any insulating gaskets since receiving the energy efficiency kit. Those that did purchase more purchased 10 in most cases, suggesting they were purchasing enough gaskets to use on the remaining outlets in their home.

Were you already planning on installing gaskets before visiting the website?		
Yes	25	34.2%
No	42	57.5%
No, already have them installed in all available outlets	6	8.2%
Total	73	100.0%
Have you purchased any additional insulating gaskets since receiving the kit from the website?		

Yes	13	19.4%
No	54	80.6%
Total	67	100.0%
How many did you purchase?		
4	1	7.7%
5	1	7.7%
10	11	84.6%
Total	13	100.0%

Website Tips – Installation and Repairs

The Energy Efficiency website also lists tips and suggestions for customers to install energy efficient items in their home, or to repair existing items to help them save energy. The most frequently installed or repaired item after visiting the website was the furnace filter (75% "yes"), while the least frequent install or repair was to install a heat pump (87.8% "no"). Customers were most likely to say they plan to install attic insulation at a later date (8.1%).

Table 10. Frequency of Installation or Repair
Have you installed any of the following since visiting the website?

	Yes	No	No, but plan to	N/A	Total
Natural gas furnace	2	127	3	16	148
	1.4%	85.8%	2.0%	10.8%	100.0%
Heat pump	4	130	4	10	148
	2.7%	87.8%	2.7%	6.8%	100.0%
Central air conditioning	5	123	4	16	148
	3.4%	83.1%	2.7%	10.8%	100.0%
Insulated sidewalls	6	129	1	12	148
	4.1%	87.2%	.7%	8.1%	100.0%
Attic insulation	12	112	12	12	148
	8.1%	75.7%	8.1%	8.1%	100.0%
Heating or cooling duct insulation	6	122	7	13	148
	4.1%	82.4%	4.7%	8.8%	100.0%
Repaired or fixed holes in heating or cooling ducts	25	103	4	16	148
	16.9%	69.6%	2.7%	10.8%	100.0%
Furnace filter replacement	111	25	6	6	148
	75.0%	16.9%	4.1%	4.1%	100.0%
New refrigerator	17	114	8	9	148
	11.5%	77.0%	5.4%	6.1%	100.0%

Install New Furnace

Customers who installed a new furnace were asked to describe the characteristics of the furnace they installed. The two customers who installed a new furnace stated the exhaust exits out a plastic pipe in the side of the home. In addition, neither customer stated that they installed the furnace as a major renovation of their home.

While one customer stated the website was very useful in helping them to decide whether to install the furnace, the other customer stated that the website was not at all useful because they did not reference the website when deciding to install the furnace.

Furnace Characteristics		
the exhausts exit out a plastic pipe coming through the side of the home	2	100.0%
the exhausts go up a chimney similar to a standard efficiency unit	0	0.0%
Total	2	100.0%
Did you do this as part of a major renovation of your home?		
Yes	0	0.0%
No	2	100.0%
Total	2	100.0%

How useful was the website in determining whether or not to install a high efficiency unit in your house?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
1	0	0	0	1	2
50.0%	.0%	.0%	.0%	50.0%	100.0%

Please explain why you did not find the website very useful in determining whether to install a high efficiency unit in your house?

I did not find any information about this on the website.	The information I found on the website about this was unclear	The information I found on the website about this was not the information I needed to make a decision	Other	Total
0	0	0	1	1
.0%	.0%	.0%	100.0%	100.0%

Other – Please Explain:

Comment	Count	Total

I did not look at this information on the website	1	100.0%

Total savings were calculated for the two customers who installed the furnace using the data above. Total savings were 37.6 Therm, while mean savings were 18.8 Therm.

Table 11. New Furnace Savings

Install New Furnace	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	2	None	None	37.60
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		None	None	18.80

Install New Heat Pump

Of the four customers stating they installed a heat pump after visiting the website, two customers stated the heat pump was high efficiency, while two customers stated the heat pump installed was standard efficiency. Three of the four customers did not know the SEER number of their heat pump. In addition, no customers installed the heat pump as a part of a major renovation of their home.

Half of customers stated that the Energy Efficiency website was not useful in deciding to install the heat pump, while one customer stated it was minimally useful, and another stated the site was very useful. The customers who did not find the website useful stated they either did not look at the website, or they did not find information about heat pumps on the website.

Heat Pump Efficiency		
High Efficiency (>13 SEER)	2	50.0%
Standard Efficiency (<13 SEER)	2	50.0%
Total	4	100.0%
SEER Number		
<=11	0	0.0%
12	0	0.0%
13	0	0.0%
>=14	1	25.0%
Don't know	3	75.0%
Total	4	100.0%
Did you do this as part of a major renovation of your home?		
Yes	0	0.0%
No	4	100.0%
Total	4	100.0%

How useful was the website in determining whether to install a high efficiency unit in your house?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
2	1	0	0	1	4
50.0%	25.0%	.0%	.0%	25.0%	100.0%

Please explain why you did not find the website very useful in determining whether to install a high efficiency unit in your house?

I did not find any information about this on the website.	The information I found on the website about this was unclear	The information I found on the website about this was not the information I needed to make a decision	Other	Total
1	0	0	2	3
33.3%	.0%	.0%	66.7%	100.0%

Other – Please explain:

Comment	Count	Total
I didn't look on the website	1	50.0%
Wasn't looking. Had to replace our central air system. Decided to go with a heat pump to save on fuel oil.	1	50.0%

Savings calculations for customers installing a heat pump are described below. For those customers who did not know their SEER number, 14 was estimated for high efficiency and 12 was estimated for standard efficiency. Savings totals exceeded 15,000 kWh and 8 kW, and average savings were over 3,000 kWh per install.

Table 12. New Heat Pump Savings

Install New Heat Pump	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	4	8.68	15099.20	0
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		2.17	3774.80	0

Install New Central Air Conditioner

Of the 5 customers installing the central air conditioner, 3 customers installed a high efficiency unit, while two customers installed a standard unit. The most frequently installed SEER number for the central air conditioner was a 13, while two customers also

stated they did not know the SEER number of their unit. Most customers did not do this as a part of a renovation.

No customers rated the website as useful or very useful (4 or above) regarding installation of their air conditioner. Two customers stated the information on the website was not what they needed to make a decision, while one customer stated they did not find the information they were looking for. Other responses included they either weren't looking for the information on the website, or they had researched air conditioners somewhere other than on the Duke Energy website in order to make their decision.

Central Air Conditioner Efficiency		
High Efficiency (>13 SEER)	3	60.0%
Standard Efficiency (<13 SEER)	2	40.0%
Total	5	100.0%
SEER Number		
<=11	1	20.0%
12	0	0.0%
13	2	40.0%
>=14	0	0.0%
Don't know	2	40.0%
Total	5	100.0%
Did you do this as part of a major renovation of your home?		
Yes	1	20.0%
No	4	80.0%
Total	5	100.0%

How useful was the website in determining whether to install a high efficiency unit in your house?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
2	1	2	0	0	5
40.0%	20.0%	40.0%	.0%	.0%	100.0%

Please explain why you did not find the website very useful in determining whether to install a high efficiency unit in your house?

I did not find any information about this on the website.	The information I found on the website about this was unclear	The information I found on the website about this was not the information I needed to make a decision	Other	Total
1	0	2	2	5
20.0%	.0%	40.0%	40.0%	100.0%

Other – Please Explain:

Comment	Count	Total
I had already researched A/C purchase	1	50.0%
Wasn't looking for this info	1	50.0%

Customers who did not recall their SEER number were estimated at 12 for a standard unit, and 14 for a high efficiency unit. Qualifying savings are calculated below. Total savings were 2399 kWh per install, for a total kWh savings of 9,596. Total kW savings were 7.20, or 1.80 per install.

Table 13. New Central Air Conditioner Savings

Install New Central Air Conditioner	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	4	7.20	9596.00	0
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		1.80	2399.00	0

Insulate Sidewalls

Of the 6 customers who insulated their sidewalls, two thirds of them insulated 1 or 2 walls. The highest number of walls insulated by a customer was four. Nearly all customers insulated their walls using fiberglass insulation. Customers added anywhere from 2 to 10 inches of insulation to their sidewalls, with two customers adding two inches, and two customers adding 6 inches. A majority of customers did not have any insulation in the sidewalls before they insulated them. Two thirds of customers stated that they insulated their sidewalls as a part of a major renovation of their home.

Only one customer found the website useful or very useful when insulating their sidewalls. The customers who did not find the website useful stated that in general, they already had the information they needed to make a decision before visiting the website.

Number of Walls		
1	2	33.3%
2	2	33.3%
3	1	16.7%
4	1	16.7%
Total	6	100.0%
Type of Insulation		
Fiberglass	5	83.3%
Cellulose	0	0.00%
Foam	1	16.7%
Other	0	0.00%
Total	6	100.0%

Inches Added		
2	2	33.3%
3	1	16.7%
6	2	33.3%
10	1	16.7%
Total	6	100.0%
How thick was the insulation before you added more?		
0	4	66.7%
2	1	16.7%
6	1	16.7%
Total	6	100.0%
Did you do this as a part of a major renovation of your home?		
Yes	4	66.7%
No	2	33.3%
Total	6	100.0%

How useful was the website in determining whether to insulate your walls?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
0	2	3	0	1	6
.0%	33.3%	50.0%	.0%	16.7%	100.0%

Please explain why you did not find the website very useful in determining whether to insulate your walls?

I did not find any information about this on the website.	The information I found on the website about this was unclear	The information I found on the website about this was not the information I needed to make a decision	Other	Total
0	0	1	4	5
.0%	.0%	20.0%	80.0%	100.0%

Other – Please explain:

Comment	Count	Total
Already knew it needed insulation and husband had installation experience.	1	25%
Already planned to insulate.	1	25%
I already had info about insulation.	1	25%
I already knew the information found on the site.	1	25%

Savings for insulating sidewalls are calculated below. Total savings are over 3,000 kWh and over 2 kW, for an average of 865 kWh and 0.5 kW per install. Therm savings were 5.28 per install for a total of 21.13 Therm.

Table 14. Insulate Sidewalls Savings

Insulate Sidewalls	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	4	2.06	3459.48	21.13
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.52	864.87	5.28

Insulate Attic

Customers who stated they insulated their attic most frequently insulated their entire attic (66.7%). Nearly all the customers who insulated their attic used fiberglass insulation. Insulation base thickness and thickness added varied, with two thirds of customers adding between 5 and 12 inches of insulation to their base layer, and over 40% of customers having a base layer of 1-4 inches. 58.3% of customers stated that they did not add insulation to their attic as part of a renovation.

75% of customers found the website to be only somewhat useful with regard to insulating their attic. Customers stated in general that either the information they were looking for was on the site, or they already had the information they needed to make a decision before visiting the site, either from prior knowledge, or another information source.

Area of Attic Insulated		
Part	4	33.3%
All	8	66.7%
Total	12	100.0%
Type of Insulation		
Fiberglass	10	83.3%
Cellulose	0	0.0%
Foam	0	0.0%
Other	2	16.7%
Total	12	100.0%
Inches Added		
1-4	3	25.0%
5-8	4	33.3%
9-12	4	33.3%
>12	1	8.4%
Total	12	100.0%
How thick was the insulation before you added more?		
0	3	25.0%
1-4	5	41.6%

5-8	3	25.0%
9-12	1	8.4%
>12	0	0.0%
Total	12	100.0%
Did you do this as a part of a major renovation of your home?		
Yes	5	41.7%
No	7	58.3%
Total	12	100.0%

How useful was the website in determining whether to insulate your attic?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
1	0	9	2	0	12
8.3%	.0%	75.0%	16.7%	.0%	100.0%

Please explain why you did not find the website very useful in determining whether to insulate your attic?

I did not find any information about this on the website.	The information I found on the website about this was unclear	The information I found on the website about this was not the information I needed to make a decision	Other	Total
1	0	4	5	10
10.0%	.0%	40.0%	50.0%	100.0%

Other – Please explain:

Comment	Count	Total
I already knew it needed to be insulated	1	20.0%
I already knew the information from the site.	2	40.0%
I am a remodeler with prior experience in the insulation industry	1	20.0%
I did not look there first.	1	20.0%

Table 15. Insulate Attic Savings

Insulate Attic	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	7	0.02	1081.58	65.73
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.0035	154.51	9.39

Insulate Ducts

Tips on the website regarding ducts involved both insulating ducts and repairing ducts.

Those customers who chose to insulate their ducts insulated ducts located in heated areas of their home 83.3% of the time, and therefore did not qualify for savings. Half of customers stated that they insulated their ducts as part of a major renovation of their home.

Two thirds of customers found the website to be somewhat useful with regard to duct insulation. Half of customers who did not find the website useful or very useful stated they did not find the information on the website that they needed to make a decision regarding insulation of their ducts.

Duct Location		
Heated	5	83.3%
Unheated	1	16.7%
Don't know	0	0.0%
Total	6	100.0%
Did you do this as a part of a major renovation of your home?		
Yes	3	50.0%
No	3	50.0%
Total	6	50.0%

How useful was the website in determining whether to insulate your ducts?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
0	0	4	2	0	6
.0%	.0%	66.7%	33.3%	.0%	100.0%

Please explain why you did not find the website very useful in determining whether to insulate your ducts?

I did not find any information about this on the website.	The information I found on the website about this was unclear	The information I found on the website about this was not the information I needed to make a decision	Other	Total
1	0	2	1	4
25.0%	.0%	50.0%	25.0%	100.0%

Please explain why you did not find the website very useful in determining whether to insulate your ducts? Other

Comment	Count	Total
I already knew the info provided by the site	1	100.0%

Savings for insulation of ducts were 384 kWh and 17.3 Therm total, along with a savings of 0.08 kW. Four customers made installs, but only one customer installed in an unheated area of their home. Average savings for the four installs were 0.02 kW, 96

kWh, and 4.33 Therms.

Table 16. Insulate Ducts Savings

Insulate Ducts	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	4	0.08	384.00	17.30
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.02	96.00	4.33

Repair or Fix Holes in Ducts

Customers who repaired or fixed their ducts did not take this action as a part of a major renovation of their home (76.0%). 60% of customers found the website to be useful or very useful with regard to this suggestion. Those who did not find the website useful suggested that they either did not find information about this on the website, or they already had the information they needed regarding repairing their ducts.

Did you do this as a part of a major renovation of your home?		
Yes	6	24.0%
No	19	76.0%
Total	25	100.0%

How useful was the website in determining whether to repair your ducts and where to conduct the repairs?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
3	0	7	10	5	25
12.0%	.0%	28.0%	40.0%	20.0%	100.0%

Please explain why you did not find the website very useful in determining whether to repair your ducts and where to conduct the repairs?

I did not find any information about this on the website.	The information I found on the website about this was unclear	The information I found on the website about this was not the information I needed to make a decision	Other	Total
4	1	1	4	10
40.0%	10.0%	10.0%	40.0%	100.0%

Other – Please explain:

Comment	Count	Total

Already knew that information.	2	50.0%
I had already planned repair.	1	25.0%
Solutions seemed expensive for the benefit.	1	25.0%

Total savings for fixing/repairing ducts are 2.93 kW, 6256.25 kWh, and 53.83 Therm.

Table 17. Fix or Repair Ducts Savings

Fix or Repair Ducts	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	20	2.93	6256.25	53.83
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.15	312.81	2.69

Change Furnace Filter

Of the customers who utilized the tip to change the furnace filter, most customers found the website to be somewhat useful (38.7%), while 42.3% found the website to be useful or very useful in making the decision to change the filter. A majority of customers who did not find the website useful in their decision stated the website did not have the information they needed to make a decision (29.7%) or stated "Other" (51.6%). The responses of those customers who stated "Other" are summarized below, and included already being aware of the tips given on the website, didn't look at the website, and following manufacturer's instruction on filter replacement.

Frequency of Filter Change – Post Website		
Weekly	1	0.9%
Monthly	51	47.2%
Quarterly	47	43.4%
Yearly	9	8.5%
Total	108	100.0%
Frequency of Filter Change – Pre Website		
Weekly	1	0.9%
Monthly	36	33.3%
Quarterly	55	50.9%
Yearly	16	14.9%
Total	108	100.0%

How useful was the website in determining whether to replace the filter?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
14	7	42	27	18	108
13.0%	6.4%	38.9%	25.0%	16.7%	100.0%

Please explain why you did not find the website very useful in determining whether to replace your furnace filter?

I did not find any information about this on the website.	The information I found on the website about this was unclear	The information I found on the website about this was not the information I needed to make a decision	Other	Total
9	3	18	33	63
14.1%	4.7%	29.7%	51.6%	100.0%

Other – Please explain:

Comment	Count	Total
Already following tips found on site	21	63.6%
Tips didn't influence decision	1	3.0%
Didn't review website before decision	2	6.2%
I follow filter manufacturer/HVAC dealer's instructions	6	18.2%
I forget to change the filter	1	3.0%
Can't afford to change filter as frequently	1	3.0%
Not applicable	1	3.0%

Although many customers changed their furnace filter after visiting the website, none of the customers had a high enough changing frequency before and after visiting the website to account for savings.

Table 18. Change Furnace Filter Savings

Change Furnace Filter	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	96	0.00	0.00	0.00
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.00	0.00	0.00

Install New Refrigerator

Customers who installed a new refrigerator all stated that the refrigerator they purchased was Energy Star compliant. No customers left their old refrigerator plugged in as a backup. 75% of customers did not install a new refrigerator as a major renovation of their home.

Three of the 8 customers (37.5%) stated that the website was useful or very useful in their decision to install a new refrigerator. Those customers who did not find the website useful stated that they did not use the website to make their decision to purchase a new refrigerator, or they already needed a new refrigerator. One customer stated they did not find any information about refrigerators on the website.

Energy Star Compliant		
Yes	8	100.0%
No	0	0.0%
Don't know	0	0.0%
Total	8	100.0%
Old Refrigerator Still Plugged In		
Yes	0	0.0%
No	8	100.0%
Don't know	0	0.0%
Total	8	100.0%
Did you do this as part of a major renovation of your home?		
Yes	2	25.0%
No	6	75.0%
Total	8	100.0%

How useful was the website in determining whether to install a new refrigerator?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
3	0	2	1	2	8
37.5%	.0%	25.0%	12.5%	25.0%	100.0%

Please explain why you did not find the website very useful in determining whether to install a new refrigerator?

I did not find any information about this on the website.	The information I found on the website about this was unclear	The information I found on the website about this was not the information I needed to make a decision	Other	Total
1	0	0	4	5
20.0%	.0%	.0%	80.0%	100.0%

Other – Please explain:

Comment	Count	Total
We had to replace refrigerator	2	50.0%
I didn't refer to the website to decide	1	25.0%
I was already in the process of shopping for a new refrigerator.	1	25.0%

Table 19. Install New Refrigerator

Install New Refrigerator	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	8	2.08	12305.43	-18.07
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.26	1538.18	-2.26

Website Tips – Actions Taken

First Group

For this set of actions, customers were most likely to manage their drapes in summer and winter (80.4% and 72.3%, respectively). Customers were least likely to install a dual heating system (87.8%). These numbers make sense, as managing drapes is a fairly simple measure to implement, while installing a dual heating system requires much more investment. Customers were most likely to plan to insulate their hot water heater (23.6%) at a future date. Overall, a majority of customers found the website to be useful in determining whether to do these actions (47.1%).

Table 20. Frequency of Actions Taken - Group 1

	Yes	No	No, but plan to	N/A	Total
Turn off heat in unused rooms	70	51	6	21	148
	47.3%	34.5%	4.1%	14.2%	100.0%
Clean baseboards of dust	88	40	13	7	148
	59.5%	27.0%	8.8%	4.7%	100.0%
Install dual heating system	5	130	3	10	148
	3.4%	87.8%	2.0%	6.8%	100.0%
Keep draperies open on sunny days and closed at night during winter months	107	27	4	10	148
	72.3%	18.2%	2.7%	6.8%	100.0%
Keep draperies closed on sunny days during summer months	119	22	0	7	148
	80.4%	14.9%	.0%	4.7%	100.0%

Insulate your hot water heater	20 13.5%	83 56.1%	35 23.6%	10 6.8%	148 100.0%

Overall, how useful was the website in determining whether to perform any of these actions?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
6 4.3%	6 4.3%	36 26.1%	65 47.1%	25 18.1%	138 100.0%

Turn off Heat in Unused Rooms

Almost two thirds of customers stated that they have turned the heat off in 1-2 rooms (62.9%).

In how many rooms have you turned the heat off?		
0	4	5.7%
1-2	44	62.9%
3-4	19	27.1%
5-6	1	1.4%
7-8	2	2.9%
Total	70	100.0%

Total savings for turning off heat are over 21,000 kWh and over 200 Therm.

Table 21. Turn off Heat in Unused Rooms Savings

Turn Heat Off in Unused Rooms	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	62	14.02	21251.00	271.00
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.23	342.76	4.37

Clean Baseboards

Of the 88 customers who stated they cleaned baseboards of dust, 40.9% of them stated they cleaned 6 to 10 baseboards. However, when listing their heating system type, only one customer who indicated they cleaned their baseboards chose electric baseboard as

their heating system type. The difference may be that customers did not understand the difference between an electric baseboard and a heating register (such as would exist with a central furnace system) without additional clarification.

How many baseboards have you cleaned?		
0	2	2.3%
1-5	20	22.7%
6-10	36	40.9%
11-20	21	23.9%
21+	9	10.2%
Total	88	100.0%

Because only one customer used electric baseboards for their heating, this customer was the only customer that had energy savings for taking this action. The total savings calculations for cleaning baseboards are 4.25 kWh.

Table 22. Clean Baseboards Savings

Clean Baseboards	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	1	None	4.25	None
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		None	4.25	None

Manage Window Coverings

Twelve more customers stated they manage their window coverings in summer than in winter (119 customers in summer, 107 customers in winter). Customers who manage their window drapes in winter state that they manage 1-6 windows (46.7%), similar to customers who manage their window drapes in summer, who also state they manage 1-6 windows (48.7%).

Coverings Managed in Winter		
0	8	7.6%
1-6	50	46.7%
7-12	39	36.4%
13-18	7	6.5%
19+	3	2.8%
Total	107	100.0%
Coverings Managed in Summer		
0	6	5.0%
1-6	58	48.7%
7-12	46	38.7%

13-18	7	5.9%
19+	2	1.7%
Total	119	100.0%

The total savings for customers who manage their window coverings are 63,562 kWh for winter, and over twice that amount, 127,483 kWh for summer. Similarly, the Therm savings are 1858 Therm for winter management of drapes, and almost twice that, 3535 Therm, for summer.

Table 23. Manage Window Coverings Savings

Manage Coverings in Winter	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	94	0	63,562.00	1858.00
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0	676.19	19.77
Manage Coverings in Summer	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	106	0	127,483.00	3535.00
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0	1202.67	33.35
Manage Coverings Total Savings		Total kW Savings	Total kWh Savings	Total Therm Savings
		0	191045.00	5393.00
Mean (per customer)	110	Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0	1736.77	49.03

Insulate Water Heater

Of the customers who installed the water heater insulation, half of them stated their water heater was 31-50 gallons in capacity. Nearly two thirds of these customers stated they use natural gas to fuel their water heater (62.5%). No customer did this as a major renovation of their home, which is understandable since this was a small task to undertake.

Although customers were asked generally about the usefulness of the website regarding the 6 measures described in this section, customers were also asked specifically about usefulness of the website regarding water heater insulation, and these values were used for the savings estimates. Most customers installing the water heater insulation found the website to be useful or very useful in their decision to do so, suggesting that either the website contained the information they were looking for regarding water heater insulation, or insulating the water heater was a new tip for customers that they decided to

implement after learning about it on the website. Of the 43.7% of customers who rated the website less than useful regarding this measure, customers were split regarding why the website wasn't useful, ranging from not finding the information they were looking for, to information being unclear or not what was necessary. Those customers who mentioned "other" stated that they either already had information about water heater insulation, or had difficult implementing the measure even after looking at the website.

Capacity		
0	2	12.4%
<=30	3	18.7%
31-50	8	50.0%
51-60	1	6.3%
61-75	1	6.3%
76+	1	6.3%
Total	16	100.0%
Water heater heating type		
Electricity	6	37.5%
Gas	10	62.5%
Total	16	100.0%
Did you do this as a major renovation of your home?		
Yes	0	0.0%
No	16	100.0%
Total	16	100.0%

How useful was the website in determining whether to insulate your hot water heater tank?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
0	2	5	5	4	16
0.0%	12.4%	31.3%	31.3%	25.0%	100.0%

Please explain why you did not find the website very useful in determining whether to insulate your hot water heater tank?

I did not find any information about this on the website.	The information I found on the website about this was unclear	The information I found on the website about this was not the information I needed to make a decision	Other	Total
1	2	2	2	7
14.2%	28.6%	28.6%	28.6	100.0%

Comment	Count
Already knew this information	1
Insulation difficult to install	1

The total savings for water heater insulation were over 7500 kWh and over 300 Therm, with a savings of 0.70 kW.

Table 24. Insulate Water Heater Savings

Insulate Water Heater	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	16	0.70	7678.80	374.40
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.044	479.92	23.40

Second Group

The action most frequently taken by customers in this group was to lower their thermostat temperature in winter (75.0%), followed closely by washing laundry in cold water (72.3%). The least taken action was to install doors on the front of the fireplace (29.1%), in part due to the fact that 55.4% of customers mentioned this action did not apply to them.

These actions have the same usefulness values as the table for the 6 items in the previous section. Overall, a majority of customers found the website to be useful in determining whether to do these actions (47.1%).

Table 25. Frequency of Actions Taken - Group 2

Have you taken any of the following actions since visiting the website?

	Yes	No	No, but plan to	Does Not Apply	Total
Wash laundry in cold water	107 72.3%	33 22.3%	0 .0%	8 5.4%	148 100.0%
Lower thermostat temperature in winter	111 75.0%	20 13.5%	9 6.1%	8 5.4%	148 100.0%
Install doors on front of fireplace	19 12.8%	43 29.1%	4 2.7%	82 55.4%	148 100.0%
Keep fireplace	60	14	2	72	148

damper closed when not in use	40.5%	9.5%	1.4%	48.6%	100.0%
Do not use fireplace during periods of extreme cold	50	30	2	66	148
	33.8%	20.3%	1.4%	44.6%	100.0%

Overall, how useful was the website in determining whether to perform any of these actions?

Not at all Useful 1	2	Somewhat Useful 3	4	Very Useful 5	Total
6	6	36	65	25	138
4.3%	4.3%	26.1%	47.1%	18.1%	100.0%

Wash Laundry in Cold Water

Customers who took the action to wash their laundry in cold water tended to wash 5-6 loads per week (33.6%), while a smaller number of customers washed 3-4 loads in cold water (25.2%).

Loads Per Week		
1-2	8	7.5%
3-4	27	25.2%
5-6	36	33.6%
7-8	16	15.0%
9-10	13	12.2%
11-12	0	0.0%
13+	7	6.5%
Total	107	100.0%

Overall, the savings for qualified actions taken totaled 21.241 kW, 19,765 kWh, and 3400.80 Therm.

Table 26. Cold Water Wash Savings

Cold Water Wash	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	94	21.241	19,765.00	3400.80
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.23	210.27	36.18

Lower Thermostat Temperature in Winter

Customers who chose to lower their thermostat after visiting the website tended to choose to lower the thermostat both at night and during the day (74.8%). However, customers lowered their thermostat more at night than they did during the day, with 45.1% of customers lowering by 4-6 degrees at night, and 41.3% of customers lowering 1-3 degrees during the day.

When do you lower your thermostat temperature?		
At night	19	17.1%
During the day	9	8.1%
Both at night and during the day	83	74.8%
Total	111	100.0%
Degrees lowered at night		
1-3	33	32.4%
4-6	46	45.1%
7-10	21	20.6%
>=11	2	2.0%
Total	102	100.0%
Degrees lowered during the day		
1-3	38	41.3%
4-6	35	38.0%
7-10	16	17.4%
>=11	3	3.3%
Total	92	100.0%

Overall savings for lowering the thermostat were over 120,000 kWh and over 1600 Therm. There were no kW savings for this measure.

Table 27. Lower Thermostat in Winter

Lower Thermostat in Winter	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	97	None	121933.00	1653.60
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		None	1257.04	17.05

Close off Fireplace

When describing closing off their fireplace, customers could indicate if they installed doors on their fireplace, closed the damper of their fireplace, or did not use their fireplace

in winter. While savings are realized for installing doors or closing the fireplace damper, savings are not realized for discontinuing use of the fireplace in winter. Total savings are described below.

Table 28. Close off Fireplace Savings

Close off Fireplace	Number of Installs	Total kW Savings	Total kWh Savings	Total Therm Savings
	54	0.25	1029.30	16.38
Mean (per total installs)		Mean kW Savings	Mean kWh Savings	Mean Therm Savings
		0.0047	19.06	0.30

Savings Totals and Summary

Final savings calculations for the 154 survey respondents are based on the savings described in the sections above. The final savings for the Energy Efficiency website program take into account both freeriders and freedrivers for the energy efficiency kit items, as well as website usefulness for the website tips/actions. In general, freeriders were those customers who had already installed a kit item before receiving the energy efficiency kit, or those who had already planned to install a kit item before receiving the kit. Freedrivers were those customers who had not purchased or planned to purchase a kit item before receiving the kit, but decided to purchase/install more of an item after installing the item that came in the kit. The degree of freeridership or freedrivership was based on whether the customer had installed the item before receiving the kit, planned to install the item before receiving the kit, and/or had purchased/installed additional of the item since installing the item that came with the kit, and was calculated using the following table:

Table 29. Calculation of Freeriders and Freedrivers

Did you install item X before you got the kit?	Were you planning on buying item X before you got the kit?	Have you purchased any of item X since you got the kit?	% Freeridership	% Freedrivers
yes	yes	yes	100	
yes	yes	no	100	
yes	no	yes		75
no	no	yes		100
no	yes	no	50	
no	yes	yes	50	50
yes	already installed in every place	yes	100	
yes	already installed in every place	no	100	
yes	yes	don't know	100	

yes	already installed in every place	don't know	100	
no	yes	don't know	50	

The kit item with the most savings before calculation of freeridership was the low-flow showerhead, with over 15000 kWh in savings and over 1300 Therm. After accounting for freeridership and freedrivers, the low-flow showerhead still had the greatest total savings, with 14,337.37 kWh. The low-flow showerhead also had the greatest Therm savings, with 1209.39 Therm.

The kit item with the least final total savings was the weather stripping, which saved 381.14 kWh. This item also had one of the lowest Therm savings values of 5.94 Therm, with the lowest Therm savings coming form the window shrink fit.

The greatest total peak savings were 1.72 kW for the low-flow showerhead.

For those that responded to the survey (n=154), total savings for the energy efficiency kit items were 2.81 kW, 32,407.50 kWh, and 1291.69 Therm.

Table 30. Kit Items Total Savings

	Initial Total Savings			Discounting		Final Total Savings		
Kit Item	kW	kWh	Therm	FreeRidership	FreeDrivers	kW	kWh	Therm
Low-flow Showerhead	1.72	15734.87	1327.27	15.79%	6.91%	1.57	14337.37	1209.39
Kitchen Faucet Aerator	0.01	946.92	43.19	12.26%	0.00%	0.01	830.79	37.90
Bathroom Faucet Aerator	0.01	757.54	46.52	4.26%	10.11%	0.01	801.86	49.24
15W CFL Bulb	0.56	12287.71	-17.94	60.29%	23.04%	0.35	7709.93	-11.26
20W CFL Bulb	0.58	11709.42	-17.63	59.47%	23.16%	0.37	7457.05	-11.23
Weather Stripping	0.18	607.45	9.47	48.04%	10.78%	0.11	381.14	5.94
Window Shrink Fit	0.34	675.14	4.71	42.31%	11.54%	0.23	467.41	3.26
Insulating Gaskets	0.23	658.65	13.18	40.63%	4.69%	0.15	421.95	8.44
Total Savings						2.81	32407.50	1291.69

Final savings for the website tips and actions take into account how useful the website was to a customer when deciding to install an item or taking an action. The cold water wash had the highest kW savings with 21.24 kW. Other items had high kWh or Therm savings, such as lowering thermostat in winter (121,933 kWh), managing drapes (191,045 kWh). Managing drapes also had the largest Therm savings, with 5,393 Therm. After accounting for website usefulness, the actions and tips with the highest amounts were similar.

Self-Selection and False Response Bias

There are some risks associated with relying on self-reported behavioral changes, because the foundation of the savings estimates are based solely on the participant's responses, with no means to verify that the respondent has installed the kit's measures and is using them effectively. There are two main sources of bias with these types of surveys that directly impact the conclusions drawn from the responses. These sources of bias are Self-Selection Bias and False Response Bias.

Self-Selection Bias

For this evaluation, we are using the self-selection bias value of 60%. Self-selection resulted in only 16.5% response rate for the survey. This indicates a very high degree of self-selection bias. We are unsure what the true value is because this bias is not measured in this evaluation. However, with the very low response rate, we estimate that the self-selection bias is very high for this evaluation.

False Response Bias

False Response Bias is a problem with many self-reporting surveys. The participants respond not with the truth, but with the socially acceptable answer. In short, they lie about what measures they installed or what actions they have taken as a result of the program. False response bias is typically not a high number, but ranges from a low of two or three percent to a high of 15 percent in our experience depending on the topic and the population being tested. The False Response Bias is set at 15% for this survey, given the nature of the survey (web-based with no way to verify actions). A 15% discount will be applied to all impact-related measure estimates to calculate the low end of the range of savings estimates for each measure and recommendation.

It is our opinion that together these biases likely account for a needed 75% adjustment in the savings from the reported actions by the survey respondents when they are extrapolated to the population as a whole.

	Total First-Year Savings Net of Freeriders and Freedrivers for Survey Respondents (n=154)	Total First-Year Savings Net of Freeriders and Freedrivers and Self-Reporting and False Response Bias for Population (n=2,613)

Kit Item	kW	kWh	Therm	kW	kWh	Therm
Low-flow Showerhead	1.57	14337.4	1209.39	6.660	60,817	5,130.1
Kitchen Faucet Aerator	0.01	830.79	37.9	0.042	3,524	160.8
Bathroom Faucet Aerator	0.01	801.86	49.24	0.042	3,401	208.9
15W CFL Bulb	0.35	7709.93	-11.26	1.485	32,705	-47.8
20W CFL Bulb	0.37	7457.05	-11.23	1.569	31,632	-47.6
Weather Stripping	0.11	381.14	5.94	0.467	1,617	25.2
Window Shrink Fit	0.23	467.41	3.26	0.976	1,983	13.8
Insulating Gaskets	0.15	421.95	8.44	0.636	1,790	35.8
Total Savings	2.81	32,407.5	1291.69	11.877	137,469	5,479.2

Table 31. Actions and Installations Total First-Year Savings

Measure	kW Savings	Average kW Savings	kWh Savings	Average kWh Savings	Therm Savings	Average Therm Savings	Website Useful >=4	Total kW Savings	Total kWh Savings	Total Therm Savings
Furnace					37.60	18.80	50.00%			18.80
Heat Pump	8.68	2.17	15099.20	3774.80	0.00	0.00	25.00%	2.17	3774.80	0.00
AC	7.20	1.80	9596.00	2399.00	0.00	0.00	0.00%	0.00	0.00	0.00
Sidewall	2.06	0.52	3459.48	864.87	21.13	5.28	25.00%	0.52	864.87	5.28
Attic	0.02	0.0035	1081.58	154.51	65.73	9.39	28.57%	0.01	309.02	18.78
Duct Insulation	0.08	0.02	384.00	96.00	17.30	4.33	50.00%	0.04	192.00	8.65
Duct Repair	2.93	0.15	6256.25	312.81	53.83	2.69	65.00%	1.90	4066.56	34.99
Replace Filter	0.00	0.00	0.00	0.00	0.00	0.00	40.63%	0.00	0.00	0.00
New Refrigerator	2.08	0.26	12305.43	1538.18	-18.07	-2.26	37.50%	0.78	4614.53	-6.78
Stop heating room	14.02	0.23	21251.00	342.76	271.00	4.37	64.52%	9.05	13710.32	174.84
Cleaned Baseboards			4.25	4.25			0.00%		0.00	
Manage Drapes	0.00	0.00	191045.00	1736.77	5393.00	49.03	68.18%	0.00	130257.95	3677.05
Insul. Water Heater	0.70	0.04	7678.80	479.92	374.40	23.40	56.25%	0.39	4319.32	210.60
Cold water wash	21.24	0.23	19765.00	210.27	3400.80	36.18	69.89%	14.85	13814.25	2376.90
Lower therm in winter			121933.00	1257.04	1653.60	17.05	70.83%		86369.21	1171.30
(Closed Fireplace)	0.25	0.00	1029.30	19.06	16.38	0.30	73.58%	0.19	757.41	12.05
Total Savings								29.89	263050.26	7702.46

	Total First-Year Savings Net of Freeriders and Freedrivers for Survey Respondents (n=154)			Total First-Year Savings Net of Freeriders and Freedrivers and Self-Reporting and False Response Bias for Population (n=2,613)		
Measure	Total kW Savings	Total kWh Savings	Total Therm Savings	Total kW Savings	Total kWh Savings	Total Therm Savings
Furnace			18.80	0.000	0	79.7
Heat Pump	2.17	3774.80	0.00	9.205	16,012	0.0
AC	0.00	0.00	0.00	0.000	0	0.0
Sidewall	0.52	864.87	5.28	2.206	3,669	22.4
Attic	0.01	309.02	18.78	0.042	1,311	79.7
Duct Insulation	0.04	192.00	8.65	0.170	814	36.7
Duct Repair	1.90	4066.56	34.99	8.060	17,250	148.4
Replace Filter	0.00	0.00	0.00	0.000	0	0.0
New Refrigerator	0.78	4614.53	-6.78	3.309	19,574	-28.8
Stop heating room	9.05	13710.32	174.84	38.389	58,158	741.7
Cleaned Baseboards		0.00		0.000	0	0.0
Manage Drapes	0.00	130257.95	3677.05	0.000	552,539	15,597.6
Insul. Water Heater	0.39	4319.32	210.60	1.654	18,322	893.3
Cold water wash	14.85	13814.25	2376.90	62.992	58,598	10,082.5
Lower therm in winter		86369.21	1171.30	0.000	366,368	4,968.5
Closed Fireplace	0.19	757.41	12.05	0.806	3,213	51.1
Total Savings	29.89	263,050.26	7702.46	126.832	1,115,828	32,672.9

The final total savings for the Energy Efficiency website are shown below. The program, including the energy efficiency kit offered, and the actions and installations suggested on the website, generated a total net savings of 138.71 kW; 1,253,297 kWh; and 38,152.1 Therm.

Table 32. Total Net Program Savings.

	kW	kWh	Therm
Kit Savings	11.88	137,469	5479.2
Actions/Tips Savings	126.83	1,115,828	32,672.9
Total Savings	138.71	1,253,297	38,152.1

Effective Useful Lifetime Impact Estimates

Kit Measures

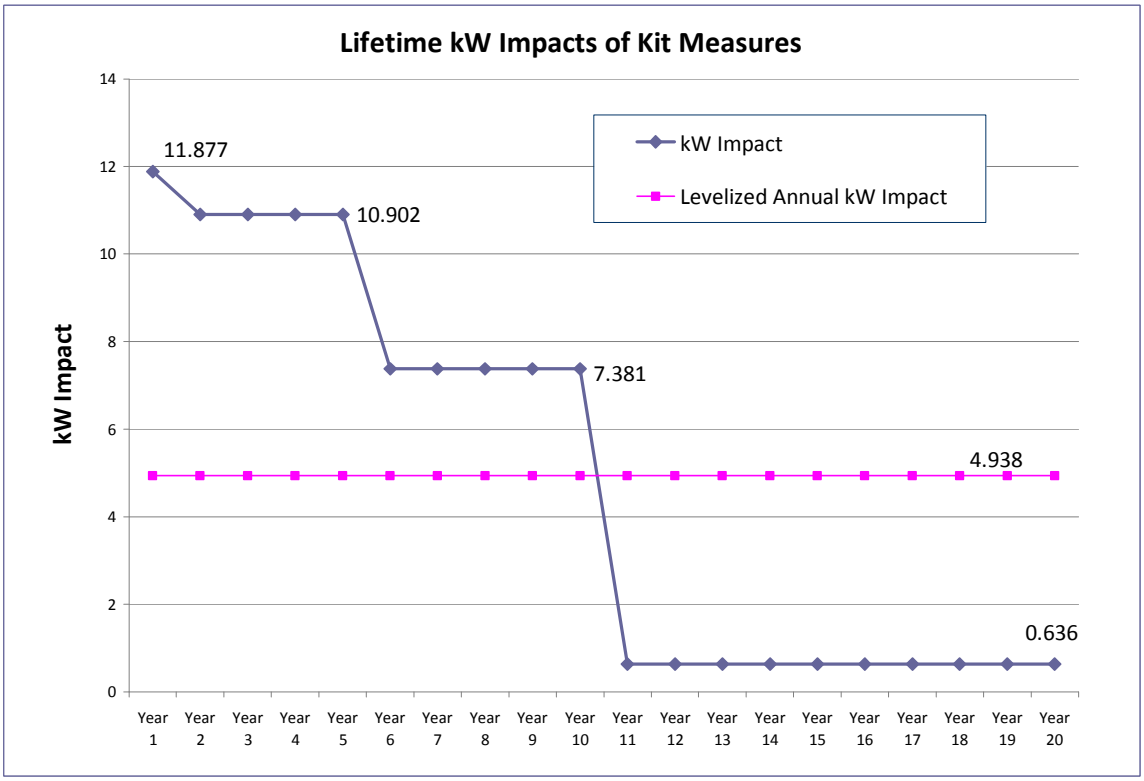
The following lifetimes were used to calculate the lifetime energy impacts of the kit measures:

Table 33. Lifetime Estimates of Kit Measures.

Kit Measures	Effective Useful Life
15-watt CFL	5
20-watt CFL	5
Weather stripping	5
Outlet gaskets	20
Window shrink kit	1
Showerhead	10
Bathroom aerator	10
Kitchen aerator	10

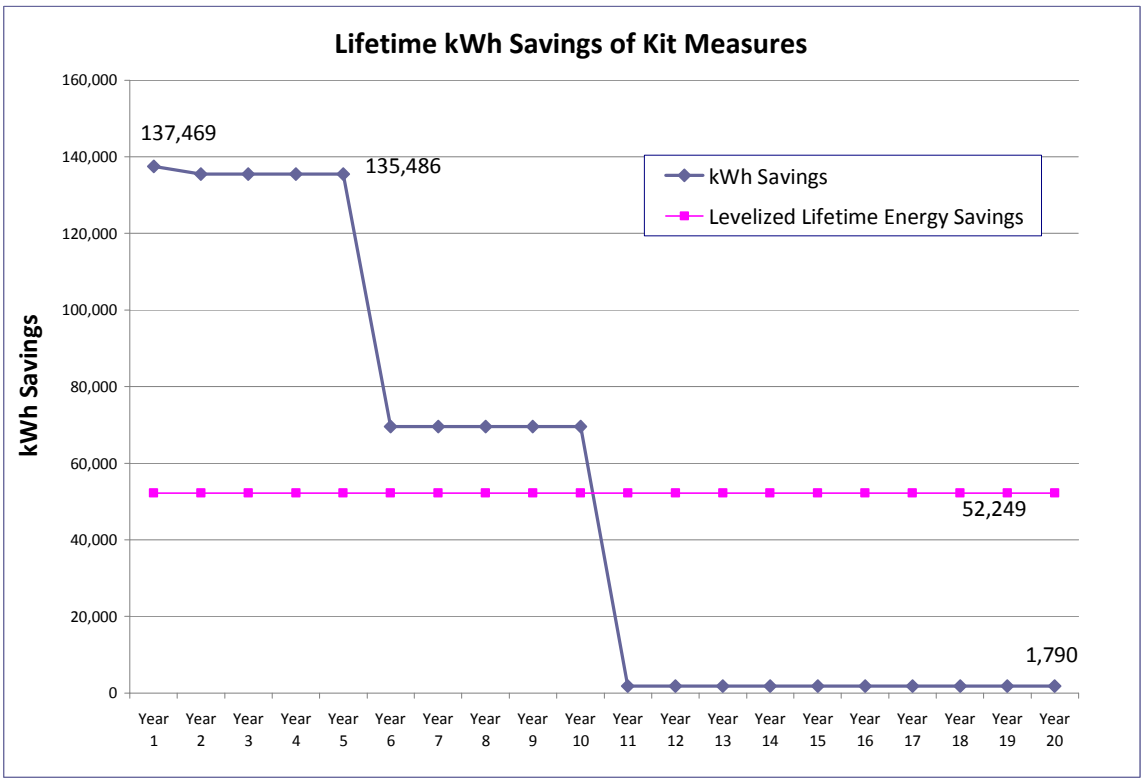
The kW lifetime impacts are shown in Figure 1. The impacts peak in year 1 at 11.877 kW, then slightly drop to 10.902 kW in year 2. By year 6, the impacts have again decreased to 7.381 kW, and in year 11, impacts drop to 0.636 kW, where they remain for the lifetime of the measures. The levelized kW impacts for the kit were 4.938 kW over 20 years.

Figure 1. Lifetime kW Impacts of Kit Measures.



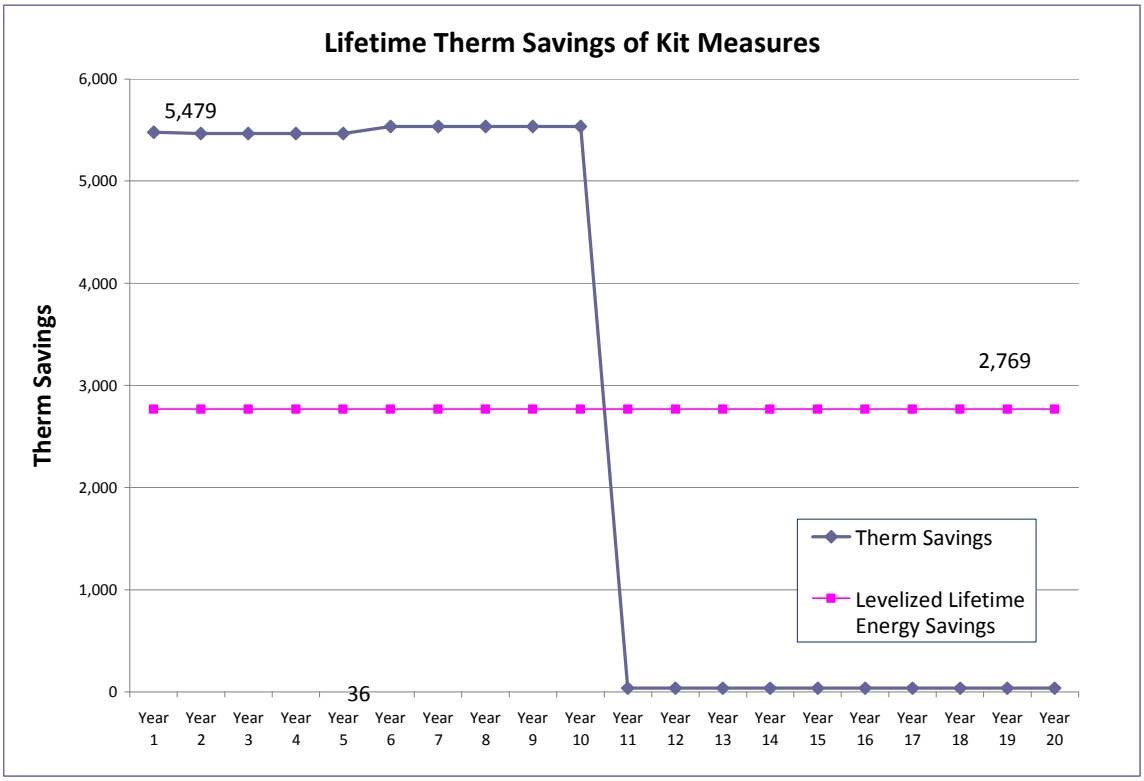
The lifetime kWh impacts for the kit are shown below in Figure 2. The impacts have a peak of 137,469 kWh in year 1, and then drop slightly to 135,486 kWh in year 5. By year 6, they have dropped to 69,533 kWh, and are 1,790 kWh from year 11 through the 20 year lifetime of the measures.

Figure 2. Lifetime kWh Impacts of Kit Measures.



The lifetime Therm impacts of the kit measures are found in Figure 3. These begin at a peak of 5,479 Therm in year 1, and rise slightly in year 6 to 5,536 Therm. At year 11, impacts drop to 36 Therm for the lifetime of the measures.

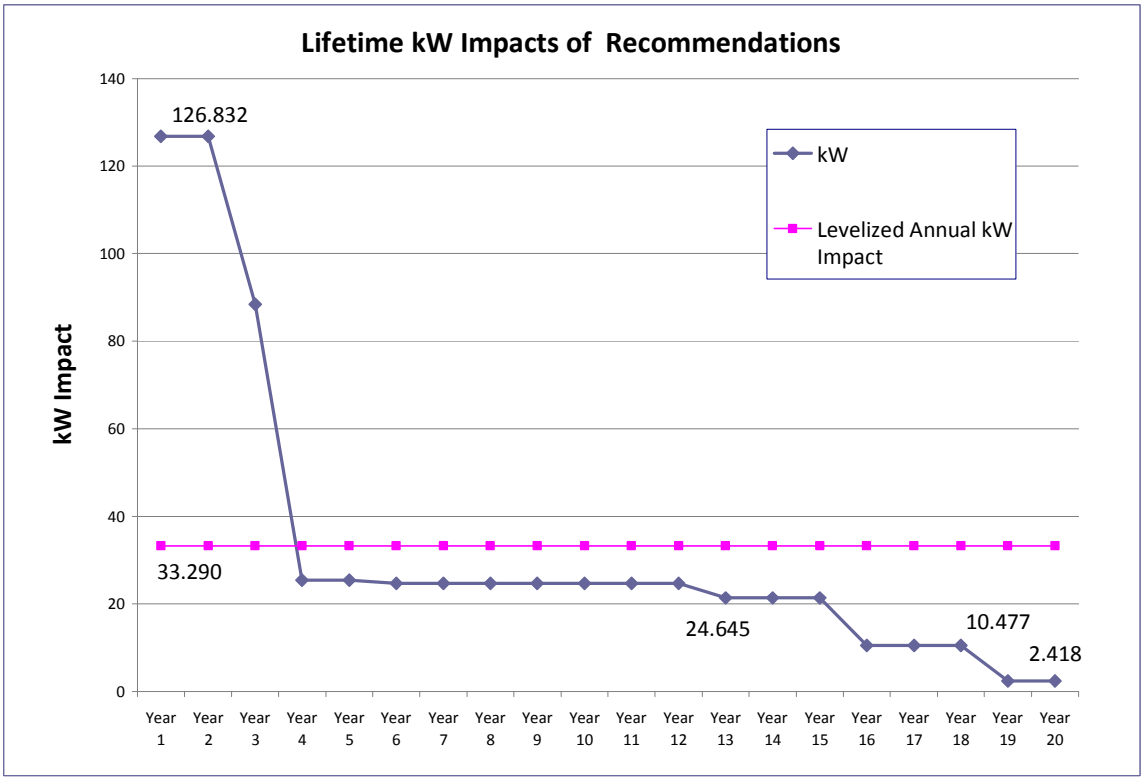
Figure 3. Lifetime Therm Savings of Kit Measures.



Recommendations

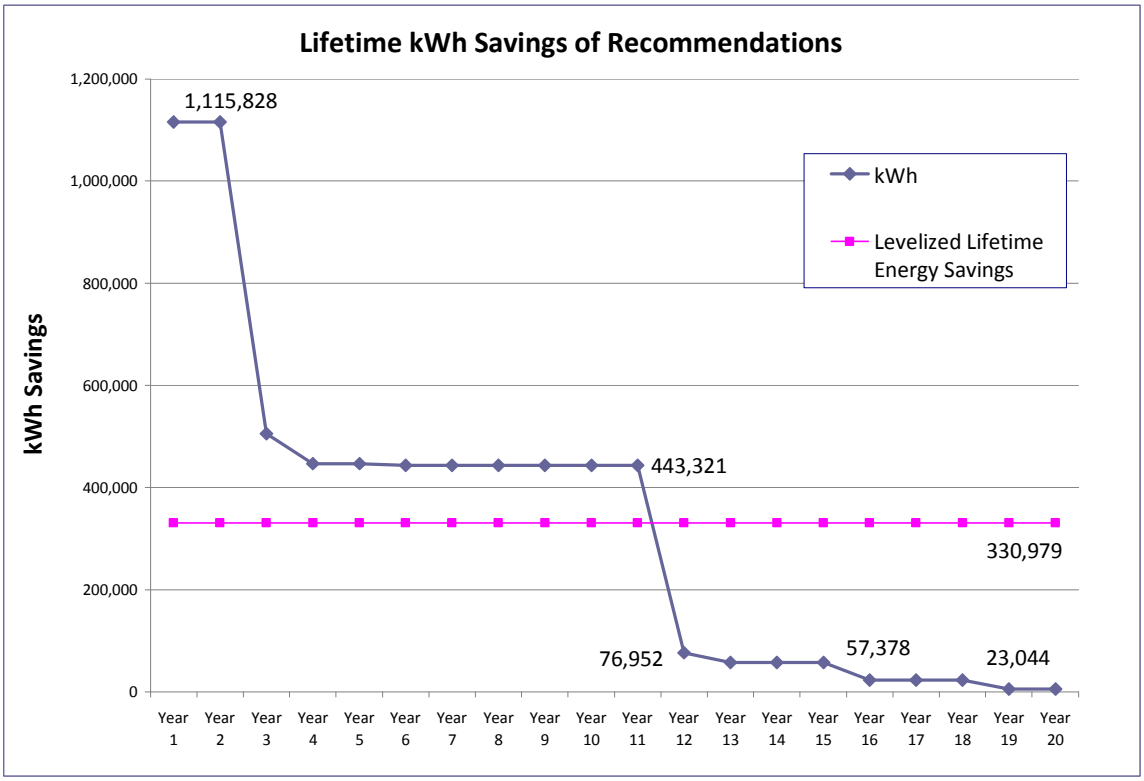
Lifetime kW impacts of savings recommendations are found in Figure 3 and start at 126.832 kW, and then begin to drop. By year 5, kW impacts are 25.45 kW, and remain around this level through year 12. At year 13, impacts drop again to 24.645, and by year 20 are 2.418 kW. Levelized lifetime impacts are 33.290 kW over the lifetime of the recommendations.

Figure 4. Lifetime kW Impacts of Recommendations.



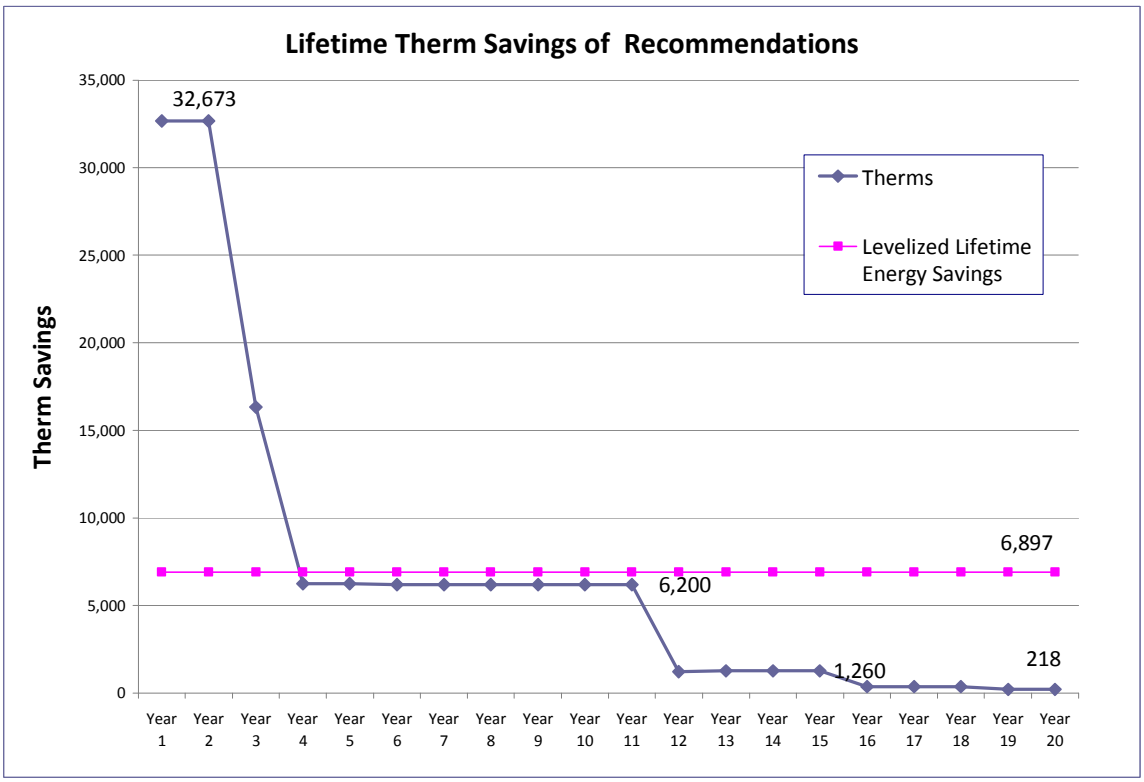
Lifetime kWh impacts of savings recommendations are shown in Figure 5. Savings start at 1,115,828 kWh, and then begin to drop. In year 4, they are 443,321 kWh, and by year 20 are 23,044 kWh. Levelized lifetime energy savings are 330,979 kWh.

Figure 5. Lifetime kWh Savings of Recommendations.



Lifetime Therm savings of recommendations shown in Figure 6 peaked at 32,673 Therm. At year 4, lifetime Therm savings are 6,200 Therm. By year 15, they are 1,260 Therm and by year 20, lifetime Therm savings are 218 Therm. Levelized lifetime energy savings are 6,897 Therm over the lifetime of the recommendations.

Figure 6. Lifetime Therm Savings of Recommendations.



Home Profile Questions

How would you best describe the type of home in which you live?

Detached single-family	Manufactured/Modular home	Condominium	Duplex/2-family	Multi-family (3 or more units)	Townhouse	Total
129	8	5	4	5	3	154
83.8%	5.2%	3.2%	2.6%	3.2%	1.9%	100.0%

In what year was your home built?

Before 1959	1960 - 1979	1980 - 1989	1990 - 1997	1998 - 2000	2001 - 2007	After 2007	Don't Know	Total
50	33	19	19	7	21	0	5	154
32.5%	21.4%	12.3%	12.3%	4.5%	13.6%	.0%	3.2%	100.0%

What is the approximate square footage (heated area) of your home?

<500	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000+	Don’t	Total

	to 999	to 1,499	to 1,999	to 2,499	to 2,999	to 3,499	to 3,999		Know	
0	10	42	35	28	13	6	5	4	11	154
.0%	6.5%	27.3%	22.7%	18.2%	8.4%	3.9%	3.2%	2.6%	7.1%	100.0%

How many rooms are in your home (excluding bathrooms but including finished basement)?

1 - 3	4	5	6	7	8	9	greater than 9	Total
26	9	0	28	36	17	14	24	154
16.9%	5.8%	.0%	18.2%	23.4%	11.0%	9.1%	15.6%	100.0%

How many people live in this home?

1	2	3	4	5	6	7	>7	Total
16	60	35	29	10	3	0	1	154
10.4%	39.0%	22.7%	18.8%	6.5%	1.9%	.0%	.6%	100.0%

Do you own or rent this house?

Own	Rent	Total
139	15	154
90.3%	9.7%	100.0%

What is the primary type of fuel used to heat your home?

Electricity	Natural Gas	Oil	Propane	Other/Don't Know	None	Total
41	95	5	8	5	0	154
26.6%	61.7%	3.2%	5.2%	3.2%	.0%	100.0%

What type of heating system do you have in your home?

None	Central furnace	Electric baseboard	Heat pump	Geothermal heat pump	How water or steam boiler	Other/Don't know	Total
0	112	1	31	0	6	4	154
.0%	72.7%	.6%	20.1%	.0%	3.9%	2.6%	100.0%

If you have a central furnace system, how old is it (in years)?

0 - 4	5 - 9	10 - 14	15 - 19	>19	Don't Know	Total

34	45	25	19	13	18	154
22.1%	29.2%	16.2%	12.3%	8.4%	11.7%	100.0%

What type of cooling system do you have in your home?

No cooling system	Central air conditioner	Room/window unit air conditioner(s)	Heat pump (for cooling)	Geothermal heat pump	Other	Total
1	107	14	31	0	1	154
.6%	69.5%	9.1%	20.1%	.0%	.6%	100.0%

How many room unit/air conditioners? (check this)

	1	2	3	4	6	Total
140	2	6	4	1	1	154
90.9%	1.3%	3.9%	2.6%	.6%	.6%	100.0%

If you have a cooling system, how old is it (in years)?

0 - 4	5 - 9	10 - 14	15 - 19	>19	Don't Know	Total
45	43	26	15	8	17	154
29.2%	27.9%	16.9%	9.7%	5.2%	11.0%	100.0%

What is the primary fuel used by your water heater?

Electricity	Natural gas	Oil	Propane	Other	Total
52	97	0	4	1	154
33.8%	63.0%	.0%	2.6%	.6%	100.0%

What is the age of your water heater (in years)?

0 - 4	5 - 9	10 - 14	15 - 19	>19	Don't Know	Total
50	42	37	10	4	11	154
32.5%	27.3%	24.0%	6.5%	2.6%	7.1%	100.0%

What fuel does your range use (cooking)?

Electricity	Natural gas	Oil	Propane	Other	Total
115	37	0	1	1	154
74.7%	24.0%	.0%	.6%	.6%	100.0%

What fuel does your oven use (cooking)?

Electricity	Natural gas	Oil	Propane	Other	Total
119	32	0	1	2	154

77.3%	20.8%	.0%	.6%	1.3%	100.0%

What is the primary fuel used by your clothes dryer?

Electricity	Natural gas	Oil	Propane	Other	Total
133	19	0	1	1	154
86.4%	12.3%	.0%	.6%	.6%	100.0%

Appendix A. Energy Efficiency Website Survey

==========
Question Name: recall1
==========
Simply answer the questions and click the "Next" button at the bottom of your screen.
Energy Savings Website

Do recall visiting the Duke Energy website to request an energy efficiency kit?

1 Yes
2 No

==========
Question Name: recall2
==========
Please think back to when you were deciding to visit the Duke Energy Savings website. What factors motivated you to visit this site and request the energy efficiency kit?

1 The energy efficiency kit offered
2 Wanted to reduce energy costs
3 The information provided by the web site
4 Because of past experience with another Duke Energy program
5 Recommendation from other utility programs
6 Recommendation of family/friend/neighbor
7 Advertisement in newspaper
8 Radio advertisement
9 Information from my bill
10 Don't Know [Exclusive]

==========
Question Name: recallother
==========
Other - Please specify

==========
Question Name: usefulneess
==========

To help us improve the website, please let us know how useful the information provided was to you.

==========
Question Name: usefulq1
==========

Overall, how useful was the website in providing you with information about energy use in your home?

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful

==========
Question Name: usefulq2
==========
Which components in the website did you review and how useful were they?

1 Home energy calculator
2 Appliance calculator
3 Lighting calculator
4 Interactive home
5 Energy library: Home energy system
6 Energy library: Fundamentals of electricity
7 For kids

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful
6 Did Not Visit

==========
Question Name: usefulq3
==========

Was the site easy to navigate to get to the information you wanted?

1 Yes
2 No

==========
Question Name: usefulq4
==========

What changes would you recommend to make the site better?

==========
Question Name: usefulq5
==========

Did you look at the Home Energy calculator report details?

1 Yes
2 No

==========
Question Name: usefulq5a
==========

Did you feel that the estimate from the home energy calculator reasonably reflected your usage?

1 Yes
2 No

==========
Question Name: usefulq5b

==========
Was the report very useful?

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful

==========
Question Name: preinstall
==========
Please let us know if you have installed any of the following items before you received your kit from the website.

1 Energy efficient (low flow) showerhead
2 Kitchen faucet aerator
3 Bathroom faucet aerator
4 15 Watt mini compact fluorescent lights
5 20 Watt mini compact fluorescent lights
6 Weather stripping
7 Window shrink fit
8 Insulating gaskets on outlet boxes or wall switches

1 Yes
2 No

==========
Question Name: installation
==========
The following questions apply to the items that were in the energy savings kit sent to you after using the Home Energy Calculator. We want to ask if you have used the items in the kit. If you have, we would like to ask a couple of questions about how you used the items.

Have you installed any of the following since visiting the website?

1 Energy efficient (low flow) showerhead
2 Kitchen faucet aerator
3 Bathroom faucet aerator
4 15 Watt mini compact fluorescent lights
5 20 Watt mini compact fluorescent lights
6 Weather stripping
7 Window shrink fit
8 Insulating gaskets on outlet boxes or wall switches

1 Yes
2 No
3 No, but plan to
4 N/A

==========
Question Name: shower2
==========

Typically how many showers per week are taken using this showerhead?

==========
Question Name: shower4
==========
Do you think your showers are longer, shorter, or about the same as they were with the old unit?

1 Longer
2 Shorter
3 About the Same

==========
Question Name: showerdat
==========
When did you install the energy efficient (low flow) showerhead?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: shower5
==========
Were you already planning on installing an energy efficient (low flow)showerhead before you visited the website to get your free kit?

1 Yes
2 No
3 No, already have them installed in all the showers

==========
Question Name: shower6
==========
Have you purchased any additional energy efficient (low flow) showerheads since receiving the kit from the website?

1 Yes
2 No
3 Don't Know

==========

Question Name: shower7
==========
How many?

==========
Question Name: aertdat
==========
When did you install the kitchen faucet aerator?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: aerator2
==========
Was there an aerator on the faucet that you had to remove?

1 Yes
2 No

==========
Question Name: aerator4
==========
Was the old aerator working well when you removed it?

1 Yes
2 No

==========
Question Name: aerator4a
==========
Would you estimate that the amount of water coming through the new aerator is:

1 Less than the old unit
2 About the same
3 More than the old unit

==========
Question Name: aerator5

==========

Were you already planning on installing a new faucet aerator before you visited the website?

1 Yes
2 No
3 No, already have them installed in all available faucets

==========
Question Name: aerator8
==========
Have you purchased any additional kitchen faucet aerators since receiving the kit from the web site?

1 Yes
2 No
3 Don't Know

==========
Question Name: aerator8a
==========
How many?

==========
Question Name: bathfaucetdat
==========
When did you install the bathroom faucet aerator?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: bathfaucet2
==========
Was there an aerator on the faucet that you had to remove?

1 Yes
2 No
==========
Question Name: bathfaucet4
==========

Was the old aerator working well when you removed it?

1 Yes
2 No

==========
Question Name: bathfaucet4a
==========
Would you estimate that the amount of water coming through the new aerator is:

1 Less than the old unit
2 About the same
3 More than the old unit

==========
Question Name: bathfaucet5
==========
Were you already planning on installing a new faucet aerator before you visited the website?

1 Yes
2 No
3 No, already have them installed in all available faucets

==========
Question Name: bathfaucet6
==========
Have you purchased any additional bathroom faucet aerators since receiving the kit from the website?

1 Yes
2 No

==========
Question Name: bathfaucet6a
==========

How many?

==========
Question Name: watt15q2
==========
How many watts was the old bulb you took out?

1 <= 44
2 45 - 70
3 71 - 99
4 >= 100

==========
Question Name: watt15q3
==========
On average, how many hours per day do you use this bulb?

==========
Question Name: watt15q4
==========
Is the CFL still in place or have you removed it?

1 Still in place
2 Removed it

==========
Question Name: watt15dat
==========
When did you install the 15 watt CFL?
1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: watt15q5
==========
Were you already planning on purchasing a new CFL before you received a kit from the website?

1 Yes
2 No
3 No, already have them installed in all available sockets

==========
Question Name: watt15q5a
==========
How many were you planning on purchasing?

==========
Question Name: watt20q2
==========
How many watts was the old bulb you took out?

1 <= 44
2 45 - 70
3 71 - 99
4 >= 100

==========
Question Name: watt20q3
==========
On average, how many hours per day do you use this bulb?

==========
Question Name: watt20q4
==========
Is the CFL still in place or have you removed it?

1 Still in place
2 Removed it

==========
Question Name: watt20dat1
==========
When did you install the 20 watt CFL?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: watt20q5
==========
Were you already planning on purchasing a new CFL before you received a kit from the website?

1 Yes
2 No
3 No, already have them installed in all available sockets

==========
Question Name: watt2q5a
==========
How many were you planning on purchasing?

==========
Question Name: watt20q6

==========
Have you purchased and installed additional CFLs since receiving the kit from the website?

1 Yes
2 No
3 Don't Know

==========
Question Name: watt20q6a
==========
How many did you purchase?

==========
Question Name: wattq7
==========
On average, what wattage bulb did you remove from the fixture before you installed the CFL?

1 <= 44
2 45 - 70
3 71 - 99
4 >= 100

==========
Question Name: wattq8
==========
Considering all CFL locations and uses, on average, how many hours per day do you use these bulbs?

==========
Question Name: wattdat2
==========
When did you install these CFL?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: wattrenov
==========
Did you do this as part of a major renovation of your home?

1 Yes
2 No

==========
Question Name: strippingq4a1
==========
How much of the 17 feet of weather stripping did you use?

1 Feet
2 Doors

==========
Question Name: strippingdat
==========
When did you install the weather stripping?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: strippingq3
==========
Were you already going to install weather stripping before you visited the website?

1 Yes
2 No
3 No, already have them installed around all available doors

==========
Question Name: strippingq4
==========
Have you purchased any additional weather stripping since receiving the kit from the website?

1 Yes
2 No

==========
Question Name: strippingq4a
==========
1 Feet

2 Doors

==========
Question Name: shrinkfitq2
==========
Would you consider the window on which you used the kit to be a small window, an average sized window or a large window?

1 Small window
2 Average sized window
3 Large window

==========
Question Name: shrinkfitq3
==========
Was the window a single pane window, a single pane window with a storm window, or a double pane window?
1 Single pane window
2 Single pane window with a storm window
3 Double pane window

==========
Question Name: shrinkfitdat
==========
When did you install the window shrink fit kit?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: shrinkfitq4
==========
Were you already going to install a window shrink fit kit before you visited the website?

1 Yes
2 No
3 No, already have them installed in all available windows

==========
Question Name: shrinkfitq4a
==========
For how many windows?

==========
Question Name: shrinkfit5
==========
Have you purchased any additional window shrink fit kits since receiving the kit from the website?

1 Yes
2 No

==========
Question Name: shrinkfitq5a
==========
For how many windows?

==========
Question Name: wallq2
==========
How many insulating gaskets have you installed from the kit?

==========
Question Name: walldat
==========
When did you install the insulating gaskets?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: wallq3
==========
Were you already going to install insulating gaskets before you visited the website?

1 Yes
2 No

3 No, already have them installed in all available outlets

==========
Question Name: wallq4
==========
Have you purchased any additional insulating gaskets since receiving the kit from the website?

1 Yes
2 No

==========
Question Name: wallq4a
==========
How many did you purchase?

==========
Question Name: tip1
==========
The next set of questions asks about the items you have installed in your home as a result of the information you learned at the Duke Energy Website. These questions are only about things that you have done after reviewing the information on the website.
Have you installed any of the following since visiting the website?

1 Natural gas furnace
2 Heat pump
3 Central air conditioning
4 Insulated sidewalls
5 Attic insulation
6 Heating or cooling duct insulation
7 Repaired or fixed holes in heating or cooling ducts
8 Furnace filter replacement
9 New Refrigerator

1 Yes
2 No
3 No, but plan to
4 N/A

==========
Question Name: furnaceq2
==========
Is the furnace a high efficiency unit in which...

1 the exhausts exit out a plastic pipe coming through the side of the home
2 the exhausts go up a chimney similar to a standard efficiency unit

==========
Question Name: furnacedat
==========
When did you install the new furnace?

1 Month
2 Year

1 January

2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: furnacerenovat
==========
Did you do this as part of a major renovation of your home?

1 Yes
2 No

==========
Question Name: furnaceq3
==========
How useful was the website in determining whether to install a high efficiency unit in your house?

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful

==========
Question Name: furnaceq4
==========
Please explain why you did not find the website very useful in determining whether to install a high efficiency unit in your house?

1 I did not find any information about this on the website.
2 The information I found on the website about this was unclear
3 The information I found on the website about this was not the information I needed to make a decision
4 Other [Respondent Specify]

==========
Question Name: heatpump2
==========
Is the heat pump a high efficiency unit (>13 *SEER) or a standard efficiency unit(<13 *SEER)?

1 High Efficiency Unit
2 Standard Efficiency Unit

==========
Question Name: heatpumpdat

==========
When did you install the new heat pump?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: heatpump4
==========
What is the *SEER number for you unit?
1 < = 11
2 12
3 13
4 >= 14
5 Don't Know

* SEER - Seasonal Energy Efficiency Ratio

==========
Question Name: heatpumprenovat
==========
Did you do this as part of a major renovation of your home?

1 Yes
2 No

==========
Question Name: heatpump3
==========
How useful was the website in determining whether to install a high efficiency unit in your house?

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful

==========
Question Name: heatpump5

==========
Please explain why you did not find the website very useful in determining whether to install a high efficiency unit in your house?

1 I did not find any information about this on the website.
2 The information I found on the website about this was unclear
3 The information I found on the website about this was not the information I needed to make a decision
4 Other [Respondent Specify]

==========
Question Name: ACq2
==========
Is the air conditioner a high efficiency unit (>13 SEER) or a standard efficiency unit (< 13 SEER)?

1 High Efficiency Unit
2 Standard Efficiency Unit

==========
Question Name: acdat
==========
When did you install the new central air conditioner?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: ACq4
==========
What is the *SEER number for you unit?

1 < = 11
2 12
3 13
4 >= 14
5 Don't Know

* SEER - Seasonal Energy Efficiency Ratio

==========

Question Name: acrepair
==========
Did you do this as part of a major renovation of your home?

1 Yes
2 No

==========
Question Name: ACq3
==========
How useful was the website in determining whether to install a high efficiency unit in your house?

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful

==========
Question Name: AC5
==========
Please explain why you did not find the website very useful in determining whether to install a high efficiency unit in your house?

1 I did not find any information about this on the website.
2 The information I found on the website about this was unclear
3 The information I found on the website about this was not the information I needed to make a decision
4 Other [Respondent Specify]

==========
Question Name: sidewall2
==========
How many walls did you have insulated?

==========
Question Name: sidewalldat
==========
When did you insulate your side walls?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: sidewalltype1
==========
What type of insulation did you add?

1 Fiberglass
2 Cellulose
3 Foam
4 Other

==========
Question Name: sidewall8
==========
How many inches of insulation depth did you add to the sidewall?

==========
Question Name: sidewall9
==========
How thick was the insulation before you added more?

==========
Question Name: sidewall10
==========
Did you do this as part of a major renovation of your home?

1 Yes
2 No

==========
Question Name: sidewall3
==========
How useful was the website in determining whether to insulate your walls?

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful

==========
Question Name: sidewall4
==========
Please explain why you did not find the website very useful in determining whether to insulate your walls?

1 I did not find any information about this on the website.
2 The information I found on the website about this was unclear
3 The information I found on the website about this was not the information I needed to make a decision
4 Other [Respondent Specify]

==========
Question Name: attic2
==========

Did you insulate part of the attic or the entire attic?

1 Insulated part of the attic
2 Insulated the entire attic

==========
Question Name: attictype
==========
What type of insulation did you add?

1 Fiberglass
2 Cellulose
3 Foam
4 Other

==========
Question Name: atticdat
==========
When did you insulate your attic?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: attic3
==========
How many inches of insulation depth did you add to the attic?

==========
Question Name: attic6
==========
How thick was the insulation before you added more?

==========
Question Name: attic7
==========
Did you do this as part of a major renovation of your home?

1 Yes
2 No

==========
Question Name: attic4
==========
How useful was the website in determining whether to insulate your attic?

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful

==========
Question Name: attic5
==========
Please explain why you did not find the website very useful in determining whether to insulate your attic?

1 I did not find any information about this on the website.
2 The information I found on the website about this was unclear
3 The information I found on the website about this was not the information I needed to make a decision
4 Other [Respondent Specify]

==========
Question Name: insulate3dat
==========
When did you insulate your ducts?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: ductarea
==========
Are these ducts located in a heated or unheated part of the home?

1 Unheated area
2 Heated area
3 Don't know

==========
Question Name: ductrenova
==========
Did you do this as part of a major renovation of your home?

1 Yes
2 No

==========
Question Name: insulate3
==========
How useful was the website in determining whether to insulate your ducts?

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful

==========
Question Name: insulate3follow
==========
Please explain why you did not find the website very useful in determining whether to insulate your ducts?

1 I did not find any information about this on the website.
2 The information I found on the website about this was unclear
3 The information I found on the website about this was not the information I needed to make a decision
4 Other [Respondent Specify]

==========
Question Name: insulate5dat1
==========
When did you repair or fix holes in your ducts?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: repairenov

==========
Did you do this as part of a major renovation of your home?

1 Yes
2 No

==========
Question Name: insulate5
==========
How useful was the website in determining whether to repair your ducts and where to conduct the repairs?

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful

==========
Question Name: insulate5follow1
==========
Please explain why you did not find the website very useful in determining whether to repair your ducts and where to conduct the repairs?

1 I did not find any information about this on the website.
2 The information I found on the website about this was unclear
3 The information I found on the website about this was not the information I needed to make a decision
4 Other [Respondent Specify]

==========
Question Name: filters2
==========
How often do you now change the filter?

1 Weekly
2 Monthly
3 Quarterly
4 Yearly
5 Other [Respondent Specify]

==========
Question Name: filters3
==========
How often did you change your filter before reading the website information?

1 Weekly
2 Monthly
3 Quarterly
4 Yearly
5 Other [Respondent Specify]

==========
Question Name: filters4
==========
How useful was the website in determining whether to replace the filter?

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful

==========
Question Name: filters5
==========
Please explain why you did not find the website very useful in determining whether to replace your furnace filter?

1 I did not find any information about this on the website.
2 The information I found on the website about this was unclear
3 The information I found on the website about this was not the information I needed to make a decision
4 Other [Respondent Specify]

==========
Question Name: refrigeratorq5
==========

Is the refrigerator Energy Star compliant?

1 Yes
2 No
3 Don't Know

==========
Question Name: refrigeratorq6
==========
Are you keeping your old refrigerator plugged in as a backup?

1 Yes
2 No
3 Don't Know

==========
Question Name: refrigdat1
==========
When did you install the new refrigerator?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November

12 December

1 2007
2 2008

==========
Question Name: refrigrenovat
==========
Did you do this as part of a major renovation of your home?

1 Yes
2 No

==========
Question Name: refrigerator8
==========
How useful was the website in determining whether to install a new refrigerator?

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful

==========
Question Name: refrigerator8a
==========
Please explain why you did not find the website very useful in determining whether to install a new refrigerator?

1 I did not find any information about this on the website.
2 The information I found on the website about this was unclear
3 The information I found on the website about this was not the information I needed to make a decision
4 Other [Respondent Specify]

==========
Question Name: grid3
==========
The next set of questions asks about actions you have taken as a result of the information you learned at the Duke Energy Website. These questions are only about things that you have done after reviewing the information on the website.

Have you taken any of the following actions since visiting the website?

1 Turn off heat in unused rooms
2 Clean baseboards of dust
3 Install dual heating system
4 Keep draperies open on sunny days and closed at night during winter months
5 Keep draperies closed on sunny days during summer months
6 Insulate your hot water heater

1 Yes
2 No
3 No, but plan to
4 N/A

==========
Question Name: tipuse
==========
Overall, how useful was the website in determining whether to perform any of these actions?

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful

==========
Question Name: unused2
==========
In how many rooms have you turned the heat off?

==========
Question Name: baseboard2
==========
How many baseboards have you cleaned?

==========
Question Name: dual2
==========
Do you manage this system to heat only the rooms you need to?

1 Yes
2 No
3 Don't know

==========
Question Name: drapes2
==========
How many windows do you manage the coverings on to save energy?

==========
Question Name: drapes3
==========
How many windows do you manage the coverings on to save energy?

==========
Question Name: watertank2
==========
How many gallons of water does your tank hold?

==========
Question Name: watertank3
==========
How is your water tank heated?

1 Electricity
2 Gas

==========
Question Name: watertankdat

==========
When did you install this insulation?

1 Month
2 Year

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

1 2007
2 2008

==========
Question Name: watertankreno
==========
Did you do this as a major renovation of your home?

1 Yes
2 No

==========
Question Name: watertank4
==========
How useful was the website in determining whether to insulate your hot water heater tank?

1 Not at all Useful
2 2
3 Somewhat Useful
4 4
5 Very Useful

==========
Question Name: watertankfollow
==========
Please explain why you did not find the website very useful in determining whether to insulate your hot water heater tank?

1 I did not find any information about this on the website.
2 The information I found on the website about this was unclear
3 The information I found on the website about this was not the information I needed to make a decision
4 Other [Respondent Specify]

==========
Question Name: grid4
==========

Additional Actions Taken

The next set of questions asks about additional actions you have taken as a result of the information you learned at the Duke Energy Website. These questions are only about things that you have done after reviewing the information on the website.

Have you taken any of the following actions since visiting the website?

1 Wash laundry in cold water
2 Lower thermostat temperature in winter
3 Install doors on front of fireplace
4 Keep fireplace damper closed when not in use
5 Do not use fireplace during periods of extreme cold

1 Yes
2 No
3 No, but plan to
4 Does Not Apply

==========
Question Name: laundry2
==========
How many loads of laundry do you wash per week?

==========
Question Name: thermo2
Do you do this at night, during the day, or both during the day and night?

1 At night
2 During the day
3 Both at night and during the day

==========
Question Name: thermo3
==========
How many degrees have you lowered the temperature at night?

1 1 - 3
2 4 - 6
3 7 - 10
4 >=11

==========
Question Name: thermo4
==========
How many degrees have you lowered the temperature during the day?

1 1 - 3
2 4 - 6
3 7 - 10
4 >=11

==========
Question Name: overall1
==========

This set of questions asks about how much the website influenced your decision to take energy conserving actions.
Overall, how much did the website alone cause you to take energy conserving actions that you had not thought of prior to visiting the site?

1 Not at All
2 2
3 Somewhat
4 4
5 Very Much

==========
Question Name: overall2
==========
If you had energy conserving actions that you did before visiting the website, how effective was the website in confirming that these actions were the correct thing to do?

1 Not at all Effective
2 2
3 Somewhat
4 4
5 Very Effective
6 N/A

==========
Question Name: overall3
==========
Did the website inspire you to take these actions sooner?

1 Yes
2 No
3 No, but plan to
4 N/A

==========
Question Name: overall4
==========
How much did the addition of the kit cause you to take energy conserving actions that you had not thought of prior to visiting the site?

1 Not at All
2 2
3 Somewhat
4 4
5 Very Much

==========
Question Name: satisfaction
==========
On a scale from 1-5, with 1 indicating that you strongly disagree, and 5 indicating that you strongly agree, please rate the following statement

The items I installed from the energy efficiency kit were of satisfactory quality?

1 Strongly Disagree
2 2

3 Somewhat
4 4
5 Strongly Agree

==========
Question Name: satwebkit1
==========
Overall, how satisfied are you with the following?

1 Energy efficiency website
2 Energy efficiency kit
3 Overall energy efficiency program

1 Not Satisfied 1
2 2
3 Somewhat 3
4 4
5 Very Satisfied 5

==========
Question Name: satcomment1
==========
Please comment on why you were not satisfied

==========
Question Name: satcomment
==========
Please let us know if you have any additional comments

==========
Question Name: homeinfo1
==========
The following questions are for classification purposes only and will not be used for any other purpose than to help Duke Energy serve you better.

How would you best describe the type of home in which you live?

1 Detached single-family
2 Manufactured/Modular home
3 Condominium
4 Duplex/2-family
5 Multi-family (3 or more units)
6 Townhouse

==========
Question Name: homeinfo2
==========
In what year was your home built?

1 Before 1959
2 1960 - 1979
3 1980 - 1989
4 1990 - 1997
5 1998 - 2000
6 2001 - 2007
7 After 2007

8 Don't Know

==========
Question Name: homeinfo3
==========
What is the approximate square footage (heated area) of your home?

1 < 500
2 500 - 999
3 1,000 - 1,499
4 1,500 - 1,999
5 2,000 - 2,499
6 2,500 - 2,999
7 3,000 - 3,499
8 3,500 - 3,999
9 4,000 or more
10 Don't Know

==========
Question Name: homeinfo4
==========
How many rooms are in your home (excluding bathrooms but including finished basement)?

1 1 - 3
2 4
3 5
4 6
5 7
6 8
7 9
8 greater than 9

==========
Question Name: demo3
==========
How many people live in this home?

1 1
2 2
3 3
4 4
5 5
6 6
7 7
8 More than 7

==========
Question Name: demo1
==========
Type: Select (Radio Button)
Required: YES

Do you own or rent this house?

1 Own

2 Rent

==========
Question Name: heatinfo1
==========
What is the primary type of fuel used to heat your home?

1 Electricity
2 Natural Gas
3 Propane
4 Oil
5 Other/Don't Know
6 None

==========
Question Name: heatinfo2
==========
What type of heating system do you have in your home?

1 Central furnace
2 Heat pump
3 Geothermal heat pump
4 Electric baseboard
5 How water or steam boiler
6 Other/Don’t know

==========
Question Name: heatinfo3
==========
If you have a central furnace system, how old is it (in years)?

1 0 - 4
2 5 - 9
3 10 - 14
4 15 - 19
5 >19
6 Don't Know

==========
Question Name: headinfo4
==========
What type of cooling system do you have in your home?

1 No cooling system
2 Central air conditioner
3 Room/window unit air conditioner(s): [Respondent Specify]
4 Heat pump (for cooling)
5 Geothermal heat pump
6 Other

==========
Question Name: heatinfo5
==========
If you have a cooling system, how old is it (in years)?

1 0 - 4

2 5 - 9
3 10 - 14
4 15 - 19
5 >19
6 Don't Know

==========
Question Name: waterinfo1
==========
What is the primary fuel used by your water heater?

1 Electricity
2 Natural gas
3 Propane
4 Oil
5 Other

==========
Question Name: waterinfo2
==========
What is the age of your water heater (in years)?

1 0 - 4
2 5 - 9
3 10 - 14
4 15 - 19
5 >19
6 Don't Know

==========
Question Name: waterinfo3
==========
What fuel does your range use (cooking)?

1 Electricity
2 Natural gas
3 Propane
4 Oil
5 Other

==========
Question Name: waterinfo3a
==========
What fuel does your oven use (cooking)?

1 Electricity
2 Natural gas
3 Propane
4 Oil
5 Other

==========
Question Name: waterinfo4
==========
What is the primary fuel used by your clothes dryer?

1 Electricity
2 Natural gas
3 Propane
4 Oil
5 Other

==========
Question Name: address
==========
Thank you for completing this survey! If you would be interested in participating in future online market research studies from Duke Energy please fill in your email address.

1 Name
2 Address
3 City
4 State
5 Zip
6 Email address

Appendix B. Impact Estimation Algorithms.

CFLs

General Algorithm

Gross Summer Coincident Demand Savings

$$\Delta kW_S = units \times \left[\frac{(Watts \times DF_s)_{base} - (Watts \times DF_s)_{ee}}{1000} \right] \times CF_S \times (1 + HVAC_{d,\,s})$$

Gross Annual Energy Savings

$$\Delta kWh = units \times \left[\frac{(Watts \times DF)_{base} - (Watts \times DF)_{ee}}{1000} \right] \times FLH \times (1 + HVAC_c)$$

$$\Delta therm = \Delta kWh \times HVAC_g$$

where:

ΔkW	= gross coincident demand savings
ΔkWh	= gross annual energy savings
$\Delta therm$	= gross annual therm interaction
units	= number of units installed under the program
$Watts_{ee}$	= connected (nameplate) load of energy-efficient unit
$Watts_{base}$	= connected (nameplate) load of baseline unit(s) displaced
FLH	= full-load operating hours (based on connected load)
DF	= demand diversity factor
CF	= coincidence factor
$HVAC_c$	= HVAC system interaction factor for annual electricity consumption
$HVAC_d$	= HVAC system interaction factor for demand
$HVAC_g$	= HVAC system interaction factor for annual gas consumption

15 W CFL Measure

$Watts_{ee}$ = 15, which is the input power of program supplied CFL

$Watts_{base}$ - calculated from survey responses as shown below:

Wattage of bulb removed	$Watts_{base}$	Notes
<= 44	40	Most popular size < 44 W
45 - 70	60	Lumen equivalent of 15 W CFL
71 - 99	75	Most popular size in range
> = 100	100	Most popular size in range

FLH - calculated from survey responses as shown below:

Hours of use per day	FLH	Notes
<1	183	Average value over range
1-2	548	Average value over range
3-4	1278	Average value over range
5-10	2738	Average value over range
11-12	4198	Average value over range
13-24	6753	Average value over range

DF = 1.0 and CF = 0.10

The coincidence factor for this analysis was taken as the average of the coincidence factors estimated by PG&E and SCE for residential CFL program peak demand savings. The PG&E and SCE coincidence factors are combined factors that consider both coincidence and diversity, thus the diversity factor for this analysis was set to 1.0

$HVAC_c$ - the HVAC interaction factor for annual energy consumption depends on the HVAC system, heating fuel type, and location. The HVAC interaction factors for annual energy consumption were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix.

Covington, KY

Heating Fuel	Heating System	Cooling System	HVACc	HVACg
Other	Any except Heat Pump	Any except Heat Pump	0	0
Any	Heat Pump	Heat Pump	-0.16	0
Gas Propane Oil	Central Furnace	None	0	-0.0021
		Room/Window	0.079	-0.0021
		Central AC	0.079	-0.0021
	Other	None	0	-0.0021
		Room/Window	0.079	-0.0021
		Central AC	0.079	-0.0021
Electricity	Central furnace	None	-0.45	0
		Room/Window	-0.36	0
		Central AC	-0.36	0
	Electric baseboard	None	-0.45	0
		Room/Window	-0.36	0
		Central AC	-0.36	0
	Other	None	-0.45	0
		Room/Window	-0.36	0

		Central AC	-0.36	0

$HVAC_d$ - the HVAC interaction factor for demand depends on the cooling system type. The HVAC interaction factors for summer peak demand were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix.

Covington, KY

Cooling System	HVACd
None	0
Room/Window	.17
Central AC	.17
Heat Pump	.17

20W CFL Measure

$Watts_{ee}$ = 20, which is the input power of program supplied CFL
$Watts_{base}$ - calculated from survey responses as shown below:

Wattage of bulb removed	$Watts_{base}$	Notes
<= 44	40	Most popular size < 44 W
45 - 70	60	Most popular size in range
71 - 99	75	Lumen equivalent of 20 W CFL
> = 100	100	Most popular size in range

Weatherstripping, Outlet Gaskets, and Fireplace Closure

Gross Summer Coincident Demand Savings
$\Delta kW_S = units \times (\Delta cfm/unit) \times (kW / cfm) \times DF_S \times CF_S$

Gross Annual Energy Savings
$\Delta kWh = units \times (\Delta cfm/unit) \times (kWh / cfm)$

$\Delta therm = units \times (\Delta cfm / unit) \times (therm / cfm)$

where:

ΔkW	= gross coincident demand savings
ΔkWh	= gross annual energy savings
units	= number of buildings sealed under the program
Δcfm/unit	= unit infiltration airflow rate (ft^3/min) reduction for each measure
DF	= demand diversity factor = 0.8
CF	= coincidence factor = 1.0
kW/cfm	= demand savings per unit cfm reduction
kWh/cfm	= electricity savings per unit cfm reduction
therm/cfm	= gas savings per unit cfm reduction

Unit cfm savings per measure

The cfm reductions for each measure were estimated from equivalent leakage area (ELA) change data taken from the ASHRAE Handbook of Fundamentals (ASHRAE, 2001). The equivalent leakage area changes were converted to infiltration rate changes using the Sherman-Grimsrud equation:

$$Q = ELA \times \sqrt{A \times \Delta T + B \times v^2}$$

where:

A	= stack coefficient (ft^3/min-in^4-°F) = 0.015 for one-story house
ΔT	= average indoor/outdoor temperature difference over the time interval of interest (°F)
B	= wind coefficient (ft^3/min-in^4-mph^2) = 0.0065 (moderate shielding)
v	= average wind speed over the time interval of interest measured at a local weather station at a height of 20 ft (mph)

The location specific data are shown below:

Location	Average outdoor temp	Average indoor/outdoor temp difference	Average wind speed (mph)	Specific infiltration rate (cfm/in^2)
Covington	33	35	22	1.92

Measure ELA impact and cfm reductions are as follows:

Measure	Unit	ELA change (in^2/unit)	ΔCfm/unit (KY)
Outlet gaskets	Each	0.357	0.69
Weather strip	Foot	0.089	0.17
Fireplace	Each	1.86	3.57

Unit energy and demand savings

The energy and peak demand impacts of reducing infiltration rates were calculated from infiltration rate parametric studies conducted using the DOE-2 residential building prototype models, as described at the end of this Appendix. The savings per cfm reduction by heating and cooling system type are shown below:

Heating Fuel	Heating System	Cooling System	kWh/cfm	kW/cfm	therm/cfm
Other	Any except Heat Pump	Any except Heat Pump	1.14	0.00000	0.000
Any	Heat Pump	Heat Pump	12.85	0.00248	0.000
Gas Propane Oil	Central Furnace	None	0	0	0.124
		Room/Window	1.14	0.00000	0.124
		Central AC	1.14	0.00000	0.124
	Other	None	0	0	0.124
		Room/Window	1.14	0.00000	0.124
		Central AC	1.14	0.00000	0.124
Electricity	Central furnace	None	23.27	0.01238	0.000
		Room/Window	23.84	0.01485	0.000
		Central AC	23.84	0.01485	0.000
	Electric baseboard	None	23.27	0.01238	0.000
		Room/Window	23.84	0.01485	0.000
		Central AC	23.84	0.01485	0.000
	Other	None	23.27	0.01238	0.000
		Room/Window	23.84	0.01485	0.000
		Central AC	23.84	0.01485	0.000

Window Shrink Kit

Gross Summer Coincident Demand Savings
ΔkW_S = no. windows ×SF/window × (ΔkW/SF) × DF_S × CF_S

Gross Annual Energy Savings
ΔkWh = no. windows ×SF/window × (ΔkWh/SF)

Δtherm = no. windows ×SF/window × (Δtherm/SF)

where:

ΔkW = gross coincident demand savings
ΔkWh = gross annual energy savings
No windows = quantity of windows treated with window film from survey
SF/window = window square feet based on window size
DF = demand diversity factor
CF = coincidence factor
ΔkW/SF `= electricity demand savings per square foot of window treated
ΔkWh/SF `= electricity consumption savings per square foot of window treated
Δtherm/SF `= gas consumption savings per square foot of window treated

Coincidence and Diversity Factors:

DF = 0.8
CF = 1.0

The diversity and coincidence factors were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993). These values are typical for residential cooling loads in summer peaking utilities.

Window area assumptions (per window):

Window Type	Size (SF)
Small	9
Average	18
Large	30

Unit energy and demand savings data

The unit energy savings were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix. The basic simulation assumptions for window U-value and solar heat gain coefficient (SHGC) were taken from the ASHRAE Handbook of Fundamentals (ASHRAE, 2001), and are described below:

	Without window film		**With window film**	
Window type	**U-value (Btu/hr-SF-°F)**	**SHGC**	**U-value (Btu/hr-SF-°F)**	**SHGC**
Single	1.27	0.86	0.81	0.76
Single with storm	0.81	0.76	0.67	0.68
Double	0.81	0.76	0.67	0.68

The unit energy savings depend on the heating fuel, heating system, cooling system and window type:

Heating Fuel	Other
Heating System	Any except Heat Pump

Cooling System None

Window type	ΔkWh/SF	ΔkW/SF	Δtherm/SF
All	0	0	0

Heating Fuel Other
Heating System Any except Heat Pump
Cooling System Room/Window or Central AC

Window type	ΔkWh/SF	ΔkW/SF	Δtherm/SF
Single	0.795	0.000853	0
Single with storm	0.566	0.000498	0
Double	0.566	0.000498	0

Heating Fuel Any
Heating System Heat Pump
Cooling System Heat Pump

Window type	ΔkWh/SF	ΔkW/SF	Δtherm/SF
Single	4.757	0.001280	0.000
Single with storm	1.621	0.000711	0.000
Double	1.621	0.000711	0.000

Heating Fuel Gas, propane or oil
Heating System Any except Heat Pump
Cooling System None

Window type	ΔkWh/SF	ΔkW/SF	Δtherm/SF
Single	0	0	0.039
Single with storm	0	0	0.011
Double	0	0	0.011

Heating Fuel Gas, propane or oil
Heating System Any except Heat Pump
Cooling System Room/Window or Central AC

Window type	ΔkWh/SF	ΔkW/SF	Δtherm/SF
Single	0.795	0.000853	0.039
Single with storm	0.566	0.000498	0.011

Double	0.566	0.000498	0.011

Heating Fuel	Electricity
Heating System	Any except Heat Pump
Cooling System	None

Window type	**ΔkWh/SF**	**ΔkW/SF**	**Δtherm/SF**
Single	8.748	0.004979	0.000
Single with storm	2.431	0.001351	0.000
Double	2.431	0.001351	0.000

Heating Fuel	Electricity
Heating System	Any except Heat Pump
Cooling System	Room/Window or Central AC

Window type	**ΔkWh/SF**	**ΔkW/SF**	**Δtherm/SF**
Single	9.335	0.005690	0.000
Single with storm	2.940	0.001849	0.000
Double	2.940	0.001849	0.000

Low-Flow Showerhead

Gross Summer Coincident Demand Savings

$$\Delta kW_S = units \times \frac{(GPD_{base} - GPD_{ee}) \times 8.33 \times \overline{\Delta T}}{3413_s} \times DF_x \times CF_s$$

Gross Annual Energy Savings

$$\Delta kWh = units \times \frac{(GPD_{base} - GPD_{ee}) \times 8.33 \times \overline{\Delta T}}{3413} \times 365$$

$$\Delta therm = units \times \frac{(GPD_{base} - GPD_{ee}) \times 8.33 \times \overline{\Delta T}}{\eta_{waterheater}} \times \frac{365}{100000}$$

where:

ΔkW	= gross coincident demand savings
ΔkWh	= gross annual energy savings
units	= number of units installed under the program
GPD_{base}	= daily hot water consumption before installation
GPD_{ee}	= daily hot water consumption after flow reducing measure installation
ΔT	= average difference between entering cold water temperature and the shower use temperature
DF	= demand diversity factor for electric water heating
CF	= coincidence factor
8.33	= conversion factor (Btu/gal-°F)
3413	= conversion factor (Btu/kWh)
24	= conversion factor (hr/day)
365	= conversion factor (days/yr)
100000	= conversion factor (Btu/therm)

Showerhead

GPD_{base} = showers/week / 7 x 3.1 gpm x 5 minutes/shower

GPD_{ee} = showers/week / 7 x 1.5 gpm x 5 minutes/shower

ΔT

City	Average cold water temperature	Shower use temperature	Average ΔT
Covington	53.9°F	100°F	46.1°F

Water heater efficiency

Combustion efficiency for residential gas water heater = 0.70

Demand diversity factor = 0.1

Coincidence factor = 0.4

The diversity and coincidence factors were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993). These values are typical for the residential water heating end-use in a summer peaking utility.

Faucet Aerators

This measure used the Efficiency Vermont deemed savings (Efficiency Vermont, 2003) adjusted for entering water temperature:

Demand Savings
$\Delta kW = 0.0171\ kW \times \Delta T / \Delta T_{VT} \times DF \times CF$

Energy Savings
$\Delta kWh_i = 57\ kWh \times \Delta T / \Delta T_{VT}$
$\Delta therms = 2.0 \times \Delta T / \Delta T_{VT\ i}$

City	Average cold water temperature	Hot water use temperature	Average ΔT
Covington	53.9°F	100°F	46.1°F
Burlington VT	44.5	100°F	55.5

Demand diversity factor = 0.1

Coincidence factor = 0.4

The diversity and coincidence factors were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993). These values are typical for the residential water heating end-use in a summer peaking utility.

Lowering the Temperature in Winter

Gross Annual Energy Savings
ΔkWh = (ΔkWh/unit)

Δtherm = (Δtherm/unit

where:

ΔkW = gross coincident demand savings
ΔkWh = gross annual energy savings
DF = demand diversity factor
CF = coincidence factor
ΔkWunit `= electricity demand savings per dwelling
ΔkWh/SF `= electricity consumption savings per dwelling
Δtherm/SF `= gas consumption savings dwelling

Unit energy savings data

The unit energy savings were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix. The basic assumptions used in the simulations are shown below:

Setback strategy	Setback schedule	Setback temperature
Night 1-3	10 pm to 5 am 7 days per week	68°F
Night 4-6		65°F
Night 7-10		61.5°F
Night 11+		59°F
Day 1-3	5 am to 10 pm 7 days per week	68°F
Day 4-6		65°F
Day 7-10		61.5°F
Day 11+		59°F

The baseline heating setpoint is assumed to be 70°F with no setback.

The unit energy savings depend on the heating fuel, heating system, cooling system and setback strategy. Since this is a heating season measure, there are no summer peak demand savings.

Heating Fuel	Other
Heating System	Any except Heat Pump
Cooling System	None

Setback strategy	ΔkWh/unit	Δtherm/unit
All	0	0

Heating Fuel	Other
Heating System	Any except Heat Pump
Cooling System	Room/Window or Central AC

Setback strategy	ΔkWh/unit	Δtherm/unit
Night 1-3	58	0
Night 4-6	107	0
Night 7-10	138	0
Night 11+	149	0
Day 1-3	80	0
Day 4-6	159	0
Day 7-10	204	0
Day 11+	232	0

Heating Fuel	Any

Heating System Heat Pump
Cooling System Heat Pump

Setback strategy	ΔkWh/unit	Δtherm/unit
Night 1-3	386	0.0
Night 4-6	1,114	0.0
Night 7-10	2,080	0.0
Night 11+	2,767	0.0
Day 1-3	951	0.0
Day 4-6	2,518	0.0
Day 7-10	4,394	0.0
Day 11+	5,715	0.0

Heating Fuel Gas, propane or oil
Heating System Any except Heat Pump
Cooling System None

Setback strategy	ΔkWh/unit	Δtherm/unit
Night 1-3	0.0	4.0
Night 4-6	0.0	10.0
Night 7-10	0.0	16.0
Night 11+	0.0	19.8
Day 1-3	0.0	8.5
Day 4-6	0.0	20.5
Day 7-10	0.0	33.3
Day 11+	0.0	41.3

Heating Fuel Gas, propane or oil
Heating System Any except Heat Pump
Cooling System Room/Window or Central AC

Setback strategy	ΔkWh/unit	Δtherm/unit
Night 1-3	58	4.0
Night 4-6	107	10.0
Night 7-10	138	16.0
Night 11+	149	19.8
Day 1-3	80	8.5
Day 4-6	159	20.5
Day 7-10	204	33.3
Day 11+	232	41.3

Heating Fuel Electricity

Heating System	Any except Heat Pump
Cooling System	None

Setback strategy	ΔkWh/unit	Δtherm/unit
Night 1-3	918	0.0
Night 4-6	2,164	0.0
Night 7-10	3,390	0.0
Night 11+	4,095	0.0
Day 1-3	1,863	0.0
Day 4-6	4,419	0.0
Day 7-10	7,030	0.0
Day 11+	8,615	0.0

Heating Fuel	Electricity
Heating System	Any except Heat Pump
Cooling System	Room/Window or Central AC

Setback strategy	ΔkWh/unit	Δtherm/unit
Night 1-3	957	0.0
Night 4-6	2,228	0.0
Night 7-10	3,467	0.0
Night 11+	4,171	0.0
Day 1-3	1,903	0.0
Day 4-6	4,492	0.0
Day 7-10	7,100	0.0
Day 11+	8,686	0.0

Using Cold Water for Laundry

The energy and demand savings for this measure were taken from the Efficiency Vermont Technical Reference Manual (Efficiency Vermont, 2001), based on the savings per load and the number of loads reported by the survey respondents.

	Gas	Electric	
Loads/wk	therm/yr	kWh/yr	kW
1-2	13.2	166	0.019
3-4	30.8	388	0.044
5-6	48.3	609	0.070
7-8	65.9	830	0.095
9-10	83.5	1052	0.120
11-12	101.0	1273	0.145

13+	114.2	1439	0.164

Replacing Furnace Filter

Gross Summer Coincident Demand Savings
$\Delta kW_S = (kW/unit_{pre} - kW/unit_{post}) \times DF_S \times CF_S$

Gross Annual Energy Savings
$\Delta kWh = (kWh/unit_{pre} - kWh/unit_{post})$

$\Delta therm = (therm/unit_{pre} - therm/unit_{post})$

where:

ΔkW	= gross coincident demand savings
ΔkWh	= gross annual energy savings
DF	= demand diversity factor
CF	= coincidence factor
$kWunit_{pre}$	= HVAC electricity demand per dwelling based on pre report filter change frequency
$kWunit_{post}$	= HVAC electricity demand per dwelling based on post report filter change frequency
$kWh/unit_{pre}$	= HVAC electricity consumption per dwelling based on pre report filter change frequency
$kWh/unit_{post}$	= HVAC electricity consumption per dwelling based on post report filter change frequency
$therm/unit_{pre}$	= HVAC gas consumption per dwelling based on pre report filter change frequency
$therm/unit_{post}$	= HVAC gas consumption per dwelling based on post report filter change frequency

Coincidence and Diversity Factors:

DF = 0.8
CF = 1.0

The diversity and coincidence factors were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993). These values are typical for residential cooling loads in summer peaking utilities.

Unit energy and demand data

The unit energy and demand savings were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix. The analysis assumes that furnace filter change outs result in a 5% savings relative to an un-maintained system. The 5% overall savings were allocated to the survey responses as follows:

Filter change frequency	Percent savings
< 1/yr	0%
1x / yr	1.7%
2x / yr	3.3%
> 2x / yr	5%

Data depend on the heating fuel, heating system, cooling system type and the pre and post filter change frequency

Heating Fuel Other
Heating System Any except Heat Pump
Cooling System None

Filter change frequency	kWh	kW	therm
all	0	0	0

Heating Fuel Other
Heating System Any except Heat Pump
Cooling System Central AC

Filter change frequency	kWh	kW	therm
< 1/yr	4,453	5.2	0
1x / yr	4,375	5.1	0
2x / yr	4,302	5.0	0
> 2x / yr	4,231	4.9	0

Heating Fuel Any
Heating System Heat Pump
Cooling System Heat Pump

Filter change frequency	kWh	kW	therm
< 1/yr	21,793	11.7	0
1x / yr	21,410	11.5	0

2x / yr	21,054	11.3	0
> 2x / yr	20,704	11.1	0

Heating Fuel Gas, propane or oil
Heating System Furnace
Cooling System None

Filter change frequency	kWh	kW	therm
< 1/yr	0	0	148
1x / yr	0	0	146
2x / yr	0	0	143
> 2x / yr	0	0	141

Heating Fuel Gas, propane or oil
Heating System Furnace
Cooling System Central AC

Filter change frequency	kWh	kW	therm
< 1/yr	4,453	5.2	148
1x / yr	4,375	5.1	146
2x / yr	4,302	5.0	143
> 2x / yr	4,231	4.9	141

Heating Fuel Electricity
Heating System Furnace
Cooling System None

Filter change frequency	kWh	kW	therm
< 1/yr	31,073	19.5	0
1x / yr	30,527	19.2	0
2x / yr	30,020	18.8	0
> 2x / yr	29,520	18.5	0

Heating Fuel Electricity
Heating System Furnace

Cooling System Central AC

Filter change frequency	kWh	kW	therm
< 1/yr	34,936	24.3	0
1x / yr	34,322	23.9	0
2x / yr	33,752	23.5	0
> 2x / yr	33,190	23.1	0

Stopping Heating Unused Rooms

Gross Summer Coincident Demand Savings
$\Delta kW_S = (\Delta kW/unit) \times DF_S \times CF_S$

Gross Annual Energy Savings
$\Delta kWh = (\Delta kWh/unit)$

$\Delta therm = (\Delta therm/unit$

where:

ΔkW	= gross coincident demand savings
ΔkWh	= gross annual energy savings
DF	= demand diversity factor
CF	= coincidence factor
ΔkWunit	`= electricity demand savings per dwelling
ΔkWh/SF	`= electricity consumption savings per dwelling
Δtherm/SF	`= gas consumption savings dwelling

Coincidence and Diversity Factors:

DF = 0.8
CF = 1.0

The diversity and coincidence factors were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993). These values are typical for residential cooling loads in summer peaking utilities.

Unit energy and demand savings data

The unit energy and demand savings were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix. The analysis assumes that each room is 220 SF in size. Savings data depend on the heating fuel, heating system, cooling system and duct treatment

Heating Fuel Other
Heating System Any except Heat Pump
Cooling System None

Number of rooms	ΔkWh/unit	ΔkW/unit	Δtherm/unit
All	0	0	0

Heating Fuel Other
Heating System Any except Heat Pump
Cooling System Central AC

Number of rooms	ΔkWh/unit	ΔkW/unit	Δtherm/unit
1	80	0.09	0
2	161	0.19	0
3	241	0.28	0
4	321	0.37	0
5	401	0.47	0
6+	482	0.56	0

Heating Fuel Any
Heating System Heat Pump
Cooling System Heat Pump

Number of rooms	ΔkWh/unit	ΔkW/unit	Δtherm/unit
1	393	0.21	0
2	786	0.42	0
3	1,179	0.63	0
4	1,571	0.84	0
5	1,964	1.05	0
6+	2,357	1.26	0

Heating Fuel Gas, propane or oil
Heating System Furnace
Cooling System None

Number of rooms	ΔkWh/unit	ΔkW/unit	Δtherm/unit
1	0	0	3
2	0	0	5
3	0	0	8
4	0	0	11
5	0	0	13
6+	0	0	16

Heating Fuel Gas, propane or oil
Heating System Furnace
Cooling System Central AC

Number of rooms	ΔkWh/unit	ΔkW/unit	Δtherm/unit
1	80	0.09	3
2	161	0.19	5
3	241	0.28	8
4	321	0.37	11
5	401	0.47	13
6+	482	0.56	16

Heating Fuel Electricity
Heating System Furnace
Cooling System None

Number of rooms	ΔkWh/unit	ΔkW/unit	Δtherm/unit
1	560	0.35	0
2	1,120	0.70	0
3	1,680	1.05	0
4	2,241	1.41	0
5	2,801	1.76	0
6+	3,361	2.11	0

Heating Fuel Electricity
Heating System Furnace
Cooling System Central AC

Number of rooms	ΔkWh/unit	ΔkW/unit	Δtherm/unit
1	630	0.44	0

2	1,260	0.88	0
3	1,889	1.31	0
4	2,519	1.75	0
5	3,149	2.19	0
6+	3,779	2.63	0

Insulated Water Heater

Gross Summer Coincident Demand Savings

$$\Delta kW_S = units \times \frac{(UA_{base} - UA_{ee}) \times \Delta T_s}{3413} \times DF_s \times CF_s$$

Gross Annual Energy Savings

$$\Delta kWh = units \times \frac{(UA_{base} - UA_{ee}) \times \overline{\Delta T}}{3413} \times 8760$$

$$\Delta therm = units \times \frac{(UA_{base} - UA_{ee}) \times \overline{\Delta T}}{\eta_{waterheater}} \times \frac{8760}{100000}$$

where:

ΔkW = gross coincident demand savings
ΔkWh = gross annual energy savings
units = number of water heaters installed under the program
UA_{base} = overall heat transfer coefficient of base water heater (Btu/hr-°F)
UA_{ee} = overall heat transfer coefficient of improved water heater (Btu/hr-°F)
ΔT = temperature difference between the tank and the ambient air (°F)
DF = demand diversity factor
CF = coincidence factor
3413 = conversion factor (Btu/kWh)
8760 = conversion factor (hr/yr)
100000 = conversion factor (Btu/therm)
$\eta_{waterheater}$ = water heater efficiency

Water heater tank UA

Water heater size (gal)	Electric		Gas	
	UAbase	UAee	UAbase	UAee
30	3.84	1.69	4.21	1.76
50	4.67	1.83	5.13	1.91
60	4.13	2.06	4.54	2.14

75	5.00	2.42	5.50	2.52
80+	5.72	2.53	6.28	2.64

ΔT = 140°F water setpoint temp – 65°F room temp = 75°F

DF = 1.0
CF= 1.0
$\eta_{waterheater}$ = 0.7

The diversity and coincidence factors were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993). These values are typical for residential water heaters meeting standby losses.

Manage Draperies

Gross Summer Coincident Demand Savings
ΔkW_S = windows × (ΔkW/window) × DF_S × CF_S

Gross Annual Energy Savings
ΔkWh = windows × (ΔkWh/ window)

Δtherm = windows × (Δtherm/ window)

where:

ΔkW	= gross coincident demand savings
ΔkWh	= gross annual energy savings
Windows	= number of windows managed
DF	= demand diversity factor
CF	= coincidence factor
ΔkW/ window	`= electricity demand savings per window
ΔkWh/window	`= electricity consumption savings per window
Δtherm/window	`= gas consumption savings per window

Coincidence and Diversity Factors:

DF = 0.8
CF = 1.0

The diversity and coincidence factors were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993). These values are typical for residential cooling loads in summer peaking utilities.

Unit energy and demand savings data

The unit energy and demand savings were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix. The analysis assumes drapes open during daylight hours on south facing windows only. The savings depend on the heating fuel, heating system, cooling system and number of windows managed.

Heating Fuel Other
Heating System Any except Heat Pump
Cooling System Any or none

Number of windows	ΔkWh/unit	ΔkW/unit	Δtherm/unit
All	0	0	0

Heating Fuel Any
Heating System Heat Pump
Cooling System Heat Pump

Number of windows	ΔkWh/unit	ΔkW/unit	Δtherm/unit
1-3	99	0	0
4-7	274	0	0
8-12	497	0	0
13+	647	0	0

Heating Fuel Gas, propane or oil
Heating System Any except Heat Pump
Cooling System Any or none

Number of windows	ΔkWh/unit	ΔkW/unit	Δtherm/unit
1-3	0	0	3
4-7	0	0	5
8-12	0	0	8
13+	0	0	11

Heating Fuel Electricity

Heating System	Any except Heat Pump
Cooling System	Any or none

Number of windows	ΔkWh/unit	ΔkW/unit	Δtherm/unit
1-3	164	0	0
4-7	451	0	0
8-12	821	0	0
13+	1067	0	0

Cleaned Electric Baseboards

Savings are based on reduced heat losses from back of electric baseboard unit through insulated wall to the outside. Cleaning unit is assumed to reduce the average temperature inside the unit from 115°F to 90°F. Heat losses are estimated based on an R-11 wall and 40°F outside temperature. Each unit is assumed to be 8 ft long. Heat loss reductions are estimated to be 0.13% of the baseboard rated input, resulting in 4.25 kWh per baseboard unit cleaned. Apply only when heating fuel = electric and heating system type = baseboard. No kW savings.

Attic Insulation

Gross Summer Coincident Demand Savings
$\Delta kW_S = SF \times (kW/SF_{base} - kW/SF_{ee}) \times DF_S \times CF_S$

Gross Annual Energy Savings
$\Delta kWh = SF \times (kWh/SF_{base} - kWh/SF_{ee})$

$\Delta therm = SF \times (therm/SF_{base} - therm/SF_{ee})$

where:

ΔkW = gross coincident demand savings
ΔkWh = gross annual energy savings
SF = insulation square feet installed
DF = demand diversity factor
CF = coincidence factor
kW/SF `= electricity demand per square foot of insulation installed
kWh/SF `= electricity consumption per square foot of insulation installed

therm/SF `= gas consumption per square foot of insulation installed

Coincidence and Diversity Factors:

DF = 0.8
CF = 1.0

The diversity and coincidence factors were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993). These values are typical for residential cooling loads in summer peaking utilities.

Insulation square foot assumptions:

Average house size from site data (Carolinas), or estimated from number of rooms (Kentucky)

Size of house = number of rooms * 330 SF/room

Average ceiling area = house size / 1.2

If partial insulation, then reduce ceiling area by 50%

R value assumptions

Rbase:

Base thickness	**R_{base}**
0	0
2	7
4	14
6	21
8	28
10	35

Assumes existing insulation is fiberglass or cellulose, at R-3.5 per inch. This assumption addresses insulation R-value only. The R-value assumptions for other materials within the ceiling construction are embedded in the simulation model.

Ree

The R-value of the wall with added insulation depends on base thickness, added insulation thickness and insulation type: Fiberglass, cellulose and "other" insulation is assumed to have an R-value of 3.5 per inch. Foam insulation is assumed to have an R-value of 5.6 per inch.

Base thickness	Added thickness	Ree	
		fiberglass, cellulose or other	Foam
	2	7.00	11.2
	4	14.00	22.4
	6	21.00	33.6
	8	28.00	44.8
	10	35.00	56.0
0	12	42.00	67.2
	2	14.00	18.20
	4	21.00	29.40
	6	28.00	40.60
	8	35.00	51.80
	10	42.00	63.00
2	12	49.00	74.20
	2	21.00	25.20
	4	28.00	36.40
	6	35.00	47.60
	8	42.00	58.80
	10	49.00	70.00
4	12	56.00	81.20
	2	28.00	32.20
	4	35.00	43.40
	6	42.00	54.60
	8	49.00	65.80
	10	56.00	77.00
6	12	63.00	88.20
	2	35.00	39.20
	4	42.00	50.40
	6	49.00	61.60
	8	56.00	72.80
	10	63.00	84.00
8	12	70.00	95.20
	2	42.00	46.20
	4	49.00	57.40
	6	56.00	68.60
	8	63.00	79.80
	10	70.00	91.00
10	12	77.00	102.20
	2	49.00	53.20
	4	56.00	64.40
	6	63.00	75.60
	8	70.00	86.80
12	10	77.00	98.00

	12	84.00	109.20

Unit energy and demand data

The unit energy savings were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix. The unit energy and demand savings depend on the heating fuel, heating system, cooling system type and Rvalue

Heating Fuel	Other
Heating System	Any except Heat Pump
Cooling System	None

R-value	kWh/SF	kW/SF	therm/SF
All	0	0	0

Heating Fuel	Other
Heating System	Any except Heat Pump
Cooling System	Room/Window or Central AC

R-value	kWh/SF	kW/SF	therm/SF
0	1.649	0.00198	0
7	1.339	0.00157	0
14	1.272	0.00149	0
21	1.245	0.00145	0
28	1.231	0.00143	0
35	1.220	0.00142	0
42	1.214	0.00141	0
49	1.210	0.00141	0
56	1.206	0.00140	0
63	1.203	0.00140	0
70	1.201	0.00140	0
77	1.200	0.00140	0
84	1.196	0.00139	0
109	1.194	0.00139	0

Heating Fuel	Any
Heating System	Heat Pump
Cooling System	Heat Pump

R-value	kWh/SF	kW/SF	therm/SF

R-value	kWh/SF	kW/SF	therm/SF
0	7.636	0.00390	0.00000
7	6.550	0.00387	0.00000
14	6.121	0.00378	0.00000
21	5.937	0.00374	0.00000
28	5.833	0.00371	0.00000
35	5.768	0.00370	0.00000
42	5.724	0.00368	0.00000
49	5.689	0.00368	0.00000
56	5.665	0.00367	0.00000
63	5.644	0.00366	0.00000
70	5.628	0.00366	0.00000
77	5.616	0.00366	0.00000
84	5.605	0.00366	0.00000
109	5.576	0.00365	0.00000

Heating Fuel	Gas, propane or oil
Heating System	Any except Heat Pump
Cooling System	None

R-value	kWh/SF	kW/SF	therm/SF
0	0	0	0.05917
7	0	0	0.04418
14	0	0	0.04058
21	0	0	0.03908
28	0	0	0.03828
35	0	0	0.03768
42	0	0	0.03738
49	0	0	0.03708
56	0	0	0.03688
63	0	0	0.03668
70	0	0	0.03658
77	0	0	0.03648
84	0	0	0.03638
109	0	0	0.03618

Heating Fuel	Gas, propane or oil
Heating System	Any except Heat Pump
Cooling System	Room/Window or Central AC

R-value	kWh/SF	kW/SF	therm/SF

R-value	kWh/SF	kW/SF	therm/SF
0	1.649	0.00198	0.05917
7	1.339	0.00157	0.04418
14	1.272	0.00149	0.04058
21	1.245	0.00145	0.03908
28	1.231	0.00143	0.03828
35	1.220	0.00142	0.03768
42	1.214	0.00141	0.03738
49	1.210	0.00141	0.03708
56	1.206	0.00140	0.03688
63	1.203	0.00140	0.03668
70	1.201	0.00140	0.03658
77	1.200	0.00140	0.03648
84	1.196	0.00139	0.03638
109	1.194	0.00139	0.03618

Heating Fuel	Electricity
Heating System	Any except Heat Pump
Cooling System	None

R-value	kWh/SF	kW/SF	therm/SF
0	12.181	0.00659	0.00000
7	9.063	0.00501	0.00000
14	8.254	0.00463	0.00000
21	7.915	0.00447	0.00000
28	7.728	0.00439	0.00000
35	7.610	0.00432	0.00000
42	7.528	0.00429	0.00000
49	7.468	0.00426	0.00000
56	7.423	0.00424	0.00000
63	7.387	0.00422	0.00000
70	7.358	0.00421	0.00000
77	7.334	0.00420	0.00000
84	7.313	0.00419	0.00000
109	7.262	0.00417	0.00000

Heating Fuel	Electricity
Heating System	Any except Heat Pump
Cooling System	Room/Window or Central AC

R-value	kWh/SF	kW/SF	therm/SF
0	13.541	0.00839	0.00000
7	10.184	0.00646	0.00000
14	9.327	0.00601	0.00000
21	8.969	0.00581	0.00000
28	8.773	0.00571	0.00000
35	8.645	0.00564	0.00000
42	8.560	0.00560	0.00000
49	8.497	0.00557	0.00000
56	8.448	0.00554	0.00000
63	8.410	0.00552	0.00000
70	8.380	0.00551	0.00000
77	8.356	0.00550	0.00000
84	8.331	0.00548	0.00000
109	8.279	0.00546	0.00000

Sidewall Insulation

Gross Summer Coincident Demand Savings
$\Delta kW_S = SF \times (kW/SF_{base} - kW/SF_{ee}) \times DF_S \times CF_S$

Gross Annual Energy Savings
$\Delta kWh = SF \times (kWh/SF_{base} – kWh/SF_{ee})$

$\Delta therm = SF \times (therm/SF_{base} – therm/SF_{ee})$

where:

ΔkW = gross coincident demand savings
ΔkWh = gross annual energy savings
SF = insulation square feet installed
DF = demand diversity factor
CF = coincidence factor
kW/SF `= electricity demand per square foot of insulation installed
kWh/SF `= electricity consumption per square foot of insulation installed
therm/SF `= gas consumption per square foot of insulation installed

Coincidence and Diversity Factors:

DF = 0.8
CF = 1.0

The diversity and coincidence factors were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993). These values are typical for residential cooling loads in summer peaking utilities.

Insulation square foot assumptions:

Average house size from site data (Carolinas), or estimated from number of rooms (KY)

Size of house = number of rooms * 330 SF/room

Number of walls	Wall area as a fraction of floor area
1	0.26
2	0.52
3	0.72
4+	0.92

R value assumptions

Rbase:

Base thickness	R_{base}
0	0.91

The base case assumes an uninsulated wall with 3.5 inch air gap. This assumption addresses "insulation" R-value only. The R-value assumptions for other materials within the wall construction are embedded in the simulation model.

Ree

The insulated wall R-value depends on added insulation thickness and insulation type. Fiberglass, cellulose and "other" insulation is assumed to have an R-value of 3.5 per inch. Foam insulation is assumed to have an R-value of 5.6 per inch.

Added thickness	Ree	
	fiberglass, cellulose or other	Foam
1-3	7.9	12.1
4-6	18.4	28.9
7-12	30.7	48.5
13+	46.4	73.7

Unit energy and demand data

The unit energy and demand savings were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix. The unit energy and

demand savings depend on the heating fuel, heating system, cooling system type and wall Rvalue:

Heating Fuel	Other
Heating System	Any except Heat Pump
Cooling System	None

R-value	kWh/SF	kW/SF	therm/SF
All	0	0	0

Heating Fuel	Other
Heating System	Any except Heat Pump
Cooling System	Room/Window or Central AC

R-value	kWh/SF	kW/SF	therm/SF
0.91	2.361	0.00273	0
7.9	2.046	0.00238	0
18.4	1.950	0.00227	0
30.7	1.908	0.00224	0
46.4	1.887	0.00220	0
12.1	1.988	0.00230	0
28.9	1.917	0.00224	0
48.5	1.886	0.00220	0
73.7	1.874	0.00220	0

Heating Fuel	Any
Heating System	Heat Pump
Cooling System	Heat Pump

R-value	kWh/SF	kW/SF	therm/SF
0.91	12.078	0.00655	0.00000
7.9	9.865	0.00605	0.00000
18.4	9.160	0.00588	0.00000
30.7	8.892	0.00581	0.00000
46.4	8.734	0.00578	0.00000
12.1	9.477	0.00597	0.00000
28.9	8.918	0.00583	0.00000
48.5	8.721	0.00578	0.00000
73.7	8.620	0.00575	0.00000

Heating Fuel	Gas, propane or oil
Heating System	Any except Heat Pump

Cooling System None

R-value	kWh/SF	kW/SF	therm/SF
0.91	0	0	0.08530
7.9	0	0	0.06565
18.4	0	0	0.05974
30.7	0	0	0.05751
46.4	0	0	0.05623
12.1	0	0	0.06230
28.9	0	0	0.05767
48.5	0	0	0.05623
73.7	0	0	0.05543

Heating Fuel Gas, propane or oil
Heating System Any except Heat Pump
Cooling System Room/Window or Central AC

R-value	kWh/SF	kW/SF	therm/SF
0.91	2.361	0.00273	0.08530
7.9	2.046	0.00238	0.06565
18.4	1.950	0.00227	0.05974
30.7	1.908	0.00224	0.05751
46.4	1.887	0.00220	0.05623
12.1	1.988	0.00230	0.06230
28.9	1.917	0.00224	0.05767
48.5	1.886	0.00220	0.05623
73.7	1.874	0.00220	0.05543

Heating Fuel Electricity
Heating System Any except Heat Pump
Cooling System None

R-value	kWh/SF	kW/SF	therm/SF
0.91	17.807	0.00963	0
7.9	13.354	0.00749	0
18.4	12.045	0.00685	0
30.7	11.552	0.00663	0
46.4	11.277	0.00650	0
12.1	12.616	0.00712	0

28.9	11.599	0.00665	0
48.5	11.254	0.00649	0
73.7	11.075	0.00641	0

Heating Fuel	Electricity
Heating System	Any except Heat Pump
Cooling System	Room/Window or Central AC

R-value	kWh/SF	kW/SF	therm/SF
0.91	12.078	0.00655	0.00000
7.9	9.865	0.00605	0.00000
18.4	9.160	0.00588	0.00000
30.7	8.892	0.00581	0.00000
46.4	8.734	0.00578	0.00000
12.1	9.477	0.00597	0.00000
28.9	8.918	0.00583	0.00000
48.5	8.721	0.00578	0.00000
73.7	8.620	0.00575	0.00000

Duct Insulation and Repair

Gross Summer Coincident Demand Savings
$\Delta kW_S = (\Delta kW/unit) \times DF_S \times CF_S \times LF$

Gross Annual Energy Savings
$\Delta kWh = (\Delta kWh/unit) \times LF$

$\Delta therm = (\Delta therm/unit) \times LF$

where:

ΔkW	= gross coincident demand savings
ΔkWh	= gross annual energy savings
DF	= demand diversity factor
CF	= coincidence factor
LF	= location factor
ΔkWunit	`= electricity demand savings per dwelling
ΔkWh/SF	`= electricity consumption savings per dwelling
Δtherm/SF	`= gas consumption savings dwelling

Coincidence and Diversity Factors:

DF = 0.8
CF = 1.0

The diversity and coincidence factors were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993). These values are typical for residential air conditioners and heat pumps in summer peaking utilities.

The location factors used are as follows:

Heated Area	Unheated Area	DK/No Response
0	1	.43

Unit energy and demand savings data

The unit energy and demand savings were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix. The basic assumptions are listed below:

Assumption	Pre treatment	Post treatment	Notes
Duct insulation	Uninsulated	R-19	Consistent with Smart Saver program requirements
Duct sealing	26% leakage	8% leakage	Duct leakage assumptions used in CA for Title 24 and utility program design. Evenly distributed between supply and return

The unit energy and demand savings depend on the heating fuel, heating system, cooling system and duct treatment as follows:

Heating Fuel Other
Heating System Any except Heat Pump
Cooling System None

Duct treatment	ΔkWh/unit	ΔkW/unit	Δtherm/unit
All	0	0	0

Heating Fuel Other

Heating System Any except Heat Pump
Cooling System Central AC

Duct treatment	ΔkWh/unit	ΔkW/unit	Δtherm/unit
Insulate	384	0.10	0
Seal	466	0.25	0

Heating Fuel Any
Heating System Heat Pump
Cooling System Heat Pump

Duct treatment	ΔkWh/unit	ΔkW/unit	Δtherm/unit
Insulate	1,520	0.48	0.0
Seal	2,422	0.78	0.0

Heating Fuel Gas, propane or oil
Heating System Furnace
Cooling System None

Duct treatment	ΔkWh/unit	ΔkW/unit	Δtherm/unit
Insulate	0.0	0.0	17.3
Seal	0.0	0.0	16.5

Heating Fuel Gas, propane or oil
Heating System Furnace
Cooling System Central AC

Duct treatment	ΔkWh/unit	ΔkW/unit	Δtherm/unit
Insulate	384	0.10	17.3
Seal	466	0.25	16.5

Heating Fuel Electricity
Heating System Furnace
Cooling System None

Duct treatment	ΔkWh/unit	ΔkW/unit	Δtherm/unit
Insulate	3,917	3.13	0.0
Seal	3,798	2.98	0.0

Heating Fuel	Electricity
Heating System	Furnace
Cooling System	Central AC

Duct treatment	ΔkWh/unit	ΔkW/unit	Δtherm/unit
Insulate	4,285	3.18	0.0
Seal	4,211	3.18	0.0

Installed a New AC or Heat Pump

Gross Summer Coincident Demand Savings
$\Delta kW_S = (\Delta kW/unit) \times DF_S \times CF_S$

Gross Annual Energy Savings
ΔkWh = (ΔkWh/unit)

Δtherm = (Δtherm/unit

where:

ΔkW = gross coincident demand savings
ΔkWh = gross annual energy savings
DF = demand diversity factor
CF = coincidence factor
ΔkWunit `= electricity demand savings per dwelling
ΔkWh/SF `= electricity consumption savings per dwelling
Δtherm/SF `= gas consumption savings dwelling

Coincidence and Diversity Factors:

DF = 0.8
CF = 1.0

The diversity and coincidence factors were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993). These values are typical for residential air conditioners and heat pumps in summer peaking utilities.

Unit energy and demand savings data

The unit energy and demand savings were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix. Unit energy savings are based on replacement of an existing SEER 8.5 air conditioner or heat pump. The unit

energy and demand savings depend on the heating fuel, heating system, cooling system and replacement efficiency.

Heating Fuel	Other
Heating System	Any except Heat Pump
Cooling System	None

Replacement efficiency	ΔkWh/unit	ΔkW/unit	Δtherm/unit
All	0	0	0

Heating Fuel	Other
Heating System	Any except Heat Pump
Cooling System	Central AC

Replacement efficiency	ΔkWh/unit	ΔkW/unit	Δtherm/unit
<11	674	0.92	0
12	944	1.28	0
13	1,213	1.65	0
14+	1,346	1.80	0

Heating Fuel	Any
Heating System	Heat Pump
Cooling System	Heat Pump

Replacement efficiency	ΔkWh/unit	ΔkW/unit	Δtherm/unit
<11	2,941	1.36	0
12	2,941	1.36	0
13	5,294	2.45	0
14+	6,496	2.98	0

Heating Fuel	Gas, propane or oil
Heating System	Any except Heat Pump
Cooling System	None

Replacement efficiency	ΔkWh/unit	ΔkW/unit	Δtherm/unit
All	0.0	0.0	0

Heating Fuel	Gas, propane or oil

Heating System Any except Heat Pump
Cooling System Central AC

Replacement efficiency	ΔkWh/unit	ΔkW/unit	Δtherm/unit
<11	674	0.92	0
12	944	1.28	0
13	1,213	1.65	0
14+	1,346	1.80	0

0

Heating Fuel Electricity
Heating System Any except Heat Pump
Cooling System None

Replacement efficiency	ΔkWh/unit	ΔkW/unit	Δtherm/unit
All	0.0	0.0	0

Heating Fuel Electricity
Heating System Any except Heat Pump
Cooling System Central AC

Replacement efficiency	ΔkWh/unit	ΔkW/unit	Δtherm/unit
<11	674	0.92	0
12	944	1.28	0
13	1,213	1.65	0
14+	1,346	1.80	0

Installed a New Furnace

Gross Annual Energy Savings
Δtherm = (Δtherm/unit)

where:

Δtherm/SF `= gas consumption savings dwelling

Unit energy and demand savings data

The unit energy and demand savings were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix. The basic assumptions are listed below:

Furnace Type	AFUE
Baseline	0.78
Standard efficiency (metal flue pipe) replacement	0.80
Condensing furnace (plastic flue pipe) replacement	0.90

The unit energy and demand savings depend on the heating fuel, heating system type, and replacement furnace type:

Heating Fuel	Gas, propane or oil
Heating System	Furnace

Replacement efficiency	Δtherm/unit
Standard (metal pipe)	3.0
Condensing (plastic pipe)	18.8

Otherwise 0

Installed a New Refrigerator

Gross Summer Coincident Demand Savings

$$\Delta kW_S = units \times \left[\frac{kWh_{base}}{8760 \times LF_{base,s}} - \frac{kWh_{ee}}{8760 \times LF_{ee,s}} \right] \times CF_s \times (1 + HVAC_{d,\,s})$$

Gross Annual Energy Savings

$$\Delta kWh = units \times (kWh_{base} - kWh_{ee}) \times (1 + HVAC_c)$$

$$\Delta therm = \Delta kWh \times HVAC_g$$

where:

ΔkW	= gross coincident demand savings
ΔkWh	= gross annual energy savings
units	= number of refrigerators or freezers installed under the program
LF	= load factor for refrigeration end-use
CF	= coincidence factor

$HVAC_c$ = HVAC system interaction factor for annual energy consumption
$HVAC_d$ = HVAC system interaction factor at utility peak hour
$HVAC_g$ = HVAC system interaction factor for annual gas consumption
8760 = conversion factor (hr/yr)

Refrigerator energy consumption

Assumption for refrigerator annual energy consumption are shown below:

Refrigerator type	kWh per year
Old refrigerator	2100
New standard efficiency refrigerator	594
New Energy Star refrigerator	505

kWh savings are calculated as follows:

Question	Response	kWhbase	kWhee
Purchased new refrigerator	Yes, but not Energy Star	2100	594
	Yes, is Energy Star	2100	505
Keeping old refrigerator	New not Energy Star	0	594
	New is Energy Star	0	505

(Note, if old refrigerator is kept, then no savings – load actually goes up, indicating negative savings)

The existing (old) refrigerator consumption, load factor and coincidence factor were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993).

Refrigeration summer load factor = 0.82
Coincidence factor = 1.0

$HVAC_c$ - the HVAC interaction factor for annual energy consumption depends on the HVAC system, heating fuel type, and location. The HVAC interaction factors for annual energy consumption were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix.

Covington, KY

Heating Fuel	Heating System	Cooling System	HVACc	HVACg
Other	Any except Heat Pump	Any except Heat Pump	0	0
Any	Heat Pump	Heat Pump	-0.16	0
Gas Propane Oil	Central Furnace	None	0	-0.0021
		Room/Window	0.079	-0.0021
		Central AC	0.079	-0.0021
	Other	None	0	-0.0021

		Room/Window	0.079	-0.0021
		Central AC	0.079	-0.0021
Electricity	Central furnace	None	-0.45	0
		Room/Window	-0.36	0
		Central AC	-0.36	0
	Electric baseboard	None	-0.45	0
		Room/Window	-0.36	0
		Central AC	-0.36	0
	Other	None	-0.45	0
		Room/Window	-0.36	0
		Central AC	-0.36	0

$HVAC_d$ - the HVAC interaction factor for demand depends on the cooling system type. The HVAC interaction factors for summer peak demand were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix.

Covington, KY

Cooling System	HVACd
None	0
Room/Window	.17
Central AC	.17
Heat Pump	.17

Prototypical Building Model Description

The impact analysis for many of the HVAC related measures are based on DOE-2.2 simulations of a set of prototypical residential buildings. The prototypical simulation models were derived from the residential building prototypes used in the California Database for Energy Efficiency Resources (DEER) study (Itron, 2005), with adjustments make for local building practices and climate. The prototype "model" in fact contains 4 separate residential buildings; 2 one-story and 2 two-story buildings. The each version of the 1 story and 2 story buildings are identical except for the orientation, which is shifted by 90 degrees. The selection of these 4 buildings is designed to give a reasonable average response of buildings of different design and orientation to the impact of energy efficiency measures. A sketch of the residential prototype buildings is shown in Figure 7.

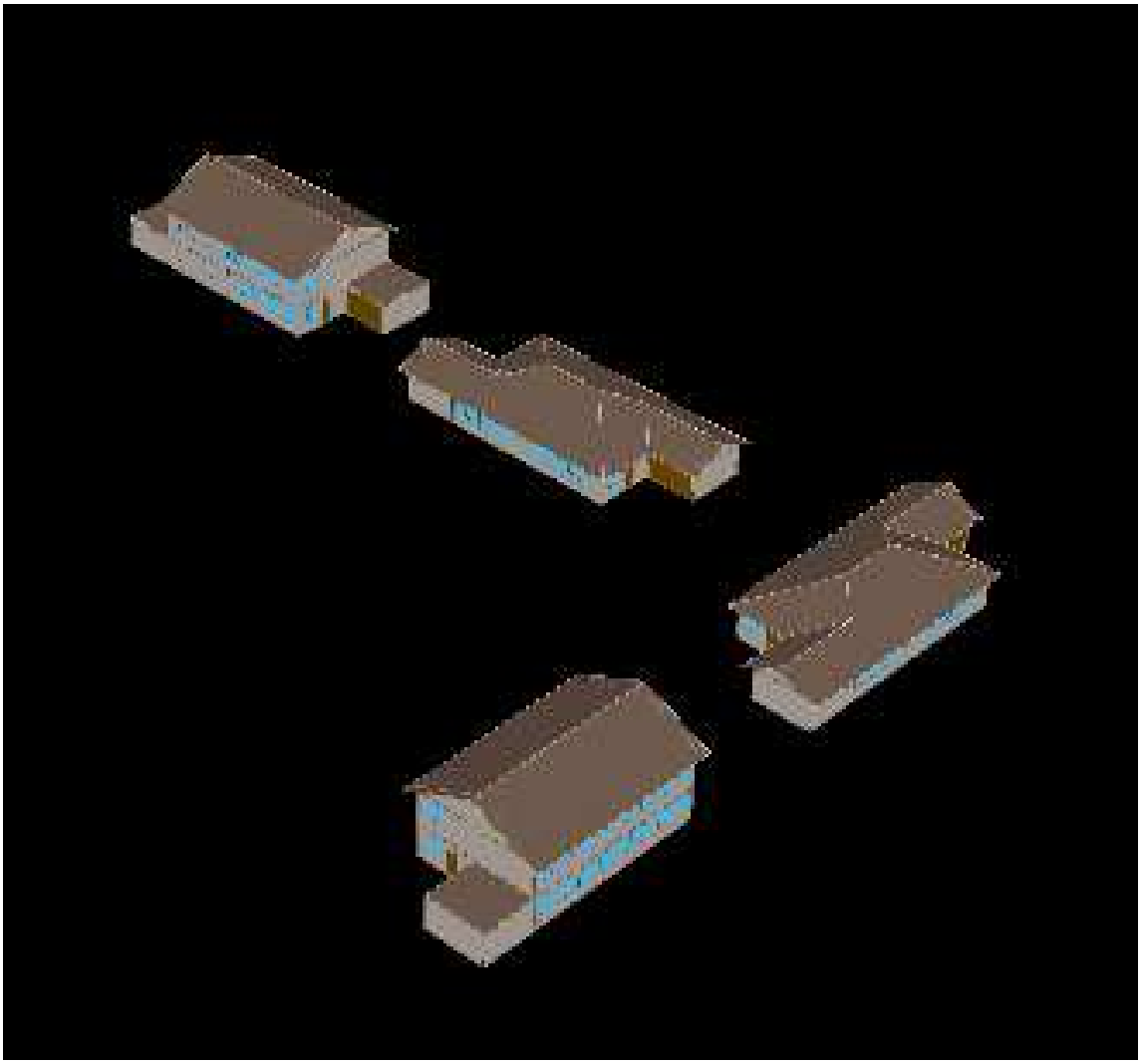


Figure 7. Computer Rendering of Residential Building Prototype Model

The general characteristics of the residential building prototype model are summarized below:

Residential Building Prototype Description

Characteristic	Value
Conditioned floor area	1 story house: 1465 SF 2 story house: 2930 SF
Wall construction and R-value	Wood frame with siding, R-11
Roof construction and R-value	Wood frame with asphalt shingles, R-19
Glazing type	Single pane clear
Lighting and appliance power density	0.51 W/SF average
HVAC system type	Packaged single zone AC or heat pump
HVAC system size	Based on peak load with 20% oversizing. Average 640 SF/ton
HVAC system efficiency	SEER = 8.5
Thermostat setpoints	Heating: 70°F with setback to 60°F Cooling: 75°F with setup to 80°F

Characteristic	Value
Duct location	Attic (unconditioned space)
Duct surface area	Single story house: 390 SF supply, 72 SF return Two story house: 505 SF supply, 290 SF return
Duct insulation	Uninsulated
Duct leakage	26%; evenly distributed between supply and return
Cooling season	Charlotte – April 17 to October 6 Covington
Natural ventilation	Allowed during cooling season when cooling setpoint exceeded and outdoor temperature < 65°F. 3 air changes per hour

References

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Itron, 2005. "2004-2005 Database for Energy Efficiency Resources (DEER) Update Study, Final Report," Itron, Inc., J.J. Hirsch and Associates, Synergy Consulting, and Quantum Consulting. December, 2005. Available at http://eega.cpuc.ca.gov/deer.

Summary: Text Appendix M of Status Report electronically filed by Anita M Schafer on behalf of Watts, Elizabeth H. Ms.